
INTERACTIVE VIDEO PRIMER
Medical Education

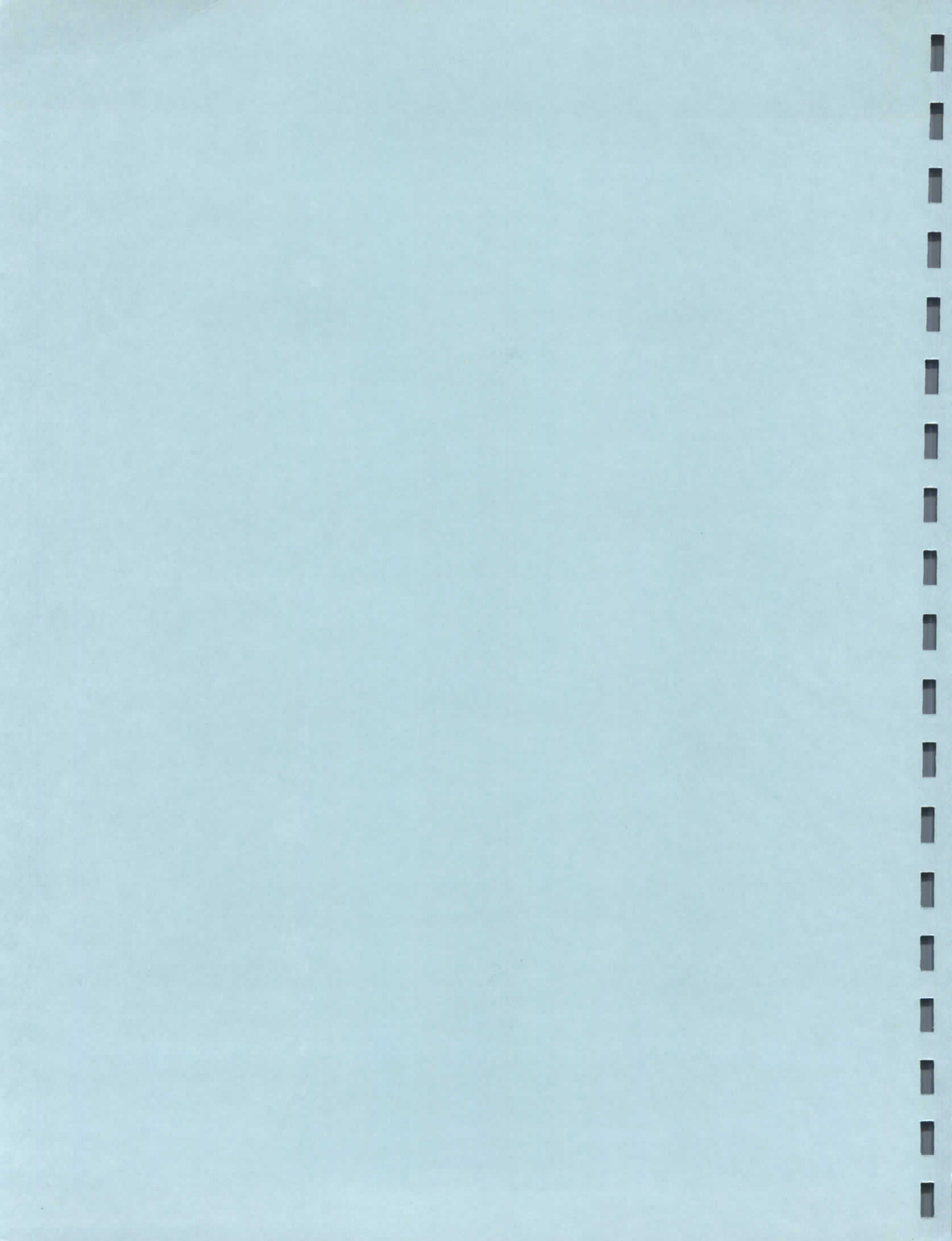
Edited by

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S T E W A R T P U B L I S H I N G , I N C .

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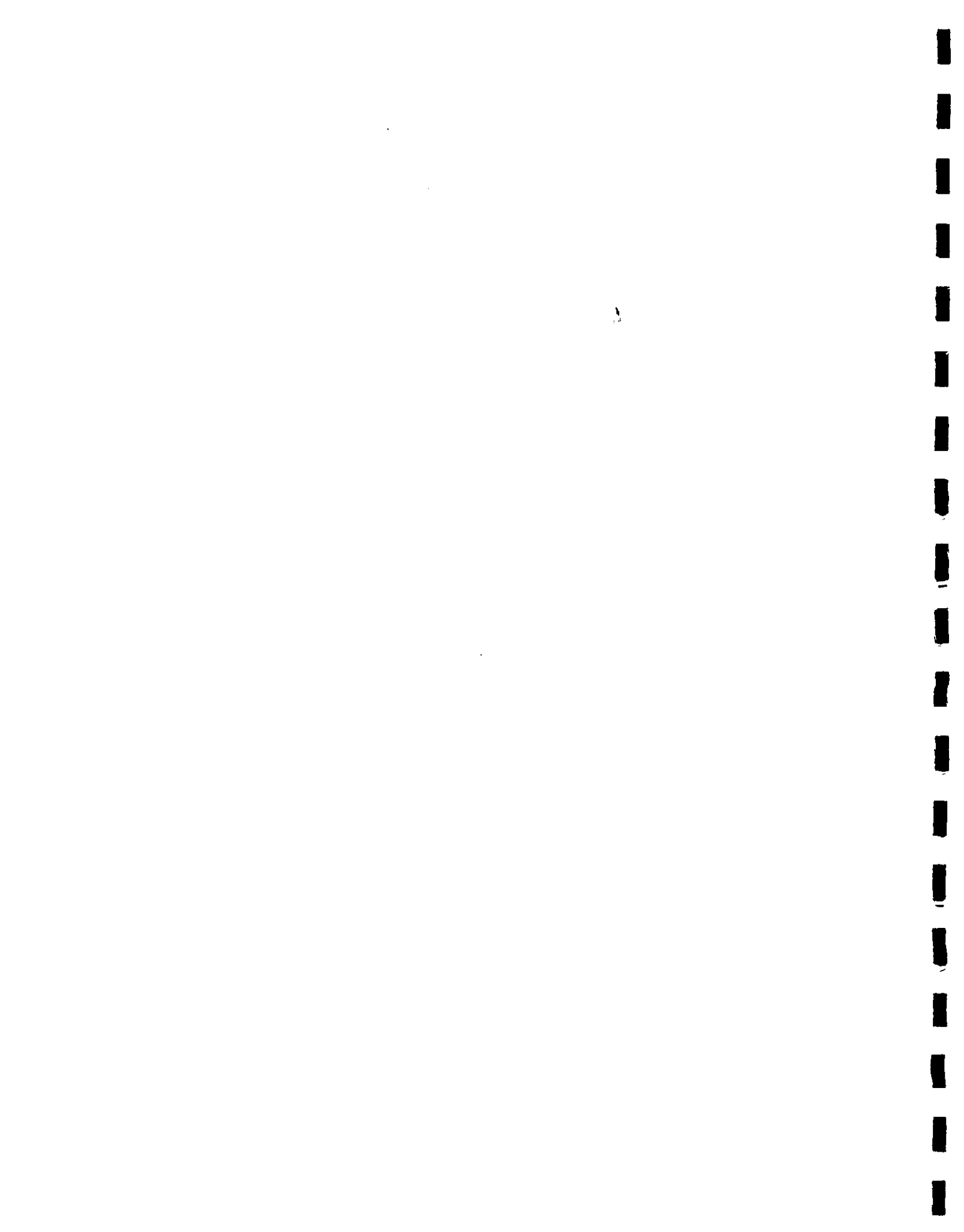
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Appendix



Chapter 1

Videodisc Hardware Systems

Interactive videodisc systems come in a variety of configurations, depending on the use for which they are intended. They can range in complexity from a single videodisc player and keypad to a fully integrated system of computer, graphic overlay board, touchscreen monitor, and videodisc player—such as the IBM InfoWindow. Even these high-end systems can be further enhanced by adding peripherals including a CD-ROM drive, digitizing boards, and more. To better understand the different configurations, it is useful to classify them according to the levels of interactivity defined by the Nebraska Videodisc Design/Production Group in 1980:

Level I systems are simply stand-alone videodisc players which can be controlled using either a remote control or, in the case of some Pioneer players, a barcode reader. The interactivity is limited to what the viewer can produce using the videodisc player controls only—forward, reverse, slow-motion, still/freeze frame, picture stop, chapter stop, frame address, and dual-channel audio features. There is no computer processing involved.

Level II systems are simply videodisc players equipped with an internal microprocessor which can execute programming instructions that have been encoded onto the videodisc. Level II provides programming features such as branching at multiple choice questions, menu selections, and even record-keeping.

Sony and Pioneer both sell Level II videodisc players, but each company has its own programming language which must be encoded onto the videodisc. Therefore, Level II videodiscs coded for Pioneer players will not play on Sony Level II videodisc players, and vice versa. One solution to this problem is to encode programming for both Sony and Pioneer onto the same videodisc.

Level II videodisc players cost approximately twice as much as Level I videodisc players, and developing Level II discs requires additional time and expense to design and code the programming that is to be pressed onto the videodisc. Although wonderful programs can be developed for Level II systems, there is very little on the market in the way of materials for health sciences education. This may change in the future if lower-cost Level II players are developed for the educational market.

Level III systems consist of videodisc players connected to external computers—usually through a parallel port via an RS-232C cable. Computers commonly used in Level III systems are IBM PC (and compatibles) and Apple Macintosh computers. Level III systems, as with level II systems, provide programmed instruction. However, because the ca-

pabilities of the external computer are greater than the processors in Level II players, Level III programs can be more sophisticated.

The first Level III systems had two monitors: one for the computer output and one for the videodisc image. These are known simply as two-screen systems. More recently, one-screen systems have become popular—those which display both the computer text and the videodisc image on a single screen. This is done using a graphics overlay board which combines the two otherwise incompatible signals. Both two-screen and one-screen systems are popular in health sciences settings, depending on the needs of the discipline and the content of the software.

Level IV and above has been proposed by some people to describe the addition of peripherals such as CD-ROM drives, digital video and audio, etc. However, the industry has not settled on any single standard for these higher levels which, technically, all fall into the Level III category.

Two-Screen Videodisc Systems

Generally, two-screen videodisc systems are driven by either an IBM-PC compatible computer or an Apple Macintosh computer. With two-screen systems, the computer text/graphics appear on one screen, while the videodisc image appears on a separate monitor. These systems are most common in medical fields where there are a large number of still images—such as radiology, pathology, or hematology. In this way, an image can be up on one monitor while text or graphics explaining the image can appear simultaneously on the other monitor.

Where applications involve simulation or sophisticated tutorials, one-screen systems are more common. While medical applications are generally split between two-screen and one-screen systems, nursing applications for two-screen systems are rare. The few nursing programs that were designed for two-screen PC systems were developed before the increased availability of one-screen systems. Today, because the majority of videodisc systems in place for nursing education are one-screen systems, even the few commercial software programs designed for two-screen systems have been converted to play on one-screen systems. Therefore, while medical educators will find a use for both one-screen and two-screen systems, few nursing educators would consider purchasing two-screen videodisc systems unless they planned to develop their own courseware and had no plans to distribute the programs to other educators.

One-Screen PC Systems

For many interactive video applications, it is desirable to combine the text and graphics of the computer with the video image from the videodisc player. Doing so not only reduces the number of monitors needed, but also allows for any number of special effects—such as placing computer generated graphics or text on top of a video image. However, since the computer output and video output are not compatible with each other, graphic overlay boards were developed to achieve the mix.

For many years, the dozens of graphic overlay boards on the market were incompatible with one another. This meant that in order to play a program developed by someone else, you had to purchase the specific graphic overlay board which they used when devel-

oping the program. Clearly, this presented a problem for anyone who wanted to play programs developed by several different sources.

Finally, in 1987, IBM introduced the InfoWindow system, a combination of computer, overlay board, videodisc controller, touchscreen monitor, and videodisc player designed specifically to deliver interactive video programs. As an increasing amount of videodisc courseware was developed to run on the InfoWindow system, other hardware manufacturers began emulating the IBM systems so that "InfoWindow compatibility" became a selling point for their systems. Today, the InfoWindow is the standard for which almost all software manufacturers program.

By mid 1991, there were at least seven hardware delivery systems which can play courseware designed for the InfoWindow: IBM InfoWindow, IBM M-Motion Video systems, Sony VIEW System, FITNE System, Visage System, Video Associates Labs System, Microvitec System, and the Matrox Interactive Video System. These systems list between \$5,000 and \$11,000, depending on the manufacturer and the options purchased.

One-Screen Macintosh Systems

Although there are a number of graphic overlay cards available for the Macintosh, none of the cards is compatible with another. Therefore, Macintosh users are suffering from the same problems PC users had to live with until the standardization around the InfoWindow. Although one-screen applications are being developed for in-house use at some medical schools, until standardization is achieved, Macintosh-based interactive video courseware intended for distribution will be designed for two-screen systems.

Dedicated/Proprietary One-screen Systems

In an attempt to provide all of the benefits of Level III interactive video without the high cost of the hardware systems, some commercial vendors have assembled proprietary videodisc systems which they can offer clients for as little as \$1,500. These systems usually consist of a proprietary computer, videodisc player, overlay card, and some form of input, often a customized keypad.

The advantage of this type of system is the low cost. The disadvantage lies in the fact that the system will play only courseware provided by the single vendor, and will not play any of the programs which can be bought "off the shelf."

In some specialized markets this is not a problem because the user is buying a dedicated training package. An example of this is the ProCare training curriculum developed by Interactive Health Network (IHN) in Atlanta, Georgia. This curriculum consists of 34 different videodisc modules designed to train nurse assistants in nursing homes to successfully take a written competency evaluation required for certification. In this highly selective and focused market, the inexpensive, proprietary delivery system offered by IHN is a reasonable alternative to the more standard, and much more expensive, InfoWindow-compatible systems.

Features to Consider When Selecting a One-screen System

One-screen, InfoWindow-compatible hardware systems consist of several components: computer, graphics overlay board, touchscreen monitor, videodisc player, and InfoWindow emulation software.

Computer

The most common features found in computers which drive interactive video systems are 640K to 1MB RAM in an AT-compatible machine (286/386/386SX) running at 12 to 20 MHz and containing either a 5.25-inch or a 3.5-inch (or both) floppy disk drive and a minimum 40 MB hard drive. As there is little difference in cost to purchase a higher-end computer, buyers may want to consider a 386 machine with at least 1MB RAM and an 80 MB or greater harddrive.

Graphics/Overlay Board

In order to combine the computer text and graphics with the image from the videodisc player, a special graphics overlay/videodisc controller board must be installed in the computer. Although these boards may provide EGA or VGA computer graphics, all provide only EGA graphics when playing InfoWindow-compatible courseware. This is because the IBM InfoWindow system itself has an EGA graphics capability, resulting in all InfoWindow software being written for that level. VGA graphics boards, when not emulating the InfoWindow system, will display full VGA graphics for all other computer applications. While VGA boards are unquestionably better suited to the graphic standard of the future, they can increase the cost of an interactive video system by \$1,000 or more over their EGA counterparts.

Touchscreen Monitor

Level III videodisc interaction requires input to the computer from the user. This input may be entered through several different devices: computer keyboard, touch screen, light pen, mouse, or other devices. By far, the computer keyboard and touchscreen monitors are the most popular methods of user interface, or input devices, but look for the mouse to gain ground in the next two years. The touchscreen is considered the most "user friendly" form of input in that it requires no typing skills and allows the user to keep his or her eyes on the program at all times. However, the touchscreen is not particularly accurate, and in extended learning situations, the touch screen can become tiresome. The mouse makes up for these deficiencies with pinpoint accuracy and a low fatigue level. In the future, when all videodisc programs are designed to be used with a mouse, consumers can save approximately \$1,200 on hardware systems by using only a mouse and not spending the extra money that a touchscreen costs.

Today, however, virtually all programs are designed to run with a touchscreen. Buyers should be aware that there are several different types of touchscreens, each with a different look and feel. Some consist of a film over the monitor which can interfere with the picture brightness and clarity. The best type of touchscreen will have nothing but clear glass between the user and the video image.

Videodisc Player

There is a wide variety of videodisc players available, from consumer models to educational and industrial models. Most educational and industrial models have an RS-232C interface which allows the player to be connected to an external computer. Some models are Level II players with a small microprocessor built in which allows for a limited amount of programming to be loaded from the videodisc.

The most popular videodisc players are from Pioneer and Sony. The least expensive models used with interactive videodisc systems are the Pioneer LD-V2200, LD-V4200, and the Sony LDP-1450. These players include an RS-232C interface, have an access time (longest time it takes to go from one frame to another) of two to four seconds, and list between \$895 and \$1,095.

When additional features or Level II capability are needed, the most popular players are the Pioneer LD-V8000 and the Sony LDP-1550. These players improve access time to less than two seconds and include multi-track jumps which allow instant frame jumps within a 100-200 frame area. This class of videodisc player sells for between \$1,598 and \$2,280. For most interactive video systems, however, the Pioneer LD-V4200 and the Sony LDP-1450 are the most popular, providing reasonable access time for a modest price.

InfoWindow Emulation Software

Although each graphic overlay/controller board on the market is incompatible with the others, vendors have developed software programs which can translate InfoWindow-compatible software so that they can be executed by their graphics board. For the most part, these InfoWindow emulation programs work well. Occasionally, these emulators fail when a developer has programmed an obscure command into his courseware. In most of these instances, the software developer and the graphic board vendor put their heads together and quickly resolve the problem.

Vendor Support

Anyone considering the purchase of an interactive video system also should be concerned with the support that will be provided after the sale. Vendors should be expected to provide, at the very least, telephone support to assist in the initial setup and operation of the system. Ongoing telephone support and quick replacement of failed components also should be provided. Although interactive video systems generally have a low failure rate, conscientious vendors will attempt to relieve any anxiety purchasers may have.

Available InfoWindow-Compatible Hardware Systems

IBM InfoWindow System

The original IBM InfoWindow System differs from all the other systems in that the graphic overlay and controller board is located in the touchscreen monitor instead of in the computer. The InfoWindow monitor can be connected to any IBM-compatible computer (PC/XT/AT/PS/2) with the addition of special EGA graphics and jumper cards. The InfoWindow monitor lists for \$4,195. With additional cables, software, and videodisc player, the total system lists for approximately \$11,000. Discounts up to 40 percent are available to educational institutions.

One early disadvantage of the InfoWindow system was the fact that most sales representatives packaged it with the most recent IBM computer. In January 1990, this includes the PS/2 Model 30-286 or the PS/2 Model 50z. Problems can arise because many software firms could not keep up with the rapid changes IBM was making in their computers. This resulted in occasional software problems for schools with PS/2 computers which attempted to run videodisc and computer-assisted instruction programs designed for earlier model computers. Schools with InfoWindow systems built around the original AT or compatible computers rarely experienced these problems.

Although the InfoWindow produced the highest-quality video image of all systems on the market, IBM has stopped making them in favor of the new M-Motion Video Adapter. When the current supply of InfoWindows is exhausted, they no longer will be available for sale. The effect this will have on continued InfoWindow support is unknown.

Sony VIEW System

In May 1989, Sony Corporation introduced the VIEW-5000 videodisc system. The VIEW System was the first truly integrated videodisc system because Sony has built the computer *and* LDP-1200 videodisc player into the same unit, reducing both the space and number of cable connections needed.

Outside of the compact design, the most notable features of the VIEW 5000 was its IBM InfoWindow emulation and its lower price. Though the basic unit lists for only \$4,995, the addition of a touchscreen monitor (\$1,875) and 40MB hard disk (\$975) will run the list price of the system closer to \$8,000—still several thousand less than the IBM InfoWindow list price.

In addition to InfoWindow emulation, the VIEW 5000 provides VGA graphics compatibility and a 286 compatible computer running at 8MHz or 10MHz with 640K main memory, 256K standard graphics memory, and a 3.5-inch floppy disk drive.

One possible disadvantage of the Sony VIEW may be the 40MB hard disk drive. With the increasing size of educational programs (eight to 10MB is not unusual), a 40MB drive may fill up fast. Due to the compact design, standard hard disk drives will not fit in the VIEW, although Sony soon is expected to offer 80 MB and 100 MB hard drives for the VIEW. Although the VIEW 5000 costs \$1,500 more than the lowest priced InfoWindow-compatible hardware system, many people feel the compact design and the Sony name are enough to warrant the difference.

FITNE System

Designed by the Fuld Institute for Technology in Nursing Education (FITNE), the FITNE IBC202 system is built around an AT compatible, 8/12 MHz 286 computer with one MB RAM, 5.25-inch floppy drive, and 80 MB hard disk drive. A VAL Microkey/Mark 10 EGA graphics overlay board providing 16 colors is installed and drives a Mitsubishi 14-inch color monitor with an Elographics Intellitouch Screen and a Pioneer LDV-4200 player.

Emulation software produced by Video Associates Labs (VAL) allows the FITNE system to run software programs written for the IBM InfoWindow. The big advantage of the FITNE system is the support, which includes a one-year warranty and the promise to provide replacement systems while the original is being repaired. The system lists for \$7,349 and sells to FITNE members for \$6,195.

Visage System

In October 1989, Visage, Inc. announced the availability of yet another IBM InfoWindow-compatible system. The system consists of an AT-compatible Everex 286 12 MHz computer with one MB RAM, 40MB hard drive, and 5.25 floppy disk drive. Along with a Sony LDP-1200 videodisc player, a touchscreen monitor, and the Visage controller and overlay board, the Visage system also comes with a one-year warrantee and lists for more than \$7,000, but has been on perpetual sale at \$5,495, making it the lowest-priced system on the market. As with the Sony and FITNE systems, emulation software permits the Visage system to run videodisc software designed for the IBM InfoWindow.

VAL Multimedia Workstation

In early 1990, Video Associates Labs announced their own interactive video system built around their MicroKey/Mark 10 graphic overlay board—the same board used by FITNE. The ValWIN system is built around an AT-compatible 10 MHz computer with a 3.5-inch floppy and 40 MB hard drive. The system also comes with a Pioneer LD-V4200 videodisc player, a Microvitec 704/FST touchscreen monitor, InfoWindow emulation software, and a one year maintenance agreement. The ValWIN Multimedia Workstation rates as the lowest-priced InfoWindow-compatible system with a list price of only \$5,895.

Matrox Interactive Video System

The Matrox Interactive Video System (IVS) was originally developed in 1987 in response to a contract bid offered by the US Army for nearly 2,000 interactive videodisc systems. In the summer of 1990, Matrox announced that it had developed InfoWindow emulation software for its system, thereby bringing the IVS into the mainstream market.

Matrox has stacked the videodisc player on top of the computer to form a single, integrated unit—similar though more bulky than the Sony VIEW system. A basic configuration consists of an AT-compatible 10 Mhz computer with 3.5-inch floppy, 40 MB hard disk, and touchscreen monitor, and lists for \$9,140. An external 5.25-inch floppy drive cost an additional \$695. The disadvantage of this system is immediately apparent. In lieu of discounts, the Matrox IVS is one of the more expensive InfoWindow-compatible hardware systems available.

Digital Video Graphic Boards

The newest generation of graphic boards has the ability to digitize video as it comes off a videodisc and display it on a VGA monitor. Digitizing an image allows it to be manipulated in ways not possible with standard video displays. For example, using digital technology, a full video image can be placed in a window of any size and shown anywhere on the monitor. In fact, several full video images can be shown in several windows at the same time on one monitor. Digital technology also can produce fades, dissolves, and other special effects not possible with standard video.

Because the capability of digital video adapters surpasses those of the InfoWindow-compatible hardware systems, eventually a new standard will evolve which will incorporate these new features. However, since this is a new technology, and it will take some time before courseware is written to take advantage of digital effects, manufacturers of the digital boards also are beginning to offer InfoWindow emulation. This means that, while

running InfoWindow courseware, hardware systems equipped with digital video adapters will be emulating standard EGA graphics boards. The rest of the time they can be used to the full extent of their digital capabilities.

Although there are several digital video adapters on the market, at this time only three are capable of playing InfoWindow courseware, with one of these—Microvitec's DAVID board—packaged in a complete interactive video system. The other two boards are VideoLogic's Digital Video Adapter and IBM's M-Motion Video Adapter.

Microvitec DAVID

Microvitec, international marketers of color and touchscreen monitors, has developed the DAVID (Digital Audio and Video Interactive Device) Digital Overlay Board. DAVID occupies a single slot in an IBM PC/XT/AT or compatible and will support any industry standard VGA or Super VGA graphics adapter.

Microvitec has packaged DAVID into a new, integrated, InfoWindow-compatible hardware system. The system is built around a 16MHz AT-compatible with one MB of RAM, a 3.5-inch floppy disk drive, a 40MB hard drive, headphone jack, and built-in stereo speakers. A Pioneer LD-V4200 is neatly stacked with the computer to form a unit nearly as compact and cable-free as the Sony VIEW. The Insight Interactive Video Workstation is slated to be available soon and is expected to list for approximately \$9,500. The DAVID board alone is currently available and lists for \$2,295.

VideoLogic Digital Video Adapter

VideoLogic recently introduced two Digital Video Adapters, the DVA-4000/ISA for use with Industry Standard Architecture (PC/XT/AT compatibles) and the DVA-4000/MCA for use with IBM's range of PS/2 computers using Micro Channel Architecture. Both boards provide real-time manipulation of every aspect of moving video images and output a high-resolution VGA image.

The boards sell for \$2,250, and can be coupled with a computer, videodisc player, and touchscreen monitor by do-it-yourselfers to build an InfoWindow-compatible hardware system. The DVA-4000 InfoWindow emulation software costs an additional \$150.

IBM M-Motion Video Adapter

The IBM M-Motion Video Adapter/A is a special adapter card that digitizes video and delivers it in real-time on a VGA monitor. Designed for use in a Micro Channel Architecture bus, the M-Motion card can be used only in IBM's PS/2 50, 55SX, 60, 70, or 80 Micro Channel computers, and can not be installed in PC, XT, or AT compatibles.

Recent trials have shown that computers fitted with the M-Motion Video Adapter are able to play InfoWindow courseware which has been developed using commercial authoring packages, such as *InfoWindow Presentation System (IWPS)*, *Quest*, or *TenCore*. In these cases, the M-Motion board translated all of the touchscreen commands into mouse commands so an expensive touchscreen monitor is not needed. However, InfoWindow courseware which has been written using other C or other programming languages may not be compatible with the M-Motion adapter without minor programming changes.

The M-Motion board lists around \$2,200, making a complete system (without touchscreen monitor) cost around \$5,000. Unfortunately, the video quality achieved when

digitizing an image of the videodisc player is poor when compared to other systems, and may not be adequate for certain high-resolution applications. Because of the limitations placed on users regarding the type of computer used and the quality of video delivered, the M-Motion Video Adapter is not the hardware solution for everyone.

Summary

No one system will meet all needs, and buyers must choose their system based on factors such as cost, expandability, support, and image quality. However, a few generalizations may be made regarding the selection and purchase of interactive video hardware systems. If cost is the bottom line, the Visage system is the lowest-priced at \$5,495 and comes with excellent support. Those in nursing settings also will want to consider the FITNE system for their outstanding support and special focus to the nursing community.

Those who would like a VGA graphics in what is by far the most compact and least complex system available should look closely at the Sony VIEW 5000. Although the M-Motion Video Adapter provides a look at the future with its low price, digitizing capability and mouse-driven feature, it is still an evolving technology and is, at best, unproven. Still, it may be the best purchase for those who's institutions are locked into purchasing computers from Big Blue.

Hardware Contacts

Fuld Institute for Technology in Nursing Education (FITNE), 28 Station Street, Athens, OH 45701; 614/592-2511.

Matrox, 1055 St. Regis Boulevard, Dorval, Quebec, H9P 2T4 Canada; 514/685-2630.

Microvitec, 1943 Providence Court, College Park, GA 30337; 404/991-2246.

Pioneer Communications of America, 600 East Crescent Avenue, Upper Saddle River, NJ 07458; 201/327-6400.

Sony Corporation of America, Intelligent Systems Group, Sony Drive, Park Ridge, NJ 07656; 201/930-6034.

Video Associates Labs (VAL), 4926 Spicewood Springs Road, Austin, TX 78759; 512/346-9407.

VideoLogic, 245 First Street, Cambridge, MA 02142; 617/494-0530.

Visage, 1881 Worcester Road, Framingham, MA 01701; 508/620-7100.



Chapter 2

Universities/Colleges

Universities and Colleges have been drawn to the incredible potential of the videodisc as a teaching tool and image storage medium. So far, these institutions have played an important role in the research and development of interactive videodisc programs. Undermanned and underfunded, health sciences schools have, over the years, developed the prototypes which serve as the inspiration for many of the commercial products now being developed. Now the school environment is beginning to produce enough videodisc courseware of their own to make up about half of the health-related videodisc courseware available for purchase.

Early Videodisc Efforts

Looking at the early years of health-related videodisc development, two universities stand out as pioneers in the field: the University of Iowa and the University of Washington. The University of Iowa, through the Weeg Computing Center, produced two programs in 1982, both using the now discontinued Thomson-CSF transmissive videodisc player. *Urology Retrieval* was a pilot project to demonstrate the advantages in ease, speed, and accuracy of retrieval of visual images from videodisc. *Gynecology Patient Education* was the first patient education videodisc ever developed and contains information on radiation therapy for cervical cancer. Although neither of these discs is available today, the University of Iowa has produced several other programs for distribution, including *Assessment of Neuromotor Dysfunction* and *Lamaze: The Nurse's Role*.

The University of Washington, through the Health Sciences Learning Resource Center, produced several videodiscs in 1982, many of them for the Miles Learning Center (see Chapter 2, *Pharmaceutical Companies*). The most popular of the early discs was the *Medical Applications Videodisc: Hematology*, also known as the Hematology Disc. This disc contains more than 6000 slides and several films, and was responsible for the term "generic videodisc." Generic videodiscs are those that contain slide collections, sometimes film footage, and are programmed for instruction by the institution that purchases it. Other early videodiscs produced at the University of Washington include *Trauma Training Materials*, *Clinical Microscopy*, and *Acute Leukemia Morphology*. In recent years, the University of Washington has produced seven other generic videodiscs, all of which are available for purchase.

Distributing School-produced Programs

As more and more educational institutions are becoming involved in the development of generic videodiscs and interactive videodisc programs, they are looking at ways to make their courseware available to other schools and at the same time recover some of the development costs of these programs. They are finding, however, that they lack the experience, and often the administrative flexibility, to do so easily.

Co-ventures With Medical Publishers

At the same time, commercial companies are looking to "pick up" existing programs to distribute, thereby saving the significant expense of developing their own programs. Schools with reasonably good, marketable programs can expect to be approached by a half-dozen commercial firms who would like to market their programs for them. Such an arrangement was established early between the University of Iowa and medical publishers Williams and Wilkins in Baltimore, Maryland. After having produced *Assessment of Neuro-motor Dysfunction in Infants* in 1984, the University of Iowa agreed to allow Williams and Wilkins to market the program. Another cooperative venture was *Sight Through Sound: An Interactive Introduction to Medical Diagnostic Ultrasound* produced in 1984 by another medical publisher, W.B. Saunders Company. Although the entire project was funded by Saunders, the disc was produced in cooperation with the Thomas Jefferson University Hospital, with all scenes being shot on location there.

These publishing firms found, however, that there is a multitude of problems associated with marketing videodisc courseware. Not the least of these is the lack of an established hardware base. Instead of purchasing just a \$1,000 videodisc program, many buyers find they are forced to spend an additional \$6,000 to \$10,000 on a hardware system to play the program. Another problem until recently was the lack of hardware standards. Even if a school found the money to purchase the necessary hardware configuration, there were no assurances that other commercial videodisc programs would be able to play on that same system. A third problem with selling videodisc courseware developed by health sciences schools is the limited market. Most of these programs cover specific topics which limit their usefulness to a potential market of hundreds, rather than thousands. This, combined with the less-than-commercial-quality production value of most programs, makes it difficult to sell enough programs to justify the cost of development, replication, packaging, marketing, and distribution.

Changing Market Conditions. In the past year, there has been an increased level of interest in interactive video among health sciences schools—a primary market for publishers. This fact, combined with a move toward hardware standardization, has led medical publishers to reassess the market.

Williams and Wilkins, looking to expand their computer-based electronic publishing offerings, had a one-year option on the rights to the *ElectricCadaver*, a *HyperCard* textbook of anatomical images and graphics developed at the Stanford University School of Medicine. However, they recently let this option expire.

Meanwhile, the University of Colorado Health Sciences has developed a three-dimensional atlas of the human knee with developmental funds provided by St. Louis-based publisher C.V. Mosby & Co. As of January 1990, Mosby has not made a decision whether to

market the disc alone, or to support the development of additional atlases covering other areas of human anatomy.

Other Commercial Co-ventures

Some commercial vendors who have developed their own courseware for the healthcare market find it is easier to market a large library of programs rather than a few programs. For this reason, many vendors are always looking to pick up and polish school-produced programs that they can add to their offerings.

Applied Interactive Technologies. One effort at a school/commercial co-venture involves a low-cost, proprietary, hardware delivery system. Applied Interactive Technologies (AIT) in Jackson, Mississippi put together a Level III hardware system that sells for only \$1500. Since this system is proprietary and not compatible with other integrated systems such as the IBM InfoWindow or the Sony View system, the AIT system can not play videodisc programs developed by anyone but AIT. Therefore, in order to sell the system, AIT put together a library of videodisc programs by contacting schools and commercial firms that already developed programs and received permission to convert these programs to the AIT system and market them.

The advantage of this arrangement is the low cost of the delivery system. The problem is that schools and hospitals who buy this system are limited to one developer for their supply of courseware. They would not be able to use any programs developed by other commercial firms and by other health sciences schools. This hardware/software package was introduced in February 1988 and has not been very successful.

ALIVE. Another firm that began picking up courseware developed by schools is the ALIVE Center, developers of the *Active Knee* series of videodisc programs. In order to broaden their courseware selection, they secured rights to *A Right to Die*, a videodisc program produced by Carnegie Mellon University. They also are marketing a two-disc interactive videodisc program *Preventative Cardiology*, produced in conjunction with the Case Western Reserve University's School of Medicine.

Edudisc. Edudisc, Inc., of Nashville, Tennessee develops and distributes interactive video products using the Macintosh computer. To add to their offerings, they picked up several programs developed by Bloomsburg University. The programs are *Introduction to Case Studies in Hematology*, *Child Sexual Abuse*, *Stress Management*, and *AIDS Education*.

Health Sciences Consortium. The Health Sciences Consortium is a non-profit cooperative created in 1971 to distribute health sciences instructional material. Recently, the HSC has been distributing several videodisc programs developed by schools who are members of the IBM-sponsored Healthcare Interactive Videodisc Consortium.

FITNE. The Fuld Institute for Technology in Nursing Education was organized by the Helene Fuld Health Trust to promote the use of technology in nursing education. One of the activities of FITNE is the development and distribution of interactive video courseware for schools of nursing. The first program developed by FITNE was originally produced at Hocking Technical College. FITNE is reviewing additional school-produced programs for additional development and distribution.

Stewart Publishing. Stewart Publishing, Inc., sponsor of the Interactive Healthcare Consortium, helps schools market their own material, or will market and distribute the pro-

gram for them. Stewart Publishing usually picks up programs which, although useful, have a limited sales potential and, therefore, do not justify the expensive marketing and promotion allotted programs with a wider distribution potential.

Schools as Marketing Agencies

More and more schools are acting as their own marketing and distribution agent for videodisc programs developed in-house. The first, and perhaps most successful, of these is the University of Washington (UW). UW has produced a total of 11 programs, most of them "generic," on topics covering trauma training, microscopy, hematology, and neurology. The price of these discs range from \$175 to \$300. These discs contain medical images and are not sold with any type of instructional programming. This is left to the purchaser to develop.

The UW has been successful selling these discs because 1) the discs themselves were of high production quality, 2) they were generic discs (images only, no programming) which prevents running into the "not invented here" syndrome, and 3) they kept their overhead low. Because the total sales of any one disc ranges between 100 and 300 copies, there isn't any margin for expensive marketing.

Most schools, however, have only one or two videodisc programs to offer, and realize that their program has a limited audience. Their marketing efforts usually are limited to word-of-mouth and occasional brochures. These schools, because of the low volume of sales, are able to handle the packaging, distribution, and product support themselves. One of the more successful schools in this category is the University of Utah, which has been selling the shared disc *Slice of Life*. Developed by the Pathology Department, in conjunction with Media Services, sales and distribution are handled by the health sciences library. Marketing assistance is provided by the Interactive Healthcare Consortium in return for a discount to members, and a portion of the sales goes to the library to cover their administrative costs.

Other schools who, in the past, have sold their own videodisc programs include the County College of Morris in Randolph, New Jersey, Simon Fraser University in Burnaby, Canada, University of Colorado Health Sciences Center, and the University of Georgia Department of Veterinary Medicine. Recently, many more schools are developing and selling their own programs, including Auburn University, British Columbia Institute of Technology, California State University-Chico, San Diego State University, University of Iowa, University of Maryland, University of South Alabama, University of Southern California, and University of Texas.

Videodisc Consortium

In 1987 five different resource sharing groups were formed, independently, to assist in the development and distribution of health-related videodisc courseware: the IBM-sponsored Healthcare Interactive Videodisc Consortium (HCIVC), Interactive Healthcare Consortium (formerly the MDR Videodisc Consortium), Fuld Institute for Technology in Nursing Education (FITNE), Medical Interactive Video Consortium (MIVC), and Consortium of North American Veterinary Interactive New Concept Education (CONVINCE).

Healthcare Interactive Videodisc Consortium (HCIVC)

In the fall of 1987, IBM helped 17 U.S. and Canadian medical and nursing schools form a self-governing organization to develop interactive videodisc courseware. Each member of the Healthcare Interactive Videodisc Consortium (HCIVC) is committed to produce five interactive videodisc instruction modules by mid-1990, for a total consortium library of 85 modules. Three IBM groups, Academic Information Systems (ACIS) in the U.S. and Canada, and MultiMedia Solutions (MMS), are providing financial and technical support.

The consortium meets twice a year to conduct organizational business and review each other's modules. Members use IBM's private computer network, InfoNet, to communicate with each other and with on-line IBM technical experts and trouble-shooters. IBM MultiMedia Solutions, in Atlanta, provides educational and technical support on the use of the InfoWindow systems and IBM's authoring systems.

Courseware Publication and Distribution. The Health Sciences Consortium (HSC), a non-profit publishing cooperative, has been chosen as the publisher for many of the HCIVC courseware. Anticipated prices for the programs are \$650 for HSC members and \$1,300 for nonmembers. Additional copies of any videodisc are expected to cost \$125 for HSC members and \$250 for nonmembers. HSC institutional membership is \$1,000 for one year, \$2,000 for three years, and \$5,000 lifetime.

Interactive Healthcare Consortium

The Interactive Healthcare Consortium (formerly the MDR Videodisc Consortium) was formed by Stewart Publishing at the request of individuals in health sciences schools, many of whom attended the general meeting of the Medical Interactive Video Consortium in October but were excluded from active membership because their fields of study were non-medical (nursing, dentistry, allied health, etc.) The IHC is an educational publishing cooperative dedicated to the development and distribution of interactive videodisc courseware in healthcare. Membership includes schools of medicine, nursing, dentistry, allied health, pharmacy, and public health as well as hospitals, professional organizations, and pharmaceutical companies.

IHC members are entitled to a number of benefits, including a free subscription to the *Interactive Healthcare Newsletter*, discounts of 10 to 20 percent on selected commercial videodisc programs, discounts of 15 percent or more on other commercial products such as videodisc players, hardware systems, authoring systems, and other design and development software, and 20 percent discount off all products and publications offered by Stewart Publishing. In addition, the IHC will assist in the marketing and distribution of interactive video courseware developed by member schools.

The IHC also organizes a shared videodisc entitled *Resources in Medical Education*, which contains material contributed by health sciences schools. *Resources* is used as a generic videodisc for repurposing by other health sciences schools and is updated periodically to allow additional contributions.

Membership in the IHC is \$300 per year, \$150 for schools of nursing and community colleges. As of January 1990, there were approximately 100 members in the United States and Canada.

Fuld Institute for Technology in Nursing Education

The Helene Fuld Health Trust is the largest private foundation in this country that directly supports nursing education. In the fall of 1987, the Trust established the Fuld Institute for Technology in Nursing Education (FITNE). FITNE is a separate entity from the Helene Fuld Health Trust and concentrates specifically on the use of technology in nursing education.

FITNE is a membership organization, with an institutional membership fee of \$300 per year and an individual membership fee of \$85 per year. Owned by the nursing community and designed to directly serve the technological needs of nursing education. It provides a clearinghouse for educational software and hardware through reviews and evaluation of software and hardware systems. Another aspect of the institute is to negotiate attractive pricing for members on software and hardware. FITNE's information dissemination system includes a newsletter, electronic bulletin board, and CAI development and application workshops.

Hardware Grants. Perhaps the most significant contribution by FITNE to date is the impact it is having on the placement of interactive video hardware systems in schools of nursing. In 1988, the Helene Fuld Health Trust, through the FITNE, selected 46 schools of nursing across the U.S. and Canada to become the first interactive video demonstration centers to receive InfoWindow-compatible FITNE interactive video systems.

The Institute's goal was to encourage commercial producers to devote more effort toward the production of instructional programs applicable to nursing education and to provide cost savings to FITNE members who purchase the hardware and software developed by the Institute. Two FITNE Interactive Video Systems were provided to schools with more than 100 full-time nursing students, and schools with less than 100 full-time students received one system. Schools also received a copy of the interactive video instructional program *Intravenous Therapy*, distributed by FITNE. All schools will participate in data collection and evaluation for three years.

The placement of these systems and others FITNE shipped during 1988 meant there were more than 100 identical pieces of hardware in over 60 schools by the end of the year. In addition, the Helene Fuld Health Trust will continue to make hardware grants to nursing schools each year, adding to the number of compatible interactive video systems placed in this market.

Medical Interactive Video Consortium

On June 24, 1987, a meeting was held in Bethesda, Maryland of individuals to discuss the possibility of forming a consortium to promote and engage in production of interactive video materials for physician training. Present were representatives from 13 medical schools, the US Army, the US Navy, and the National Library of Medicine. It was unanimously agreed to form such a consortium, and a steering committee was elected. The thrust of the consortium is to 1) share resources in the production and dissemination of interactive video materials (discs, software, etc.), 2) promote standardization of hardware and software, 3) act as a source of information about interactive video in medical education, 4) be a source of information about current and proposed interactive video productions (to reduce duplication of effort), and 5) to undertake volume procurement of interactive video materials. It was decided that membership in the consortium would be open to

all universities and governmental agencies engaged in education of medical students or physicians. There will also be individual memberships for those attached to such institutions. The MIVC has a membership meeting in November of each year in conjunction with the Symposium on Computer Applications in Medical Care (SCAMC) meeting.

CONVINCE

CONVINCE (Consortium of North American Veterinary Interactive New Concept Education) is a not-for-profit organization allied with the American Veterinary Medical Association. The primary purpose of CONVINCE is to encourage cooperative development and sharing of interactive video and hypermedia programs for veterinary medical education.

CONVINCE was formed in 1987. Its formation was catalyzed by the 9th Symposium on Veterinary Medical Education which emphasized the need to alter veterinary medical education through increased fostering of problem solving, independent study, and the adoption of modern technology. Interactive video and hypermedia are powerful educational delivery systems which couple video and the computer into a single interactive learning tool.

CONVINCE is dedicated to implementing change in veterinary medical education by encouraging the following: involvement of American Colleges of Veterinary Medicine and allied groups in collaborative efforts to incorporate interactive video and hypermedia into educational programs; excellence in program development; hardware and software standards to assure that materials which are developed can be shared; coordination of program development to minimize duplication of effort; and development of evaluation systems that will help universities recognize and reward faculty for scholarly program development.

Active Schools and Colleges

Auburn University

The College of Veterinary Medicine was instrumental in forming a consortium for the development of videodisc-based instructional materials. A prototype disc on heart sounds has been completed, and other discs are in the planning stages. Funding is provided by the Geraldine R. Dodge Foundation and the Merck Company Foundation.

Cardiovascular Laboratory Videodisc Simulation. The college also has created an interactive video program entitled *Cardiovascular Laboratory Videodisc Simulation*, a collection of lessons which simulate cardiovascular physiology experiments traditionally conducted by health science students. *Cardiovascular Lab* is the first of a series of planned videodisc lessons including *Heart Sounds*, *Hemorrhagic Shock and Transfusion*, and *Respiratory Mechanics/Gas Exchange*.

Cardiovascular Lab Simulation includes chapters on the following topics: Introduction and Instructions, Experimental Preparation and Instrumentation, Cardiac Catheterization, Autonomic Control, Positive Pressure Ventilation, Manometer Experiments, Fibrillation, Termination, Cardiac Cycle, and Abnormal Cardiac Cycle, Autonomic Tutorial.

Drug Use Guide. Working with Auburn University's School of Pharmacy, the US Pharmacopeia (USP) has developed an electronic version of its definitive reference of drug information, *USP Dispensing Information (USP DI)*. USP has licensed a CD-ROM product and has developed four Level Three interactive prototypes to dispense information to patients wherever they are counselled – at pharmacy counters, clinics, hospital and nursing home pharmacies, physician's offices, HMOs, and ultimately by general public access.

The interactive video program, *USP DI Visualized*, presents specific health and drug information found in *USP DI*, such as the proper techniques for self administration of medications, possible side effects, and adverse reactions. The system also provides a health check feature, tailors prescription according to inputted patient information, and tests the user on his/her knowledge of the information presented through the program.

Bloomsburg University

A Center for Instructional Systems Development was established at Bloomsburg University in Pennsylvania--thanks to funding by the Ben Franklin Advanced Technology Partnership. The purpose of the center is threefold: 1) to support the design and development of computer-based interactive videodisc courseware for interested Bloomsburg University faculty, 2) to serve as a vehicle for partnership by seeking and supporting interactive videodisc projects for private sector entities through grants and sponsorships, and 3) to coordinate and cooperate with the College of Graduate Studies and Extended Programs in supporting human resource development in the Instructional Technology Master's Degree Program and Extended Educational Programs for corporate business sector training.

The initial award of \$66,131 was for the university to work cooperatively with the Geisinger Medical Management Corporation to develop model courseware for the training and retraining of nurses and physicians in critical care medicine. The following projects were completed:

Use of M.A.S.T. was developed using the Department of Transportation's objectives for pre-hospital personnel. The lesson is divided into eleven sections dealing with a different aspect of the M.A.S.T. The lesson has been tested with fifteen paramedics and EMT's.

Crisis Management of the Ventilated Patient consists of six simulated cases that give the nurses "hands-on" experience in the care of mechanically ventilated patients. Each case deals with a potentially life-threatening problem which these types of patients are especially prone to. The lesson is menu-driven and has extensive help options that allow the user to interrupt the lesson at any time for additional information.

Poison Prevention is a lesson developed in cooperation with the Geisinger Poison Center. The lesson was developed for five to seven year old children and is currently being used by the Poison Center staff for visiting school groups.

AIDS Education is an interactive video lesson for rural students between the ages of eleven and fourteen years old. The program presents information about the Acquired Immune Deficiency Syndrome. The information is necessary as the students are expected to change or avoid behaviors which spread the AIDS virus. The videodisc was designed not only to provide facts on AIDS and how it is spread, but also to stimulate active student participation in the decision-making process. Realistic scenarios provide students

with the opportunity to practice making difficult decisions that they someday may face in their own personal relationships.

Nurse Triage in the Emergency Room is a lesson that will provide students guidance and practice in the placing patients from an emergency room environment into the treatment categories. Proper placement will insure that treatment and medical diagnosis can take place in a timely and efficient manner.

Procedures in Critical Care is a companion disc to *Crisis Management of the Ventilated Patient*. This disc illustrates nursing skills and procedures that are necessary for the care of the critically-ill patient. The student controls the rate of information delivery and practice. Feedback generated by the computer further reinforces the learning.

Boston University

The Boston University School of Medicine has created two videodisc programs being used with undergraduate medical students. *Visual Guide to Tissue and Organ Histology* is an experimental videodisc that allows students to use supporting visuals during independent study. The disc contains 500-600 slides commonly used for the undergraduate histology course. A Level III program has been written that allows the students to select samples from any of three main sections: 1) Tissue, 2) Organ, and 3) Identification. The identification section allows the student to practice identifying samples selected by the computer. The other sections include examples of different categories including a written description of the sample. A "quiz me" section is planned for the future where the student would be asked various question about each slide.

Liver Pathology was created by Visage, Inc. in Massachusetts as a demonstration disc for use with their hardware delivery system. Approximately 80 slides from the Boston University's pathology department were included with other material in exchange for a copy of the disc. The slides were provided by Dr. John Dittmer and focus on tumors and cirrosis of the liver. A Level III program has been written to allow students to select slides for viewing.

Bowman Grey School of Medicine

In January 1988 Bowman Gray School of Medicine unveiled their first interactive videodisc teaching program at the Second International Wrist Arthroscopy Congress. The program on wrist arthroscopy was conceived by Dr. Gary Poehling, an orthopedic surgeon at the medical school and chairman of the arthroscopy congress.

The program presents 25 individual topics covering anatomy of the wrist, operating room setup and instruments, fundamentals of using an arthroscope, and the diagnosis and treatment of common wrist pathologies. Dr. Poehling estimates most users will spend from two to eight hours reviewing the program material depending on their previous experience with the wrist and with arthroscopy in general.

Dr. Poehling created the wrist arthroscopy videodisc with the assistance of Dr. Boyd Richards, an instructional specialist working in the school's Office of Educational Research and Services. With funds from a special research and development account, Dr. Poehling contracted with the Learning Resources Institute in Durham, North Carolina to produce the program according to the specifications he and Dr. Richards had developed. Most of the video material came from archives of tapes prepared by the school's Audiovi-

sual Department. The AV Department also contributed illustrations depicting the anatomy of the wrist and configuration for setting up the operating room equipment.

British Columbia Institute of Technology

The British Columbia Institute of Technology (BCIT) has produced two videodiscs, one in heart anatomy and physiology and the other in radiology. *A Test Disc on Medical Radiology* is a prototype project exploring the use of videodisc for projecting radiographs in the classroom. The disc explores the use of still-frame transfer technology as a way of using videodiscs in the classroom. X-rays were transferred to video still frame using a Sony Mavica, which writes video signals to a 1-1/4-inch diskette. Each disk stores up to 50 frames which were then transferred to videodisc. The images are then played back in the classroom using a Sony Superbright projector.

Anatomy and Physiology of the Heart is a thirty-minute videodisc filled with several short introductory clips, video of surgical procedures, autopsy, moving medical images such as ultrasound, magnetic resonance imaging, or nuclear medicine, and a wide variety of anatomical specimens. These images are blended together with extensive computer graphics and text to portray each topic through a number of presentations of varying depth and speed. The program is comprised of 25 modules which cover six major themes: Cardiac Basics, Anatomy of the Heart, Cardiac Cycle - Mechanical, Cardiac Cycle - Electrical, Regulation of Cardiac Output, and Common Cardiac Pathologies. While each of the six themes is treated with an introduction, each of the 25 topics is presented through five venues:

Overview. This video clip introduces the topic showing its relevance and scope. It serves as an advanced organizer and presents many of the images which will be studied in greater detail in other venues.

Presentation. This covers the actual material to be learned. There is interaction with the material through the touchscreen approximately every 20 seconds. Relevant animations, computer simulations, and still images (with graphic overlay) are used as required.

Exploration. While the presentation deals with "need to know" material, the exploration deals with "nice-to-know" information and provides additional examples or views of medical imaging to supplement the topic.

Summary. This is a one- or two-page precis of the key points in the presentation. Students particularly like the summary when preparing for examinations.

Test. While review questions are given throughout the presentation, the test section provides access to an extensive test-item bank dealing with the topic. Since questions are drawn at random and the distractors appear in scrambled order, a wide variety of multiple-choice, labelling, or matching questions may be seen.

Case Western Reserve University

The Case Western Reserve University School of Medicine completed a shared disc in 1983 simply titled *Sharedisc*. Production of the disc was cosponsored by the RPC Corporation, NCR Corporation, and Media Videotex. The disc was produced as part of a joint demonstration project involving the production of videodisc material for use in undergraduate medical education. Areas of specialization involve neurology (special emphasis on the visual system), histology, and renal biology. Some comparisons of lighting and

camera techniques were carried out and various types of original media were employed. The resulting disc and instructional programs have been used in small-group teaching modalities.

Preventive Cardiology. CWRU also has developed a two-disc interactive videodisc program *Preventative Cardiology*. Produced in conjunction with the ALIVE Center, the program consists of two parts. Part I, geared for pediatricians and physicians, is designed to familiarize doctors with the procedures for distributing cardiovascular disease prevention information throughout their communities. It includes early detection and early intervention strategies for detecting and controlling arteriosclerosis.

The programs are designed to assist physicians in their discussions with patients about sensitive issues such as diet, exercise, and the risks of cigarette smoking. Interactive videodisc allows the physician to learn and practice Strategic Interview Skills. Through evaluation of doctor-patient dialogs, the physician learns how to encourage healthy behavior in his patients.

Part II is intended for doctors, patients, and students (junior high school level and above). It provides an overview of the heart and its relationship to the circulatory system, and it examines cardiovascular disease and coronary heart disease. The introduction covers basic information on the heart, the circulatory system, and arteriosclerosis, while three lessons zero in on effective means of combating coronary artery disease: exercise, nutrition, and not smoking.

Surgical Management Information Project. Medical students and surgeons-in-training at Case Western Reserve University are benefiting from the use of a newly developed *HyperCard* program on surgical topics. Now, instead of having to go to numerous sources to look up information about a surgical procedure, students can sit down at a single workstation and find print and graphic information on physiology, pathology, and histology, as well as X-ray, and video sequences of the operation.

The *Surgical Management Information Project* was conceived by Joel A. Weinstein, MD as both a surgical reference and as a way to orient students to surgical procedures. The work station consists of a two-screen Macintosh system. When beginning, students first see a card which gives them some background information on the surgical procedure. At the same time, they have access to two buttons: one that gives them a video index to access the laserdisc, the other to take them to a text index. As students click through the text area, they browse through cards that provide text information.

The student may be reading about the small intestine and the text may say "the intestine consists of three different parts, the duodenum, the jejunum and the ileum." That, alone, doesn't put an image in the student's mind. But the student has the option to click on a graphic that shows the relationship of the different parts to each other and to other structures around them. When the students are done with the graphic, they simply click on another button and return to the text exactly where they left off reading so they don't lose their train of thought.

Students may also go to the video index, where the operation is divided into multiple segments. Unlike linear videotape, videodisc material can be randomly accessed. This allows students to select any segment of the video material for an immediate viewing. If students don't understand how a particular aspect of an operation was performed, they can click on a button and immediately that part of the operation is playing on the monitor.

Cornell University

Cornell University Medical College, in conjunction with a grant from the National Institute of Mental Health, produced a videodisc program titled *An Interactive Video Course on AIDS*. The program is recommended for use in an AIDS-related clinic and is designed to gather and disseminate psychological, medical, and therapeutic information from/to AIDS Antibody Blood Test recipients. The course is part of a three-armed study to determine the effectiveness of a program designed to counsel and educate people who undergo blood testing for AIDS virus antibodies. The program also collects information from its viewers to determine a baseline of knowledge on the viewer regarding the full spectrum about AIDS and the antibody test.

Interviewing Skills. Another program produced at Cornell is *An Interactive Video Program for Teaching Interviewing to Medical Students*. This is part of a Cornell Grant project to determine the usefulness of interactive video as an educational tool, specifically with teaching interviewing to medical students. The content shows segments of a physician/patient interview (staged) and asks the medical student to analyze each and respond to its appropriateness within their notion of what a patient interview should include, should not include, and the order in which information should be gathered.

Pathmac. The Department of Pathology at Cornell has developed a videodisc network called *Pathmac* designed allow first and second year medical students access to a large mass of information. *Pathmac* is a Ethernet network of 20 Mac IIs. Each work station has a Panasonic player and a copy of the recordable disc, which contains approximately 4000-5000 images including gross and microscopic pictures of normal and pathologic specimens, microscopic sections (LM and EM) as well as a complete serial sectioning of the human brain with correlative CAT scans and MRI.

George Washington University

The George Washington University Medical Center has developed a videodisc entitled *Human Light Microscopic Anatomy*. Jointly produced with the National Library of Medicine, the eight-inch laser videodisc contains more than 2,800 human microanatomy images taken from microscopic slides.

The visual data base is paired with a computer data base/search program containing descriptive information about the images. The software allows the user to search for images using natural language or to change image descriptions, add or delete key search words, change hierarchical relationships of images, or create individualized slide shows. The program is designed to run on a two-screen PC videodisc configuration. The videodisc also supplements an anatomy text, *Introduction to Functional Histology* (by Ira Telford and Charles Bridgman), available from Harper and Row. The text has been laser barcoded so that users may drive their videodisc player with a barcode reader system.

John Hopkins University

The Johns Hopkins University, in conjunction with the National Library of Medicine, has developed an interactive video tutorial for InfoWindow or compatible hardware systems. The content was developed by dermatology educators to emphasize the possibility of diagnosis of early melanoma by non-dermatologists.

The program was designed as a text-based tutorial on melanoma, with selected images from the videodisc used with graphic overlay. Authoring was performed using the IBM InfoWindows Presentation System (IWPS). Images of pigmented skin lesions were taken from clinical photographic slides and histologic sections loaned by William Crutcher, MD, and the University of Pennsylvania Pigmented Lesion Clinic. The American Academy of Dermatology also contributed to the production of the videodisc.

Leiden University (The Netherlands)

Professor H.A. Verbeek of Leiden University, in conjunction with an impressive team of advisors, specialists, and staff connected with VNU Nieuwe Media Groep and CAT BENELUX in the Netherlands, have produced a 30,000 image collection on videodisc for medical education. Included in the collection are drawings, photographs, micrographs, radiographs, and echocardiograms covering normal body systems and pathology, pediatrics, surgery, physical rehabilitation, and a wide range of other topics. An electronic index, searched using the "Freebase" data base program also comes with the collection.

Louisiana State University

The Louisiana State University Medical Center is creating a series of interactive videodisc modules to help medical students develop basic skills for conducting initial psychiatric interviews. Building on actual videotaped cases, the interactive videos bridge a gap between classroom instruction and real interviews on "rounds." One module teaches skills for active listening, directing an interview, gaining rapport, and observing non-verbal communication.

The Initial Psychiatric Interview is a set of interactive videos based on subject matter in actual case videotapes. Designed mainly for medical students, the series also has value for graduate education, social and pastoral care work, and other allied health fields. One module is already completed, one designed to teach skills in listening, directing and interview, gaining rapport, and observing non-verbal communication.

The decision was made to use an actual videotaped patient interview as a basis for content. The first task was to transcribe the videotape and prepare a rough script. Then a road map was charted, creating basic pathways for each of the four objectives: listening, rapport, interview technique, and non-verbal communication. The idea was to take the student down each path with motion video of the interview plus interactive questions and responses, and also to offer the complete, uninterrupted interview for review and voice-over commentary.

Once the motion video was shot, the team finished editing the video and audio tracks and integrated all introductory, how-to, graphics, and commentary material. Also added were a HELP function, a CONTINUE function to skip the introduction, a glossary of terms, and provision for a student ID number. The module was produced at an estimated cost of more than \$50,000, plus the time of the subject matter expert, Dr. Paul Ware.

Loyola University (Chicago)

The Stritch School of Medicine at Loyola University in Chicago recently produced a videodisc program titled *Pulmonary Procedures*. The program first presents the video of an actual procedure then interacts with the student to discuss the rationale of each step.

Video segments and graphics are used to explain each step. Indications, preparations, complications, contraindications, and post procedure management are reviewed. A knowledge base is available for the student's review throughout the program.

Massachusetts Institute of Technology

In 1986, MIT was engaged in a campus-wide effort to integrate computers into all phases of the educational enterprise. One of the programs supported was a two-year effort to create a computer-aided learning system in neuroanatomy. Using conventional databases, videodisc, and CD-ROM, the program allows students to freely explore thousands of images of brain structure.

Most of the images that make up the instruction are computer-generated, three-dimensional views of the brain that allow the student to see any of a number of major brain structures and pathways, singly or in combination. These images are supplemented by video images of original slides and video sequences from a human brain dissection. The programmed instruction leads students through each of the neural pathways relevant to a particular function, presents a graphic display of the region, then asks questions and provides feedback to answers.

Medical College of Georgia

To better teach problem-solving skills to their medical students, Abdulla M. Abdulla, M.D. and John S. Henke, M.S. at the Medical College of Georgia (MCG) developed a series of videodisc-based patient simulations. The simulations allow the student to "interview" and "examine" a patient who presents a complaint or symptom.

As in other simulations, the student is required to diagnose and treat the patient by ordering diagnostic tests and therapeutic interventions. The unique aspect of this system is that it allows the student to enter questions and requests in plain English via the computer keyboard. The computer then compares the typed question with a list of synonyms and determines the appropriate response.

When presented with the question "Where does it hurt" or "Where is the pain located," the computer will key in on the words "where--hurt" or "where--pain", and might provide the user with a video sequence of the patient describing the pain in his chest. As the student progresses through the simulation, the computer is able to record a student's entries and compare his decisions with those established by a panel of experts. In this way, a score can be generated for each component, which includes history-taking, physical examination, laboratory evaluation, and therapy. The costs of diagnostic and therapeutic intervention are also tracked and compared with an expert's cost-of-care.

Some of the videodisc simulations completed to date include *Simulation of a Patient with Unstable Angina*, *Simulation of a Middle-Aged Man with Fever of Unknown Origin*, and *Simulation of an 11-Month-Old Child with Fever of Unknown Origin*. Each lesson was created on the MCG's PROF authoring system, which is written in machine language with the use of a "C" compiler.

Medical University of South Carolina

The Medical University of South Carolina (MUSC) produced the Introduction to Ultrasound videodisc being marketed by the American College of Radiology Institute. The

program is designed primarily for medical students and radiology residents, and is widely used in the MUSC teaching program. The disc may be used as a Level III program for self-study, or can be shown during lectures to stimulate discussion.

Michigan State University

The Media Services Department and Pathology Department of Michigan State University are creating interactive videodisc instructional units on neuropathology topics for use by undergraduate medical students. These programs are being developed as *HyperCard* stacks with images from the *Slice of Life* videodisc, a shared disc coordinated by the University of Utah.

The first unit, *Central Nervous System Neoplasms*, consists of five parts: a pretest, an instructional lesson, a post-test based on information in the lesson, a clinical simulation emphasizing reinforcement of concepts and problem-solving related to neuroanatomy, neuropathology and neurology, and a glossary which can be accessed from the lesson or simulation. The instructional lesson includes an outline which provides random access to any topic in the lesson, didactic information taught in the neuropathology lectures, illustrations of pathology and radiology, questions to test understanding, and case histories.

During the clinical simulation (based on Neuropathology Problem Solving Exercises: Jones, et al., Soc. Neurosci. Abstr. 4:398, 1978) the student is given segments of the patient history followed by questions related to signs and symptoms. Then, autopsy neuropathological findings are presented, with questions related to the images of gross and microscopic lesions from the videodisc. For all questions, remediation or reinforcement is provided for each answer selected. Throughout both the lesson and simulation, glossary entries are indicated by an asterisk following a word, and a mouse click will call up that entry. The CNS neoplasms unit underwent evaluation during summer and fall 1988, with additional units planned.

Preclinical HyperCard Stacks. Students in the College of Human Medicine at Michigan State University are developing extensive *HyperCard* stacks for use in Track II of the Preclinical Program. The Track II program is a problem-solving curriculum which is divided into 13 clinically oriented Focal Problems (e.g. Anemia, Mental Insufficiency, Muscle Weakness, etc.). Students are assigned required reading in each problem area and meet in small groups to discuss and integrate the information.

One Focal Problem group (12 students) organized the project which eventually involved 30 students. Each of the 12 students was assigned a discipline and became a "concept captain" for that discipline. Students were assigned required readings to summarize and organize information. This information was then entered into an Apple HyperCard program shell developed by several of the more computer literate members of the project. Students entered text, graphics and graphics—as well as sound and video images from a videodisc. The goal at this level was to identify and summarize critical concepts. Concept Captains had the goal of integrating the concepts at the discipline level. Finally, an Inter-Concept Linking Group integrated across disciplines. To date, two Focal Problems have been completed, the Anemia Focal Problem (called HYPER-ANEMIA) and the Jaundice Focal Problem. Each is being reviewed by faculty for possible inclusion in the Track II curriculum.

Ohio State University

The Office of Academic Services for Medical Education at the Ohio State University is developing a series of interactive videodisc programs on gross anatomy. The program series, entitled *Anatlab*, is designed to supplement the lab work in anatomy for the allied health professions. If successful, *Anatlab* will reduce the costs associated with the traditional anatomy courses by decreasing the number of teaching assistants and cadavers required for instruction.

To determine the effectiveness of *Anatlab*, half of the students in three gross anatomy classes were randomly assigned to either a computer lab or the traditional cadaver lab. The computer lab videodisc includes everything the students would see in the actual lab. In addition, the interactive tutorial is written to simulate the kind of student-teacher conversations that usually occur during the three-hour lab covering the same material.

One week after the lab experience, each class was tested in an unannounced lab practical. Even though they were tested on the unfamiliar cadaver, in two of three classes, the students trained with the computer lab scored as well as the cadaver lab trained students.

Anatlab is the second videodisc produced by The Ohio State University College of Medicine and represents the combined efforts of several departments. The medical school's CAI center contains several hundred hours of programmed instruction, many incorporating videodisc still images, motion sequences, and sound. Student carrels are configured with IBM AT's, Sony or Pioneer videodisc players, and Sony video monitors.

San Diego State University

The San Diego State University School of Nursing has developed the videodisc program *The Story of Maria* to provide pregnant women with information on infant feeding. The Level III program was designed for use by Hispanic women and dramatizes the experience of a young first-time pregnant woman as she engages in the decision-making process regarding her choice of infant feeding. The user can follow Maria through the process of breast and bottle feeding and compare and contrast the two methods. Through the interactive component of the program, the user becomes actively involved in the issues faced by Maria, is able to internalize the information, and make informed choices about applying the knowledge to her own life. The program can be used in Spanish or English.

Stanford University

An electronic textbook developed by Stanford University Medical Center researchers could aid students trying to master the complexities of human anatomy. Combining text, computer graphics and full-color video, *The Electric Cadaver* allows a user to interactively explore the structure of the human body in a way unavailable in conventional printed books. The system displays images on two screens, one for computer graphics, the other for full-color video. A user can "jump" from picture to text to video and back, just as a reader jumps from place to place in a printed volume. *The Electric Cadaver* allows students to move beyond the lecture, printed page, and laboratory to the domain of interactive self-study.

David Bassett, M.D., a Professor of Anatomy at Stanford and the University of Washington, spent 15 years creating the anatomical images that form the core of *The Electric Cadaver's* visual database. In collaboration with William Gruber, the inventor of the ViewMaster Stereo Slide System, Bassett worked through the 1940s and 1950s preparing 1600 pairs of stereo slides, originally published on ViewMaster reels in the *Stereo Atlas of Human Anatomy*. After Bassett's death in 1966, the collection fell into obscurity, despite their unique quality and comprehensiveness. Several years ago, at Dr. Robert Chase's urging, Bassett's wife, Lucile, reclaimed the original images and lent them to Stanford University.

Syracuse University

The Psychological Research Disc was developed in 1985 by the Department of Psychology at Syracuse University to provide a tool to study the ability of subjects to mentally rotate abstract, two-dimensional figures. The program replaces paper and pencil measures.

Thomas Jefferson University

In March 1986, Jefferson Medical College published its first videodisc slide collection, *Resources in Medical Education-I*. The disc contains 1149 slides contributed by members of the Anatomy and Pathology Departments and fifteen minutes of video. The video segments include a tutorial on the integumentary system and a tutorial on range of motion. The slides also include illustrations from several anatomy textbooks, with the consent of their publishers. Because of its experimental nature and because of copyright restriction, the videodisc may not be sold to outside institutions.

In October 1987 the MDR Shared Disc *Resources in Medical Education-II* was released. This disc was the result of a collaborative effort by Jefferson Medical College, University of Florida, University of Cincinnati, University of Washington, and Duke University. The disc contains medical images covering microanatomy, histology, radiology, immunology, pathology, and clinical microscopy. Since then, a third edition of the disc has been produced and several tutorials have been developed using images from the disc. These include *CAI-IV Histology*, *Histology: Hematology*, and *Skin*.

Radiographic Artifacts Tutorial. The Thomas Jefferson University Office of Academic Computing, supported in part by the IBM Corporation, has developed an interactive videodisc program titled *Recognizing Radiographic Artifacts*. Developed for the IBM InfoWindow hardware system, the program is aimed at students of radiologic technology who must be able to distinguish artifact from pathology on an X-ray film.

The program consists of four modules: a tutorial on radiographic artifacts (objectionable features on an X-ray image that are not produced by the patient's body or pathology), a side-by-side comparison of artifacts and pathologies, image database, and a self-assessment exam. In the tutorial module, a radiographic image is displayed on the screen along with identifying information. Through the use of the touch-screen the user can ask for help in locating an artifact, identifying the cause of an artifact, or can ask for additional information in the form of explanatory text, graphics, or photographs. Examples of each of the major types of artifacts are presented, including patient belongings, ingested materials, hospital paraphernalia, and processing errors.

In the second module, artifacts with similar appearance are compared to one another and to the radiographic appearance of pathological processes. For this section, composite images showing side-by-side comparisons of two or more processes were created photographically before transfer to the videodisc. Distinguishing elements are highlighted and explained.

Administering Therapeutic Agents. Thomas Jefferson University also has developed an interactive videodisc learning package to assist nurses and other health care professionals in acquiring the knowledge base and psychomotor skills necessary to safely and effectively administer therapeutic agents to clients. This program facilitates decision making related to the total process of medication administration.

Tufts University

Tufts University School of Medicine is developing a series of interactive videodisc programs to help students understand the central nervous system. The initial five modules of the series are being produced at a total cost of about \$300,000. The modules progressively examine the CNS from the spinal cord through the brain stem and into the fore-brain. The first completed module is *Pathways in the Spinal Cord*.

The human brain model was created by assembling images of successive slices of brain tissue through the entire brain, which were then recorded on film. Each slice was optically scanned to convert its image to digitized data that could be read by computer. Finally, the data set was reconstructed and recorded three-dimensional animations of the brain on videodisc. It took a week, working twelve hours a day, to digitize a single series in one plane through the brain. A programmable video recorder taped the model rotating 360-degrees at different angles, and it took eight hours to record each angle during its full rotation.

After completing the first five fundamental units, which together depict the conscious sensory and voluntary movement systems, the team will develop additional units covering functions of cranial nerve nuclei and their control; the extrapyramidal systems and the control of movement; modulators of sensory function/pain; reticular formation and the limbic system; development of the nervous system; and stroke: language, memory, movement.

University of California-Davis

The University of California-Davis, in conjunction with the University of Colorado, has developed an interactive video program for teaching sophisticated life-supporting procedures for hospital emergency departments. The program, *Computer-based Teaching and Evaluation of Thoracotomy Skills*, recently received an award at the American College of Emergency Physicians meeting in Washington, DC.

The course is designed to allow medical students and resident physicians to acquire and refine skills by observing and practicing simulated procedures. "The conditions we create put the student physician in a virtual hands-on environment," say Dane Chapman, Assistant Professor of Emergency Medicine and Clinical Toxicology at the University of California, Davis. "It presents the user with branching alternative or choices that must be made as the procedure is performed.

A sense of realism was achieved by videotaping actual surgical procedures. After an opening scene is created with sound and video of a simulated human patient, closeup sur-

gery is performed on a pig, whose organs are very similar in function and appearance to human organs. *Thoracotomy Skills* provides the user with experience in a critical area of emergency care that is infrequently encountered in an emergency department. It also provides a means of evaluating a physician's procedural skills. The program was developed through support from the Emergency Medicine Foundation, the University of Colorado School, and the IBM-sponsored Health Sciences Interactive Video Consortium.

University of Colorado

The Office of Educational Services at the University of Colorado Health Science Center has produced *Level III Videodisc-Based Neuroanatomy Course* to provide an alternative to the lab section of an introductory anatomy course. The project consists of a series of 25 computer-generated modules with associated quizzes on basic neuroanatomy. The videodisc serves as an image bank which replaces dissection with a series of stills. The content for the course was developed by Jack Nolte, who has also authored a basic neuroanatomy text, *The Human Brain* (C.V. Mosby, 1981).

The University of Colorado also worked with the University of California-Davis to develop an interactive video program for teaching sophisticated life-supporting procedures for hospital emergency departments. The program, *Computer-based Teaching and Evaluation of Thoracotomy Skills*, received an award at the American College of Emergency Physicians meeting in Washington, DC.

University of Florida

University of Florida College of Pharmacy recently finished *Communication Skills in Community Pharmacy* to familiarize and test student's communication skills in the areas of interview and assessment, counselling, and consultation. The program is divided into three modes: an educational mode, a test mode, and a small communication skills package. The educational and test modes address all aspects of interview and assessment skills, problems in counselling clients or patients, and consultation with physicians regarding drug interactions.

University of Georgia, College of Veterinary Medicine

The Department of Veterinary Medicine has organized a group of schools to contribute to several veterinary pathology slide collections discs. One of these discs is *International Veterinary Pathology Slide Bank Disc* which contains 3000 slides of gross pathology lesions in domestic animals. Images were contributed by 26 veterinary schools in the U.S., Canada, and Europe. All entries are catalogued using Dbase III. The catalog includes 1) frame number, 2) species, 3) body system, 4) organ, 5) key word, 6) diagnosis, 7) contributor, and 8) contributing organization. Several schools have written instructional programs based on the disc (e.g. University of Georgia, Oregon State, Tuskegee).

University of Hawaii

The University of Hawaii School of Medicine has developed a program entitled *Cyanotic Premature Babies* designed to assist medical students and pediatric residents with diagnosis and management of premature infants exhibiting cyanosis. The program con-

sists of six diverse case simulations, with additional information available on diagnosis, procedures, and relevant drugs.

Respiratory difficulties accompanied by cyanosis are a common problem in premature infants at or just after birth. However, the full diversity of causes is rarely seen in a short training period. This program was developed to assist students and residents with the diagnosis and management of a variety of conditions which they may not see during their training.

The program begins with a menu which permits selection from six cases covering the following: a congenital heart disorder, sepsis/pneumonia, persistent fetal circulation, diaphragmatic hernia, tracheo-esophageal fistula, and respiratory distress syndrome proceeding through patent ductus arteriosus to pneumothorax.

In each case the student is provided with relevant introductory information and must then proceed with diagnosis and management. At each decision point the student may view information about relevant procedures, obtain assistance with diagnosis, or see information about useful drugs. Segments between decision points may be repeated if required. Provision is made for review of instructional segments.

Cyanotic Premature Babies was authored using IBM InfoWindow Presentation System and run on InfoWindow or compatible systems. The extensive graphics in the program were developed with Storyboard Plus using 640x350 resolution mode. This program is one of a number being developed for the Health Sciences Interactive Videodisc Consortium and was funded, in part, by the IBM Corporation. The University of Hawaii is preparing five modules for the HCIVC: *Cyanotic Premature Babies I & II* and *Procedures in Pediatrics I, II, and III*. The first two modules consist of six case studies that require students to make decisions on managing a patient by selecting from menus on the videodisc touchscreen.

University of Illinois at Chicago

The Center for Educational Development at the University of Illinois-Chicago, with support from Metropolitan Life, has produced two programs on interactive videodisc. Each program was developed to demonstrate the potential of interactive videodisc technology and to determine the cost and feasibility of such productions.

Emergency Room Physician. The first program is designed to provide a simulated clinical experience for 2nd and 3rd year medical students. Shot primarily from a subjective perspective, the program provides the student with all of the resources normally available to a hospital physician treating a trauma case, including diagnostic imaging, laboratory testing, consultations, and referral services. Natural language inputs are accepted by the program, which recognizes approximately 800 synonyms in a variety of medical areas.

Back Stress and Body Alignment. The second program is intended to raise health awareness among the general public regarding back care. The viewer is introduced to the program and offered a few simple interactions with the equipment before taking a short risk assessment test. Responses to the test determine which interactive program segments the viewer will see, although an index is available for more in-depth exploration following each individual program segment. Segments include lessons on anatomy, motion, balance, strength and flexibility, disease, diagnosis, and prevention. The segments are structured around the demands of modern life and include practical hints to consider

in selecting furniture, buying proper shoes, exercising, lifting, and driving. In addition, the program offers background information and bibliographical references for viewers who wish to pursue further research on program topics. Each videodisc has been pressed and is being programmed for an Apple IIe computer with Microkey graphics overlay board. IBM compatible versions are planned.

University of Illinois at Urbana-Champaign

The University of Illinois College of Medicine at Urbana-Champaign has developed a videodisc/computer system that provides access to a large knowledge-base of pathology. Known as the Expandable Computerized Learning and Inquiry Into Pathology System (ECLIPS), the system provides textual, pictorial, and graphic information, as well as bibliographic references and abstracts of selected current literature. The prototype disc contains approximately 2500 illustrations.

University of Iowa

One of the first to develop computer-controlled videodisc instruction for the health sciences was the Weeg Computing Center at the University of Iowa. The Center has developed at least four interactive programs for health professionals. Two early videodiscs, *Gynecology Patient Education* and *Urology Retrieval*, were developed in 1982 and intended as research and development projects. The gynecology project was designed to introduce cervical cancer patients to the treatment they would receive at University Hospitals, while the urology disc demonstrated a videodisc-based information storage and retrieval system. Because of the experimental nature of the projects, neither disc is available to the public, but may be viewed at the Weeg Center.

The third videodisc produced by the Center has been the recipient of several awards, including a "Best Educational Production" award by the Nebraska Videodisc Group. *Assessment of Neuromotor Dysfunction in Infants* is designed to teach health professionals to identify early signs of neuromuscular dysfunction on the basis of five parameters: muscle function, reflexes, movement, structure, and gross motor skills. The latest project from the Weeg Center is *Lamaze: The Nurse's Role*, which presents the principles of the Lamaze method of childbirth to nurses and nursing students. The disc was produced as a joint project of the College of Nursing and the Weeg Computing Center under a special projects grant titled "The Use of Microcomputers in Continuing Nursing Education."

Pathology of the Eye. A team at the University of Iowa also is producing interactive videodisc modules on ophthalmology, pediatrics, psychiatry, and dentistry for the Health Care Interactive Video Consortium (HCIVC). One module, *Pathology of the Eye*, is expected to fill a critical national void in medical education at those institutions without the services of an ocular pathologist.

Pathology of the Eye takes full advantage of the videodisc system to superimpose computer graphics over clinical photographs, gross photographs, photomicrographs, and electron micrographs. Users may turn graphic help on and off, according to their training and interests. They can request a magnified view of slides and see additional visual examples of a concept. The course contains 13 different sections, a glossary of over 300

terms linked to videodisc images, and two different forms of self-assessment. It is estimated that it will take students a minimum of 40 hours to complete the course.

University of Iowa Dental School

The University of Iowa College of Dentistry has developed a series of computer videodisc patient simulations to train dental students in problem-solving skills. The program, *Oral Disease Simulations for Diagnosis and Management (ODSDM)* consists of videodisc with an extensive image bank combined with a computer program that delivers multiple case studies. To date, 30 patient simulations have been created, with potential to create a total of approximately 9,000 case studies.

The ODSDM program consists of five major sections:

Case Summary presents the patient's chief complaint and the clinical visuals, which are accompanied by written descriptions.

Investigation enables the student to gather information about the patient's chief complaint, medical and dental history, and clinical findings. To ask questions, students select from a prepared list (versus natural language "interviews"). The rationale for this technique is threefold: 1) so that typing skills do not create an advantage, 2) research regarding natural language entries does not prove it superior to other methods, and 3) menus permit questions to be grouped into meaningful categories--which is desirable based on research demonstrating that organization encourages students to learn a systematic approach to information gathering.

Clinical Impression makes use of a decision tree to encourage students to develop an alternative to a "shot-gun" approach to diagnosis. The decision tree encourages the student to make a series of deductive decisions rather than one diagnostic judgment.

Management is available to the student after entering one clinical impression. This emphasizes that a clinical impression precedes patient management. The patient's management consists of a series of treatment decisions which may include a diagnostic test or a consultation with a specialist. In their management, students are limited to one definitive treatment, encouraging them to focus on the most essential treatment.

Critique contains the student's scores and the correct diagnosis and management. An expert describes the information vital to decision-making and provides a rationale for each clinical impression and management decision. A printout repeats the Critique and the student's clinical impression and management. This enables students to immediately compare their decision-making with an expert's.

New patients may be created for the program using a patient simulation template. In the Case Summary the author specifies the patient's chief complaint, age and sex, and describes the clinical visuals. For Investigation the author writes a response to all patient specific questions. In Clinical Impression and Management the author specifies the correct path through the decision tree and the score for each correct decision. In Management the author also describes the results for each relevant diagnostic procedure. The Critique requires the author to summarize the vital information for Investigation and to write a rationale for each decision in Clinical Impression and Management.

The College of Dentistry and the University Video Center will also be producing a videodisc dedicated entirely to dental images. It will contain approximately 80,000 still im-

ages, representing more than 9,000 patients from eleven departments. Histology and radiograph databases will also be included.

In addition, the Department of Oral Pathology and Diagnosis, the College of Dentistry, and the Weeg Computing Center are developing a prototype computer network system to assign patient simulations to students and to provide grading reports to faculty. Other departments within the College of Dentistry, the Department of Sports Medicine, and the Colleges of Pharmacy and Medicine are modifying and expanding the ODSDM to meet their own instructional needs.

University of Maryland Dental School

The Dental School at the University of Maryland has formed a focal group for dental informatics. Originally funded by the American Association of Dental Schools, the program was hindered by the regular change of officers and organizational direction. The group also receives funding from some participating schools and a hardware support group. A membership fee of \$1200 includes a videodisc player and software. The group is currently working on a slide collection involving ten university dental schools and two international organizations.

Generic Dental Disc. The Information Resources Management Division and the Educational and Instructional Resources Department at the University of Maryland at Baltimore have developed a generic dental disc which contains more than 3000 dental images and 10 minutes of motion video. The disc is designed to provide an image base in dental education to promote Level I and Level III applications for student, faculty, practitioner, and patient education.

The disc contains information contributed by the University of Maryland, University of Iowa, Mount Zion Hospital, the American Academy of the History of Dentistry, Medical College of Virginia, Pan American Health/World Health Organization, and the American Cancer Society. Educational programs are being written using the OAYSIS authoring system (OnLine Computer Systems) and for a hardware system which includes an OnLine GL-512 graphics overlay board.

University of Maryland University College

The Center for Instructional Development and Evaluation (CIDE) at the University of Maryland University College has produced a number of health-related videodisc programs for the Navy. One of their projects involves adapting existing film footage to videodisc to provide refresher training on basic anatomy and physiology. This "repurposing" effort includes four videodiscs containing more than 20 lessons and is titled *Anatomy, Physiology, Pathology: Linking Concepts*.

University of Medicine & Dentistry of New Jersey

The University of Medicine & Dentistry of New Jersey has developed a videodisc program titled *Course on Health Communications*. The course is built around a series of six scenarios which involve health professionals' interactions with each other and with patients and families. Each of the six sections includes: 1) a scenario, 2) a computer-assisted tutorial which discusses critical incidents in healthcare communications, 3) a diag-

nostic section in which the learner identifies key variables in outcomes of interactions and alternatives for resolving interpersonal conflict, and 4) an evaluation component.

University of Miami

The University of Miami School of Medicine developed "*Harvey*" *Cardiology Patient Simulator* in 1985. "Harvey" is an electronic manikin designed to simulate the bedside findings of dozens of cardiac disease states. The accompanying videodisc program provides instruction on the use of "Harvey" and also provides background data for each disease state that "Harvey" simulates. These include matched historical, physical, electrocardiographic, radiologic, noninvasive, hemodynamic, therapeutic, pathologic, and epidemiologic information.

University of Missouri

The Missouri Institute of Psychiatry, affiliated with the University of Missouri-Columbia School of Medicine, has produced a videodisc program to teach chronically mentally ill patients stress management and other skills necessary to remain out of the hospital. *How to Get Out and Stay Out: the Story of Cathy* begins with the main character, Cathy, being released from a psychiatric hospital. She encounters a problem on her first day out. The viewer, using the touch screen, makes a series of choices such as whether she should take her medication and whether she should engage in self-help activities such as talking to people and relaxing. There are eight possible endings to the story, ranging from Cathy being rehospitalized to Cathy thriving in the community. The ending is dependent upon the number of positive choices made by the viewer.

AI/RHEUM. The Information Science Group and the Division of Immunology/Rheumatology at the University of Missouri-Columbia School of Medicine has developed the *AI/RHEUM Knowledge-Based Consultant System in Rheumatology*. The AI/RHEUM system, developed in collaboration with the Department of Computer Science at Rutgers University, uses artificial intelligence techniques to provide non-rheumatologist physicians with advice in the diagnosis and management of rheumatologic problems. The system is being extended and further validated at the National Library of Medicine by members of the original project team.

Also developed at the University of Missouri-Columbia School of Medicine by the Information Science Group is *AI/LEARN: An Interactive Rheumatology Teaching Videodisc*. *AI/LEARN* is a computer-controlled, educational videodisc system which teaches important rheumatologic observation skills. Observational skills are taught by presenting pairs of images on a videodisc and asking the student to determine which image represents a specific feature.

University of Nebraska

Three interactive videodiscs have been developed by the Nebraska Videodisc Design/Production Group to teach introductory college-level biology, chemistry and physics. Known as the Nebraska Interactive Videodisc Science Instruction Project, the discs are designed to enable students to simulate science laboratory experiments via a personal computer interfaced to a videodisc player.

The project was one of the first funded in 1981 when The Annenberg School of Communications announced initiation of a 15-year grant program providing for annual awards of \$10 million to the Corporation for Public Broadcasting. The intention of the grant is to help fund projects designed to furnish institutions of higher learning with significant new educational programming resources and to explore new ways of advancing higher education through telecommunications.

University of Puget Sound

A videodisc-based tutorial on biomechanics for allied health students has been developed at the University of Puget Sound in Tacoma, Washington under a grant from the Health Foundation. The purpose of the program is to provide occupational and physical therapy students with supplemental experiences in a required anatomy/biomechanics/-kinesiology course. Although some students have taken college physics as a preparatory course, others have not and experience difficulty grasping concepts of forces, vectors, torque, etc. without this background.

The program begins with an introduction designed to heighten the students' attention and explain the procedures used in the tutorial. A topics menu is then presented which includes Forces, Vectors, Laws of Motion, and Torque. Students have constant access to a glossary which gives definitions and further background information on terminology and principles which are presented during the tutorial.

In the presentation of material, students are shown examples of the concepts discussed through video scenes of human action as well as graphics and animations. Throughout, students are asked to work practice questions based on the video images, and are given detailed feedback according to their answers. At the end of each sub-unit students are given a quiz, which the computer grades. When the student feels ready, the post-test is given and graded.

The tutorial runs on a Macintosh computer using the Beatles movie *Help!* produced by the Criterion Corporation. Authoring was done using the *Course of Action*. The second phase of the Health Foundation grant will be the production of a teaching module on the early assessment of movement in infants to identify children at risk of developing motor handicaps.

University of Southern California-Los Angeles

The Annenberg School of Communications at the University of Southern California, Los Angeles, has produced a videodisc on hairloss, one side effect of some treatments for cancer. It is currently under evaluation at the Cedars-Sinai Comprehensive Cancer Center, and will shortly be in three other Southern California sites.

The disc offers chapters which answer the following questions: 1) What causes hair loss?, 2) How will hair loss happen, and what to do about it?, 3) How will hair loss feel physically?, 4) How will hair loss affect feelings, family, and friends?.

After the user chooses a chapter, he or she is then asked to pick a level of information, General, Detailed, or chapters designed for "significant others," close friends, and family members of the cancer patient.

University of Southern Alabama

The University of Southern Alabama Department of Family Medicine has completed a generic disc designed to provide students with a simulated doctor-patient interaction with which they can practice their clinical skills. The disc contains 560 short video segments which can be used to program a clinical simulation. Patient complaints include chest pain, abdominal pain, otitis media infection, urinary tract infection, upper respiratory infection, and pharyngitis. The disc is programmed to permit the complaints to represent a variety of problems. For example, the complaint of chest pain may represent organic heart disease or esophageal spasms, depending on how the simulation was programmed. One hundred still frames on the disc contain X-ray, EEG, bacterial smears, etc, to support the physical exam and eventual diagnosis.

University of Tennessee

The University of Tennessee, Memphis College of Allied Health Sciences and College of Medicine have produced a Level I videodisc which provides a morphologic review of cytopathologic and hematologic diagnostic material. Designed for use by health science students, residents, practitioners, and faculty, the disc consists of two parts: *An Atlas of Cytopathology* and *The Morphology of Blood and Marrow Cells*. Each part is accompanied by a syllabus with content outline and descriptive listing of each of 5,457 image frames. Several case studies also are included.

University of Texas – MD Anderson Cancer Center (Houston)

Two interactive videodisc modules have been completed at the University of Texas MD Anderson Cancer Center. *Care of the Immuno-suppressed Oncology Patient* helps nurses learn to recognize and treat symptoms of infection in cancer patients. *Perspectives in Diagnosing and Treating Breast Cancer* helps keep the practicing physician informed of recent developments.

The first module developed, *Care of the Immuno-suppressed Oncology Patient*, is a self-paced interactive video designed to help nurses assess and manage infections. Nurses play a critical role in managing the side effects and toxic effects of cancer and its treatment, with infection the number one threat. Often the symptoms of the infection are very subtle and are not easily taught in the classroom.

The module shows an actual video sequence of a nurse interviewing a patient and making a hands-on-assessment. The student can choose from five program branches based on the ADPIE Nursing Process Model: assessment, diagnosis, planning, implementation, and evaluation. Each path allows the student to investigate the content in depth. For example, assessment of the patient has three instructional layers: patient vital signs, history taking, and physical examination of 11 body sites.

At various stages the student is asked to make decisions. Should the physician be called? What is the risk of infection? Video motion and graphics reinforce correct choices in diagnosis testing and other areas, with explanations for incorrect choices. The student nurse is also asked to indicate reasons why correct choices were made, again to reinforce learning.

MD Anderson's second module is *Perspectives in Diagnosing and Treating Breast Cancer*. This module is for the practicing physician who wishes to become more familiar

with the latest information on diagnosis and treatment. Its main interactive pathways are three prepared case studies and a branch for the physician to construct an individual case study. Supplementary material includes epidemiology, a bibliography, and background on a 90-minute national teleconference used for content of the prepared case studies.

University of Toronto

An interdisciplinary team at the University of Toronto Faculty of Medicine has produced an interactive videodisc on human embryology. The topic was selected as a videodisc project by Lawrence Spero, professor of pharmacology and director of the Faculty of Medicine's Computers in Education program, because of the technology's ability to demonstrate a three-dimensional series of events such as fetal development. Spero worked with the Department of Arts as Applied to Medicine (AAM), which created a computer-generated 3-D embryo model used in the program.

The module also goes beyond basic concepts and includes diagnosis. One segment depicts clinical problems, and the students have to decide at what state of embryonic development the problem arose. Students can return to the tutorial portion if they are unable to answer. "We want students to evaluate their own knowledge and, as they do that, we'll track how they use the program and whether it leads them to ask more questions," said Spero.

University of Utah

The University of Utah Pathology Department is working on their second version of *A Slice of Life*, the shared disc containing 12,500 slides in pathology, histology, neuroanatomy, nuclear radiology, etc. Most were contributed by various departments at the University of Utah, with some from the University of Cincinnati Pathology Department and some from the Mayo Clinic. Level III teaching programs are being developed at the University of Utah and other universities to be used with the disc. The cataloging is being done on the Smart System database by Innovative Smartware, Inc.

Using visuals from their shared videodisc *A Slice of Life*, the University of Utah has developed two interactive applications using *HyperCard*.

HyperHeart. *HyperHeart* was developed to aid students in the study of cardiac physiology. The program is divided into five sections: Section One a study of basic cardiac anatomy which combines labeled diagrams on the computer and photographs stored on videodisc; Section Two examines pressure and volume changes in the heart during the cardiac cycle; Section Three uses animation sequences to interrelate those pressures and volumes with the blood flow and corresponding muscle and valve contractions.

Section Four features synthesized heart sounds, synchronized with ECGs and Phonocardiograms. Finally, Section Five provides an overview of ECGs and explains how they are measured and recorded. Common abnormalities are introduced, as well.

HyperBrain. *HyperBrain*, another *HyperCard* application, was designed as a core resource for neuroscience education. Currently in use by first-year medical students at the University of Utah in their Neuroanatomy class, the program is intended to either complement, supplement, or substitute for a traditional neuroanatomy laboratory. *HyperBrain* is linked with the *Slice of Life III* videodisc. It contains fourteen chapters, followed by quiz-

zes, as well as animated pathway diagrams taken from Duane Hanes' Neuroanatomy Atlas. The program is complemented with a series of fourteen videotapes, as well.

HyperBrain features multiple linking characteristics. All terms in the glossary are linked instantaneously to an illustrated glossary. All digitized figures are labeled and linked to the glossary. A core of resources permits the student to access atlases (In three planes), animated reflex diagrams, neurological cases, or the videodisc index. The program is designed to expand with pathology, radiology, and other modules that are under development elsewhere and are designed to fit into the shell as independent or supplementary modules. A module on cellular neurobiology is being developed in Virginia; chemical neuroanatomy will be completed in Cincinnati, and neuropathology in Michigan, Cincinnati, and Utah.

Slice of Life Videotape Demo. The University of Utah has produced a 90-minute videotape titled *Creating a Slice of Life*, which shows how the original videodisc was made and demonstrates six interactive applications in the areas of Neurosurgery, Pathology, Neuroradiology, and Neuroanatomy—including a demonstration of *HyperBrain*. The tape is available through Stewart Publishing for \$45.

University of Washington

The Health Sciences Center for Educational Resources at the University of Washington is marketing six of their medical videodiscs. They are produced as multi-use or generic discs to allow individuals and institutions to tailor their instruction to the needs of their particular site. Each disc may be played on any optical reflective disc player.

Medical Applications Videodisc: Hematology was originally published in 1982 and was one of the first to be distributed to the Miles Laboratory's Learning Centers. The second edition contains more than 6000 slides, including those from the American Society of Hematology morphology collection (2674 frames), the World Health Organization International Histologic Classification of Tumors (1866 frames), and Selected frames from the Western Universities Physical Diagnosis Slide Bank (1782 frames).

Acute Leukemia Morphology II is a one-sided disc that contains numerous exemplary peripheral blood smears, bone marrows, and special stains for instruction and reference in the differentiation of the acute leukemias. Scans of the material at various powers augment the study of the still microscopic features of the cases in question.

Disorders of the Nervous System: Motor is a compilation of materials from a "visual glossary" collection of neurological dysfunction. Normal and abnormal gaits and reflexes are demonstrated as well as a wide variety of motor signs and disorders.

Disorders of the Nervous System: Mentation is a compilation of material from a "visual glossary" collection of neurological dysfunction. Included are six patients who demonstrate a variety of disorders of mentation.

Trauma Training Materials I and II: These two discs (three sides) demonstrate basic techniques that must be mastered by a trauma care team working in an emergency room setting.

Laboratory Medicine Video Library: Atlas of Hematology: This one-sided disc contains over 6000 stills and scans recorded directly through the microscope and forms a comprehensive library of hematologic findings which can be used for education, testing, and reference. All material is SNOMED encoded to facilitate access.

Cardiovascular Resources Videodisc contains a large collection of materials that may be used to teach cardiovascular nursing and medicine. The collection includes approximately 4000 slides covering anatomy, physiology, embryology, microscopic and gross pathology, introduction to care environment and common techniques in the assessment and treatment of cardiovascular disorders.

All of these videodiscs come with a catalog of images that allows rapid access for lecture demonstration or self-study, as well as the compilation of written or computerized instructional programs.

Hypertext Software. The University of Washington has produced hypermedia software to accompany two of their generic videodiscs. The programs are written for Owl International's *Guide*.

Acute Leukemia Morphology—Guide is an interactive Guide program that allows the student to compare and contrast the Acute leukemias by classification (M1-M6 & L1-L3). Major morphological and staining characteristics may be viewed on the videodisc. Patient information accompanies each example. The program sells for \$99 and operates with Pioneer LD-V6000 series videodisc players and the videodisc *Medical Applications Videodisc: Hematology 2nd Edition*.

Laboratory Medicine Acute Leukemia Series is a series of three Guide programs that allow the student to interactively explore the Acute Non-lymphocytic leukemias, Hairy Cell Leukemia, and Multiple Myeloma. Each program contains material on the laboratory presentation and morphology of the disease, special stains and staining characteristics, and pertinent references. Sells for \$99 and operates with Pioneer LD-V6000 series videodisc players and the videodisc *Laboratory Medicine Video Library: Atlas of Hematology*.

Virginia Commonwealth University, Medical College of Virginia

The Medical College of Virginia (MCV) at Virginia Commonwealth University has developed the first in a series of classic dog laboratory videodiscs designed to teach the physiological effects of procedures and drugs on the cardiovascular system. The series is entitled *Laboratory Experiments in Basic Health Sciences: Cardiovascular Physiology*.

The first disc in the series, *Cardiovascular Physiology*, consists of more than thirty experimental procedures and drug injections along with their effects on cardiovascular functions. An actual dog laboratory was videotaped as it was performed by two physiology professors, George D. Ford, PhD and James L. Poland PhD. These professors also provided the physiological content for each procedure and drug. Jane Terpstra, the instructional designer, planned the interactive videodisc and developed the IBM-based tutorial. MCV graduate physiology students reviewed and evaluated the pilot program, which led to revisions in the program format. The remainder of the program is being completed.

An interactive tutorial guides learners through the experiments, teaches the physiological effects of each procedure and drug, and tests for content mastery with visual and verbal items. Using a videodisc player remote control unit, the videodisc becomes a lecture tool to present experiments and their resulting effects on the cardiovascular system.

Weber State College

The Weber State College Emergency Care and Rescue Program recently completed a program titled *Paramedic Training: Myocardial Infarction*. Funded by the Marriott Cor-

poration, the disc trains emergency medical personnel in prehospital treatment of myocardial infarction. The program opens with linear video which simulates a person having a heart attack. This material is used to teach the recognition and treatment of acute myocardial infarction. The learner may then branch to any of seven interactive teaching segments which relate to the linear program. They are: 1) Anatomy and Physiology of the Cardiovascular System, 2) Pathophysiology of the Cardiovascular System, 3) Risk Factors, 4) Complications, 5) Signs & Symptoms, 6) Assessment, and 7) Treatment. The program also instructs learners in a psychomotor skill: the proper use of a cardiac monitor. An evaluation of the program effectiveness has been conducted, with very favorable results.

Wright State University

In 1989 Wright State University received funding of approximately \$100,000 from the Charles F. Kettering Foundation for the development of interactive video projects. The first is an interactive video program designed to teach the families of critically ill patients the principles of cardiopulmonary resuscitation (CPR) and give them an introduction to the Intensive Care Unit. The program is intended to decrease the anxiety and emotional shock the families experience as they walk into an intensive care room. The second stage of the project will expand the program to include the risk factors of heart disease, how heart disease develops, and what can be done to modify risk factors positively. It also include information about resources in the community that can be used to help modify these risks.

A second project is the development of another patient education program that will be used for stress reduction in oncology patients. Much of the video production will be done through the Kettering Medical Center.

Yale University

A video echocardiography videodisc was prepared in a joint effort between Yale University and the Educational Technology Branch of the National Library of Medicine. The case material on the disc is divided into more than 1200 segments which may be viewed in an "endless loop" moving sequence or as still frames. The videodisc is incorporated into an instructional program for use with either Macintosh or IBM-compatible computers. On the Macintosh, the program was developed using *Hypercard* and uses a mouse to access any segment of the instructional module. In the IBM environment, the program runs on the Infowindow hardware system, which uses touch-screen technology for user interaction.

The instructional material is offered in a non-linear sequence where the user is allowed to pursue the curriculum material as directed by curiosity rather than by the instructor. In addition, the program is designed to be visually exciting since it contains an excellently designed graphic interface and uses both sound and animation as a way of enhancing the information displayed on the videodisc. The use of graphic animation clarifies and simplifies complex image structure, thus preparing the student to make the pertinent observations on the video image. Moreover, when pathology is presented, the student is easily able to replay normal segments and directly compare each sequence so that a better understanding of the nature of the pathology can be achieved.

Patient cases were selected from more than 14,000 diagnostic studies performed over a 12-year period at Yale-New Haven Hospital. More than 160 individual cases were selected for use on the disc, exceeding the number of clinical cases the American Society of Echocardiography recommends for basic training in echocardiography. Virtually the full spectrum of echocardiographically diagnosable diseases is available on the disc so that a full range of severity and image quality is available to create a realistic environment. Although much of the videodisc content stresses two-dimensional real-time imaging, all other techniques such as M-Mode, pulsed and continuous wave Doppler, and color Doppler are fully represented where diagnostically appropriate. In addition, there are segments on transesophageal echocardiography (TEE).



Chapter 3

Commercial Ventures

1988-1989 seems to have been a growth period for commercial videodisc development, doubling the number of vendors who have a health-related project to offer. With this growth there also seems to be some hardware stability with the IBM InfoWindow system.

New Trends in Hardware

There finally seems to be a "shakedown" in the industry regarding hardware systems. Vendors today are going one of two routes: market their programs on a inexpensive, custom-built, dedicated videodisc system, or on one or more of the standard integrated systems such as the IBM InfoWindow or Sony View system. A few vendors are doing both.

In the past, hardware systems have been one of the biggest problems for the software vendors to deal with. Compatibility was a concern because buyers hesitated to purchase a non-standard system on which they would not be able to play other commercial programs. Today, this problem is being taken care of by the emergence of a few dominant systems and the willingness of most software vendors to adapt their programs for several configurations.

Integrated Hardware Systems

Integrated systems are hardware units where all components are sold together as a package: computer, videodisc player, monitor, graphic overlay, touchscreen, etc. Two main advantages of this type of system is assurance that all components will work together and the fact that there is only one dealer to call if anything fails to operate.

Until the introduction of the IBM InfoWindow, there was no standard hardware configuration in the industry. Now it appears that the InfoWindow is quickly becoming the standard, with other configurations keeping a few specialized industry niches. As evidence of this trend, of 72 Level III commercial programs listed in the 1989 *MedicalDisc Directory* (Stewart Publishing, Inc.), all but four played on an InfoWindow or compatible system. The four which played only on a proprietary system were developed by Actronics for their CPR Learning System. Many of the InfoWindow-compatible programs also were programmed to play on various other configurations, but no one system is as universally accepted as the InfoWindow.

Commercial Programs Listed in the 1989 MedicalDisc Directory

Type of System	Number of Programs
InfoWindow-compatible	68
Actronics	4
Two-screen PC	5
Two-screen Macintosh	0
Level II	6
Level I	11
Total	94

Two-screen Systems

Although the InfoWindow is the leading system for "off-the-shelf" courseware, the type of delivery systems used in the healthcare market will vary according to subject matter and setting. In some of the medical specialties which have large collections of still images (radiology, pathology, hematology), two-screen systems, costing as little as \$1,500, may remain in favor for some time. In these disciplines, users are content to have the medical image appear on one screen while descriptive text and graphics appear on the computer screen. For most applications, there is no need for graphic overlay, touchscreen, or other features offered by the more expensive InfoWindow platform.

Level One Systems

Many commercial applications are presented on Level One videodisc systems. The successful RAVEN system for ophthalmology patient education was an inexpensive, practical combination of hardware and software which used a customized keypad to access one or more of 28 different video segments. The newest variation of Level One delivery is the laser barcode reader, available in the past, but recently made more accessible by Pioneer Communications. The first health-related commercial application using this technology has been produced by the American College of Radiology (ACR). The ACR is producing a series of videodiscs which are accompanied by a barcoded workbook and scanning wand, eliminating the need for even a computer. The total cost of a Pioneer LD-V2200 videodisc player and scanning wand, and is less than \$1,000.

Companies & Products

Actronics, Inc.

Actronics was the first commercial company to be formed for the purpose of developing and marketing health-related videodisc programs. Under license to the American Heart Association, Actronics was formed in 1983 to market the well-known CPR system developed by David Hon when he was National Training Manager at the AHA.

The CPR/ACLS Learning System consists of an Apple IIe computer, Sony or Pioneer videodisc player, a random-access audio cassette player, and electronic manikins

which are interfaced with the computer. This dedicated system sells for \$12,895, with programs ranging in cost from \$8500 for *CPR* to \$995 for *AIDS Information*.

Sales of the CPR/ACLS Learning System have reached approximately 300 units at 250 locations, with sales being slowed by problems common to all videodisc hardware vendors. However, Actronics Vice Chairman Danny Cassidy, M.D., reports that sales have increased recently as the result of new marketing efforts outside the hospital community. Apparently, many of the barriers to sales found in hospitals do not exist in corporate and industry settings. See Chapters 4 and 5 for more detail.

How The System Works

The program presents "classroom" material using the videodisc player and audiocassette player. Using a light pen, learners can evaluate their progress by taking short quizzes at the end of each section. Based upon this evaluation, appropriate video segments are selected by the student to provide review sequences and more in-depth instruction. At all times, the program provides continuous and immediate feedback.

Most impressive is the ability of the system to monitor the learner's actions using one of the CPR manikins. The manikins are equipped with sensors and activators to provide feedback to the student and monitor performance on all components of CPR procedures, including pulse check, call for help, chest compressions, back blows, ventilations, open airway, etc. As with the live instruction, the program will provide on-going feedback while the student works with the manikin. The System will "coach" the learner by 1) producing audio tones to indicate proper timing of each compression and 2) displaying a graphic summary on the monitor which details the learners overall performance. During practice, the student's performance on the manikin is immediately evaluated by the computer, which, if needed, selects the appropriate coaching responses from the videodisc.

At the end of the lesson material and practice sessions, the learners are able to test their knowledge of CPR using the manikin. Performance standards are based on the AMA's standards and guidelines for CPR. Without the assistance of a live instructor, learners are able to certify at both the Heartsaver and Basic Rescuer levels and receive the AHA Certification Card.

Arrhythmia Recognition

Using the same Learning System hardware, Actronics continues producing continuing education programs for the American Heart Association. The next program developed was *Arrhythmia Recognition*, the first in a series of videodiscs designed to teach the Advanced Cardiac Life Support course offered by the AHA.

The Arrhythmia program provides a complete learning experience in arrhythmia recognition based on the AHA's *Textbook of Advanced Cardiac Life Support*. The program is divided into background lessons, specific lessons on arrhythmia and ECG monitoring, and practice and test sessions in static and dynamic arrhythmias and therapeutic modalities.

Using the large storage capacity of the videodisc, a comprehensive set of ECG's with different versions of each arrhythmia is contained in the program. To insure comprehensive learning and retention, the *Arrhythmia Recognition* program combines ECG pattern and explicit medical drawings to highlight a multitude of arrhythmia variations. Refer-

ence Banks on drugs, algorithms, and arrhythmias are also available to the student at any time during the program.

Airway Management

The third program developed by Actronics, and the second in the ACLS series, is the *Airway Management* program. The purpose of the program is to provide education and training in airway management and airway adjuncts individually or within the context of an ACLS course.

After presenting a comprehensive course overview, the program contains individual lessons to examine the specific elements of airway management, from respiratory assessment to transtracheal catheter ventilation and cricothyrotomy. Learners have the opportunity to practice procedures and insertion techniques using an electronic intubation head, which senses correct placement and effective ventilations. Reference Banks include vocabulary and respiratory anatomy.

Megacode

The latest program released by Actronics is *Megacode*, which consists of three didactic lessons and an interactive video simulation. The lessons are titled "ACLS in Perspective," "Acute Myocardial Infarction," and "Putting It All Together."

When students enter the simulation portion of the course, they play the role of the team leader and are each given 25 minutes to treat a cardiac emergency. They are presented with a patient and are given a description of the patient's history, symptoms, and present condition. The student then begins to interact with his team members who appear on the video screen before him. *Megacode* actually requires students to speak to their team leader, asking for direction and responding to each decision the leader makes. The patient condition likewise responds to those decisions. At any time, random complications may present themselves for the student to recognize and correct.

Upon approval by the American Heart Association, students will be able to test and certify in *Megacode* using the simulation portion of the course. However, students also have the option to practice, rather than test, in the simulation. If a student chooses to practice, he is provided prompt remedial instruction for any error that is made. This feature allows students to gain practical experience and confidence before testing. Because of the random presentation of patients, problems, and other factors, each student receives a different variation of a cardiac emergency to treat. This prevents students from memorizing a scenario and allows for accurate, objective evaluation of each performance.

Circulatory Adjuncts and Resuscitation Pharmacology

The *Circulatory Adjuncts and Resuscitation Pharmacology* interactive video course has been developed in accordance with the standards and guidelines of the American Heart Association (AHA), and is approved for training and testing by the AHA's Emergency Cardiac Care Subcommittee. *Circulatory Adjuncts and Resuscitation Pharmacology* contains four core lessons and provides students with the opportunity to take the ACLS Written Post-Test in a computer-assisted format. *Electrical Therapy* presents information on how defibrillators work, and what factors increase or decrease the probability of successful conversion. It also discusses the energy requirements for both the adult

and pediatric patients, and provides demonstrations of techniques for defibrillation and urgent synchronized cardioversion. Recommendations for the care and maintenance of defibrillators are discussed, along with special situations such as defibrillating a patient with a permanent pacemaker. The Electrical Therapy lesson also contains an overview of emergency cardiac pacing, and instructions on how to deliver a precordial thump. *Intravenous Techniques* provides information on various types of IV cannulas and catheters, and discusses indications for establishing IV access. It also provides information regarding the common principles, advantages, disadvantages and complications of IV techniques. The peripheral and central techniques demonstrated in this lesson include the arm and leg, external jugular, femoral, internal jugular, and subclavian vein techniques. *Cardiovascular Pharmacology* discusses the medications commonly used during cardiac arrest, and those used to control cardiac arrhythmias. It also provides information on pharmacotherapeutic objectives, and discusses the medications used to treat congestive heart failure, hypotension, hypertension, and cardiogenic shock. *Infants/Children and Special Situations* provides an overview and discusses the management of respiratory failure and shock. It also covers devices and techniques used to oxygenate and ventilate pediatric patients, as well as the treatment of life-threatening arrhythmias that may occur in these patients. Post-resuscitation management is also presented, along with information on accidental electrocution, near drowning and circulatory and pharmacological support.

Expanding Courseware Selection

Additional programs being developed by Actronics for the ACLS series include *Adjuncts*, *Pharmacology*, and *ACLS Test Disc*. However, in order to expand the selection of courseware available on their dedicated system, Actronics has begun adapting other commercial programs to play on the Learning System. Acquisitions include several programs originally produced by Health EduTech of Minneapolis, Minnesota. Titles include *Infection Control*, *Electrical Safety*, *Fire Safety*, *Back Safety*, *AIDS Information*, and *Sexually Transmitted Diseases*.

ALIVE

The Applied Learning by Interactive Video Education Center (ALIVE) started out in 1985 as "a consortium of industrial, educational, and professional organizations, associations and individuals dedicated to the utilization of laser storage and video imagery." Based in Akron, Ohio, the Center obtained enough funding to produce an interactive videodisc titled *The Active Knee*. The production was done in collaboration with the Sandy Corporation and is the first of a series ALIVE hopes to produce.

The Active Knee is designed for coaches, trainers, sports supervisors, and medical personnel who will come in contact with an athlete immediately following a sports injury to the knee. What the viewer learns from the program is three-fold: 1) to ascertain susceptibility to knee injuries through pre-screening, 2) to prevent further complications to an injured knee through correct diagnosis, and 3) to conduct a complete post-injury evaluation to determine the degree of injury.

What the Program Does

The Active Knee is a two-sided disc, divided into five modules. Module I presents functional anatomy, addressing bones, major ligaments, main muscle groups, and the specific forces that can damage these structures. Module II covers a systematic process for conducting preseason screening exams so the learner can determine which athletes and active people may be predisposed to knee injury. Module IV provides complete procedures for conducting off-site, comprehensive, systematic knee exams. Module V presents detailed applications, using specific case histories.

The Active Knee plays on most major hardware systems, including the IBM InfoWindow, Sony View, and Visage system, and has been accredited two hours of continuing education units from the National Athletic Trainers Association (NATA). The program originally sold for \$2975, but has recently been divided into 10 component parts, each now sold for between \$595 and \$995. The entire package is available for \$7995.

Natural Knee

A second program developed by ALIVE is the *Natural Knee*. It is based on a linear videotape produced by Intermedics Orthopedics on natural knee implant procedures. By watching the procedure along with enhanced graphic overlays and computer branching, the physician can learn the surgical implant procedure. The program is also used to train Intermedics sales representatives.

Preventative Cardiology

The ALIVE Center also is marketing a two-disc interactive videodisc program *Preventative Cardiology*, produced in conjunction with the Case Western Reserve University's School of Medicine. The program consists of two parts. Part I, geared for pediatricians and physicians, is designed to familiarize doctors with the procedures for distributing cardiovascular disease prevention information throughout their communities. It includes early detection and early intervention strategies for detecting and controlling arteriosclerosis.

The programs are designed to assist physicians in their discussions with patients about sensitive issues such as diet, exercise, and the risks of cigarette smoking. Interactive videodisc allows the physician to learn and practice Strategic Interview Skills. Through evaluation of doctor-patient dialogs, the physician learns how to encourage healthy behavior in his patients.

Part II is intended for doctors, patients, and students (junior high school level and above). It provides an overview of the heart and its relationship to the circulatory system, and it examines cardiovascular disease and coronary heart disease. The introduction covers basic information on the heart, the circulatory system, and arteriosclerosis, while three lessons zero in on effective means of combating coronary artery disease: exercise, nutrition, and not smoking.

Argosy Network Corporation

The Argosy Network Corporation was formed in 1987 as part of a new business development project for a major telecommunications manufacturing company. When the company later decided that the project did not fit with their primary mission, Kent Simpkins, a

consultant to the project, secured the rights to the project, name, and logo. Simpkins incorporated Argosy in the State of Tennessee in August 1988.

Argosy plans to deploy a network of interactive video learning stations in hospitals throughout the United States. The Network will offer medical manufacturers and pharmaceutical companies an innovative media opportunity for product marketing, inservice training, and new product introductions by sponsoring courses on the Network.

On-line Interactive Network. The Network is built around a proprietary hardware system which will be installed in hospitals and fed via telephone lines from the Argosy office in Nashville. The delivery system consists of a computer, videodisc player, and touchscreen monitor. The videodiscs will be located in the hospitals, but because the control software is delivered on-line from Argosy, hospitals will pay a fee each time a course is used.

Users of the Argosy learning stations are presented with a menu of available courses. Using the touchscreen, they select the desired course. At appropriate points, the course will stop for query. Users can interact with the course and receive hands-on instruction and simulate real-world situations.

When a course is completed, the user's record is stored. The record may contain the user's name, date, time, responses to questions, score, or any comments the student may have about the manufacturer's product. The data is then collected by the Argosy computer network and reported back to the courseware sponsors and the user hospitals. This provides the essential feedback and record-keeping that is so important to the hospital, medical manufacturers, and pharmaceutical companies.

Argosy Network Corporation has begun to deploy the first phase of its network in 10 hospitals nationwide during a testing phase that will be completed at end of 1989. This phase will feature the following courseware: *Right Upper and Middle Lobectomy* developed by U.S. Surgical and Health Edutech programs *Back Safety*, *Electrical Safety*, and *Fire Safety*. Plans call for growth to 300 hospitals by the end of 1990 with a substantial increase in courseware from manufacturers and pharmaceutical companies.

Edudisc

Edudisc, Inc. of Nashville, Tennessee is marketing a number of interactive videodisc programs for the Macintosh computer. All of the programs were developed by Bloomsburg University using the Edudisc Mentor/MacVideo authoring software. The programs operate on Macintosh computers with Pioneer, Sony, and Panasonic videodisc players. All programs sell for \$695.

Introduction to Case Studies in Hematology. A series of 20 case studies designed to acquaint users with basic problem-solving techniques involving cell identification and clinical correlations. It presents signs, symptoms, and laboratory data for users to explore the many levels of analysis involved.

Child Sexual Abuse. Illustrates the various physical signs of child abuse and presents a methodology for social workers and teachers to identify these problem signs and take steps to contact the proper authorities. Designed so that audiences who are either unaware of the physical indicators of child abuse or may need review can select the appropriate path best suited for them.

Stress Management. An individualized relaxation program for the viewer is determined through several questionnaires that indicate their current stress level. It then teaches them in a step-by-step manner how to let go of tension and relax their mind and body through the methods they select. The methods of relaxation are: breathing, visualization, yoga stretches, progressive relaxation, meditation, and autogenics.

AIDS Education. Addresses the many issues related to AIDS and sex education for teenagers. Consists of three parts: 1) Random access information bank consisting of AIDS information that teenagers should know; 2) Transfer and practice to assist viewers in relating information to real-life situations. Includes a simulation-based design that asks the viewer to make decisions based on their knowledge about AIDS and how it is introduced, acquired, and could be prevented. 3) Testing can either use a game show format or a standard test to evaluate viewer's understanding of the content. For Junior and Senior High School students.

Image Premastering Services, Ltd.

The *Birth Disc* is a visual database of 9,000 color and black and white photographs illustrating childbirth. Developed by Artemis and Image Premastering Services, Ltd., this resource library documents the process of birth from pregnancy and labor, through birth itself to the emerging newborn and the postpartum experience.

Images on the disc capture physiologic and emotional details of such diverse prenatal concerns as prenatal care, labor support, vertex and posterior births in a variety of positions, breech, twins, forceps, cesarean and VBAC (vaginal birth after cesarean) births, newborn attachment and sibling/family interaction.

A table of contents and a cross reference index in this Level I videodisc assists user access to images. The comprehensive collection of birth images is presented in 65 chapters and 43 case studies captioned with concise, informative text. The products included in the sale are *Health Hazards in the Workplace*, *AIDS: An Educational Program*, *STD: Sexually Transmitted Diseases Information Program*, and the *Health Care Orientation Series*. The *Birth Disc* may be used to design individualized teaching and learning programs, to facilitate pre-clinical training for childbirth professionals, and to illustrate lectures, inservices and discussions.

Intelligent Images, Inc.

In January 1985, Intelligent Images, Inc. (III) began production on a series of patient simulations designed to provide continuing education to emergency medical personnel. Funded with venture capital, the project was the largest ever in the area of health-related videodisc production—with plans to produce 30 videodiscs at a rate of two each month. Six programs were completed, with several others in various stages of development, when funds were depleted and production was suspended in December 1985.

The series was written and produced under contract to III by the Human Resources Research Organization (HumRRO) in Alexandria, Virginia. The pilot program, *Shotgun Wound to the Abdomen* (Victor Mercedes), has received numerous awards, including "Best Educational Production" by the Nebraska Videodisc Design/Production Group as

well as the Lesher Award for "best and most innovative educational communications" at the John Muir Medical Film Festival.

How the Programs Worked

The focus of the series is on the process of decision-making rather than clinical procedures. In each disc the learner must manage a patient by selecting from a series of menus which provide diagnostic and therapeutic procedures, monitors, X-rays, medications, lab tests, fluids, and consultants. The unique feature of these lessons--making them true simulations--is that the results of each decision will vary from moment to moment depending on the patient's status at the time of decision, the prior decisions of the learner, and the passage of real and simulated time.

Patient data such as vital signs, ECG's, X-ray, and lab test results change constantly and are dependent on treatment decisions. The computer keeps track of each decision and, at the conclusion of the lesson, provides feedback to the learner regarding key decision points as well as a cost-of-care analysis. Because some of the lessons are programmed with random complications, the learner may go through the same lesson several times without being able to predict the exact course the patient will take.

A Second Wind

When production was suspended, III released information stating that "initial sales efforts have shown that interactive videodiscs will become a well accepted training method in the future, but that videodisc training is competing for hospital dollars normally associated with capital equipment acquisitions rather than training materials." The company temporarily shifted its focus and initiated "Test Market II" to clarify two areas of current concern: 1) the method of selling the interactive videodisc system as a training system rather than a capital expense and 2) the viability of additional topics within the marketplace that will broaden the market base.

In 1987, III merged with the R2 Corporation (medical supply) to form the DaRox Corporation. Currently, all of III's production and programming is being coordinated by their home office in San Diego, California. III managed to finish production on an additional two patient simulations, bringing the total to eight such programs on the market. The titles of the available programs are: *Abdominal Stab Wounds*, *Chest Trauma*, *A Patient With Diarrhea and Vomiting*, *Motor Vehicle Trauma*, *Diagnostic Decisions in Shock*, *Shotgun Wound to the Abdomen*, *Initial Assessment of Respiratory Difficulties*, and *Discontinuing Mechanical Ventilation*.

In addition, III has put together eight instructional programs to form the Nursing Assessment and Intervention Series. These programs are titled *Discontinuing Mechanical Ventilation*, *Pathophysiology of Cardiac Tamponade*, *Pathophysiology of Shock*, *Anti-shock Trousers*, *Central Venous Pressure*, *Chest Tubes*, *Auscultating Breath Sounds*, *IV Therapy*, and *IV Solutions*.

Current Sales Status

In the developmental years, III went through several hardware configurations, including the DEC IVIS and Sony View systems. They settled on the IBM InfoWindow system for all of their programs. Packaging and pricing has also varied, with the programs at

one time available only in two packages: the Emergency/Critical Care Series of patient simulations costs \$12,200 for the eight programs, and the Nursing Assessment and Intervention Series of programs sells for \$5,500.

Sales of the systems has been slow, due to a number of factors relating to the technology and to the hospital environment. These problems are detailed in the chapter entitled Hospitals. In October 1987, David Allan, M.D., President of Intelligent Images, reported their programs were in approximately 20 medical schools, 20-plus community hospitals, six nursing schools, and several community colleges—for a total of about 50 systems. Although sales have continued since that time, placement has continued to be slow.

Infotronics, Inc.

In November 1987, Infotronics, Inc. of San Diego, California introduced a videodisc library for ophthalmologists. The programs were first introduced at the American Academy of Ophthalmology annual meeting and play on a proprietary Random Access Video Education (Raven) system which uses a Pioneer LD-V2000 videodisc player, color monitor, and custom-designed, programmable, hand-held remote-control unit.

A single-sided videodisc contains 28 short programs used for patient education in the doctor's waiting or examination rooms. The complete Raven system, including videodisc, costs \$3,495 (\$2,495 for additional systems). In the first six months, Infotronics sold more than 500 systems, making it the most widely distributed health-related videodisc program of the time. Following this success, Infotronics is planning three additional discs on ophthalmology and expects to enter into 10 additional medical specialty markets over the next two years.

Master Tape Ventures

Master Tape Ventures of Houston, Texas released a series of videodiscs for ophthalmology patient education in 1988. The series is produced from the more than 60 videotape programs on ophthalmic subjects Master Tape Ventures has produced since it was founded in 1982. The series clearly was intended to capitalize on the market opened by Infotronics of San Diego with their RAVEN system. In 1989, American Medical Communications, Inc. acquired MTV—which continues today as a subsidiary company.

The programs are marketed along with a selection of hardware workstations ranging from a free-standing cabinet unit for \$4,295 to a pedestal or counter top unit for \$3,495. Both prices include one videodisc program. The programs themselves range in price from \$900 to \$1,395.

MTV Ophthalmology Disc 1: Short Topics. This disc contains 23 short topics including Allergic Eye, Blepharitis, Cataracts & Cataract Surgery, Conjunctivitis, Corneal Abrasions, Diabetic Retinopathy, Dry Eye, Macular Degeneration, and more.

MTV Ophthalmology Disc 2: Informed Consent. This disc contains 13 long topics including After Cataract Surgery, Blepharoplasty, Chronic Glaucoma, Diabetic Retinopathy, Macular Degeneration, Retinal Holes & Tears, Trabeculectomy, YAG Capsulotomy, and more.

MTV Ophthalmology Disc 3: Reception Room. This disc contains a documentary style production suitable for an ophthalmology waiting room or health fair. Segments in-

clude Introduction to Professional Eye Care, What's Your Eye-Q?, Cataract Surgery: The Routine Miracle, Welcome Message, and Music Video Intermissions.

Medical Interactive

Medical Interactive of Lafayette, California is distributing a videodisc version of the *Radiology Teaching and Reference Library*, a comprehensive collection of radiographic images and teaching materials. Originally developed by the Center for Devices and Radiological Health in cooperation with more than 35 medical schools and residency programs, it represents a library of enormous value to practicing radiologists as well as residents.

The Library's 1,800 cases are a collection of different disease entities, organized into a logical learning sequence. Each case contains 1) a patient history, 2) a detailed teaching discussion, and 3) a diagnosis. The narrative may also include differential diagnoses, protocols for determining the appropriate imaging procedure, a description of how particular X-ray examinations are performed, films from different patients illustrating various manifestations of the same disease, and pertinent references.

The full-sized version of this library has been marketed for many years by the American College of Radiology. Medical Interactive has transferred all of the cases in the Library onto two videodiscs. Disc 1 contains the cases from the Ultrasound/Abdominal CT and the Cranial CT sections. Disc 2 contains the cases from the Chest, Gastrointestinal, Genitourinary, Head and Neck, Pediatric, and Skeletal sections. Taken together, the two discs contain over 20,000 images, more than 1,800 cases, and the equivalent of 2,200 pages of text.

The videodisc version of the Library has been designed to accommodate frequent revisions. Institutions can add material which reflects new medical research, discusses their own techniques and procedures, or discusses other approaches to the same case. Since all enhancements are software-based, they can be shared with other users. Medical Interactive provides the coordination necessary to keep users of the Library informed of these enhanced materials, and distributes them at nominal cost.

Also included with each videodisc is easy-to-use authoring software for developing custom interactive courseware. This authoring tool helps instructors create their own free-standing instructional modules. As different institutions develop libraries of these teaching modules, Medical Interactive may collect and distribute them to other users.

The videodisc version of *The Radiology Teaching and Reference Library* runs on most standard microcomputers and with virtually any videodisc player. A PAL version of the videodisc is available for overseas users.

Murdoch Institute for Research Into Birth Defects

The Murdoch Institute for Research into Birth Defects, located at the Royal Children's Hospital in Victoria, Australia, has developed a videodisc-based diagnostic tool to assist geneticists and pediatricians in identifying syndromes in children with birth defects. Physicians use the product, known as POSSUM, by entering the most striking features of the patient into the computer. The system will then search its database and provide a set of differential diagnoses along with a selection of relevant images from the videodisc. The

physician examines the information to confirm the likeness of the features with his or her patient.

The POSSUM Database. The POSSUM database contains information on more than 1000 published syndromes and 1200 patients. It contains over 18,000 illustrations of published cases and of patients from clinics at the Royal Children's Hospital and other medical centers. The published syndromes have been entered from standard texts and the current medical literature and checked against information drawn from the London Dysmorphology database. Standard and rare syndromes are included and referenced with selected citations and the McKusick Catalogue number.

Syndromes included are those with two or more birth defects, dysmorphic patients with mental retardation, selected skeletal dysplasia syndromes and chromosomal syndromes. Pediatric and neurological conditions are only included where there are dysmorphic features and multiple birth defects. Inherited single birth defects are not included at this stage. POSSUM also includes a local case file in which a physician can enter and store coded information about his or her own patients. Although related images cannot immediately be added to the videodisc, these materials may be sent to the developers for inclusion in the next version of the disc to be pressed. All contributions are acknowledged in the system.

Equipment /Licensing Requirements. POSSUM has been run and validated on both the IBM PC/XT and PC/AT microcomputers. The component requirements of the system are 640k bytes of memory, two megabytes of hard disk, a serial port, color or monochrome display, a videodisc player and a video monitor. The system currently supports the following videodisc players: Sony LDP-1500 (PAL and NTSC), Pioneer LD-V4200 (NTSC), and Pioneer LD-V4000 plus a IU04 Interface Control (PAL only).

A three-year license to use POSSUM costs \$3000 and includes access to the software, the syndrome database, videodisc, and the manual. Also included is an annual update of the syndrome database and any enhancements made to the operation/usability of the system plus at least one update of the videodisc within the license period. After the expiration of the three years the licensee may use POSSUM but will not be entitled to any more updates without entering into a new license renewal.

POSSUM may be viewed at 15 centers in eight different countries, including five in the United States. These include the University of California Medical Center (San Diego), Johns Hopkins Hospital (Baltimore, Maryland), Massachusetts General Hospital (Boston), Shodair Children's Hospital (Helena, Montana), and the office of Dr. V.M. Riccardi in Houston, Texas.

Scholastech Limited

Scholastech Limited of London, England has launched an ambitious videodisc series on human anatomy titled *The Anatomy Project*. When completed, the series will contain 24 disc sides in six general areas: Neuroanatomy (2 disc sides), The Upper Limb (4), The Head and Neck (6), The Abdomen and Pelvis (4), The Lower Limb (4), and The Thorax (4).

The material on each disc will include original linear and still-frame sequences as well as references for self-assessment, cross-referencing, and a glossary. In addition, each disc will be programed for six separate audiences: Medicine, Dentistry, Nursing, Radiogra-

phy, Physiotherapy, and Post-Graduate. Each audience group will be led through the discs using a different path matched to their area of interest.

The Anatomy Project discs are designed for use on Level One, Two, or Three videodisc systems. The images may be used without programming (Level One) by students or teachers, who are guided through the images by an accompanying workbook.

The series is also programmed for Level Two operation, and can be played on the Pioneer LD-V6000A series videodisc players or the new Pioneer LD-V8000 videodisc player. Level Two players incorporate an internal microprocessor which allows the program code to be loaded from the videodisc. The code is loaded automatically into the microprocessor and the system is operated by a hand-held remote.

The Anatomy Project also is offered as a Level Three software package in which the videodisc player is controlled by external computer. Software is available for both InfoWindow-compatible systems and two-screen IBM PC-compatible systems. Software for two-screen Macintosh systems is being developed.

How the Program Works. When the program is started, a short introductory sequence plays, leading the user into the First Menu of options. At this stage a user level (later also a language) and chapter is selected. By pressing play, the user chooses the default mode and Chapter One is played at the most detailed viewer level (Postgraduate).

Once a valid chapter is entered, the program takes a few seconds to load the programming for that chapter, which includes information on the video sequences, text and pictorial image frames which summarize and revise the chapter content, and a set of self-testing questions. These are organized by viewer level. There is also a Glossary which can be viewed at any time by pressing the AUTO STOP key.

The First Menu, which can be accessed at any time by pressing the left SCAN key, offers a choice of chapters and two subsidiary menus. After a choice is made from one of the other menus, the Main Menu returns to enable users to select the chapter of their choice. The course level menu enables the user level to be selected or varied using a single numerical keystroke. It can be accessed from the Main Menu or the Extra Options Menu.

The first two discs in the series, *The Eye*, and *The Hand and Wrist* have been completed, with two discs on Neuroanatomy due in April 1990. Each disc sells for \$1,650, with an additional charge of \$250 for Level Three software. A Launch Offer is in effect for the first part of 1990 where, for each disc purchased, a second copy will be provided free of charge. This "two-for-one" offer will apply to all subsequent discs in the series as long as they are purchased in sequence. In addition, the original launch price will be guaranteed for all 24 discs in the series.

The Anatomy Project

NEUROANATOMY

- Disc 1: General neural organization—peripheral and central systems; Brief cytology, synapses and transmitters; Major divisions of the CNS; The forebrain and midbrain.
Disc 2: The hindbrain, the cranial nerves; The spinal cord, the spinal nerves; The cranial cavity, blood supply and the meninges.

THE UPPER LIMB

- Disc 1: General topography and anatomy of function.

- Disc 2: The hand.
- Disc 3: The forearm and elbow.
- Disc 4: The upper arm and shoulder.

THE HEAD AND NECK

- Disc 1: General introduction to function and topography; The bones and joints of the head and neck.
- Disc 2: The teeth.
- Disc 3: The nose, paranasal sinuses, mouth, pharynx, larynx.
- Disc 4: The face and scalp.
- Disc 5: The ear, preauricular region, infratemporal fossa and pterygo-palatine fossa.
- Disc 6: The neck, its triangles, suprahyoid and vertebral regions, root of the neck.

THE ABDOMEN AND PELVIS

- Disc 1: The abdominal wall and the back—the bones, joints, muscles, and the blood and nerve supply.
- Disc 2: The abdominal cavity—general introduction and topography; The alimentary canal, pancreas and spleen, the peritoneum.
- Disc 3: The kidneys, ureters, and bladder; The vessels and nerves of the abdomen.
- Disc 4: The reproductive system.

THE LOWER LIMB

- Disc 1: General introduction and topography; The anatomy of function—locomotion and posture.
- Disc 2: The foot and ankle.
- Disc 3: The lower leg and knee.
- Disc 4: The thigh and hip.

THE THORAX

- Disc 1: The thoracic wall—its bones, joints, muscles, and skin; The diaphragm, intercostal spaces and the breast.
- Disc 2: The mediastinum—general introduction and topography; The heart.
- Disc 3: The great vessels—the aorta, the vena cavae; The pulmonary vessels; The blood, lymphatic, and nerve supply of the thoracic cavity.
- Disc 4: The pleural cavity—the lungs and pleura.

The Training Group

Another 1988 entry into the commercial videodisc market is The Training Group, based in Edmonton, Alberta, Canada. They are marketing a series of 12 Cardiology videodisc programs as well as one each in Emergency Medicine, Mega-Code, and Obstetrics. The programs range in price from \$1,000 to \$1,995, and will play on the IBM InfoWindow as well as other systems.

Cardiology Courseware

The lessons in this series were developed for use by undergraduate medical students as part of their course on instruction prior to seeing and examining patients on the wards or in the outpatient department. They are designed to provide a means for the students to work out the effects of individual heart lesions and then predict the physical find-

ings and important symptoms likely to result. Remedial material is available at each point in the lesson. By the end of each program, the students will have worked out the physical signs, symptoms, and the results of simple investigations required when faced with such clinical problems in practice. The heart sounds and murmurs are presented from a videodisc when the student touches the simulated "body" on the screen.

The Cardiology series consists of the following titles:

- The First and Second Heart Sounds
- Heart Murmurs and Other Sounds
- The Normal Electrocardiogram
- The Abnormal Electrocardiogram
- Mitral Stenosis
- Mitral Incompetence
- Aortic Stenosis
- Aortic Incompetence
- Atrial Septal Defect
- Ventricular Septal Defect
- Pulmonary Stenosis
- Patent Ductus Arteriosus

Emergency

This "real time" emergency simulation of a motor vehicle accident takes place on the street. It focuses on the procedures required to stabilize a trauma patient prior to transport to a medical facility. The decisions are monitored and student performance is displayed at the end of the simulation.

Dysrhythmia Training and Evaluation

This program simulates arrhythmia. Students can select options that provide the following: 1) a review of basic electrocardiography, 2) arrhythmia recognition, 3) patient simulations, and 4) a performance printout. Instructors have additional options that allow a pre-programming of patient simulation parameters, administration of final exams, and student performance printouts.

Obstetrics

This is a "static time" simulation of the delivery of a baby in a rural community hospital. The decisions made by the students are monitored and their performance is displayed at the end of the simulation.

Veritech Corporation

A series of videodisc programs on orthopaedic topics has been developed by the Veritech Corporation of East Longmeadow, Massachusetts for the Zimmer company of Warsaw, Indiana. Originally developed as a display exhibit for Zimmer, the programs drew

such a good response that Zimmer began using them for training workshops. Eventually they decided to market the programs to orthopaedic surgeons.

Known as the Zimmer Learning Exchange, the programs play on a proprietary system which consists of a Pioneer LD-V4200 player, a Visual Data controller which uses a cartridge instead of floppy disks, and a 13-inch Panasonic monitor, and sells for approximately \$2995. Eighteen programs are available in six different packages: Primary Hip, Revision Hip Procedures, Total Knee Procedures, Aspen Labs, The Total Hip Arthroplasty, and Miller/Galante Total Knee System. Each of the programs is designed for use by orthopaedic surgeons, residents, or nurses and qualifies for level 1 Continuing Medical Education credits.

Videodiscovery, Inc

In 1987, Videodiscovery, Inc. of Seattle, Washington announced the beginning of a major videodisc project in dental patient education. Funded by a grant of nearly \$400,000 from the National Institute of Dental Research at the National Institutes of Health, the project produced six interactive videodisc programs for patient self-instruction over a two-year period.

The Dental Patient Education Series is a five volume set of programs employing state-of-the-art videodisc training to prepare patients for major dental procedures such as oral surgery extractions, implants, orthodontics and periodontics. Topics are selected from a menu and presented in a lively combination of computer graphics animation, live video, and still photography. Patients can instantly view and review any section of the program at their own pace for interactive learning. Questions are included to test comprehension and a printed documentation of viewing is provided at the conclusion of the program.

The training station consists of a videodisc player, color video monitor, remote control, headset, and computer printer. Discs are available individually or together with all equipment. Each videodisc comes with User Guidebook, Viewing Guide Pad and Holder, and Receipt Booklet.

Preparing For Jaw Surgery

This disc provides a broad overview of the process of orthognathic surgery designed to prepare patients and speed their recovery. Clear explanations are given for a variety of procedures including what to expect after surgery and what to eat and do to get the best possible results. Information on wired fixation and rigid fixation are presented in separate tracks which can be selected by the doctor. It covers most topics usually presented by oral surgeons during presurgical consultation.

Preparing For Dental Extractions

This disc teaches in detail about the most common dental surgical procedure; the extraction of third molar teeth. It gives a clear explanation of the rationale for tooth extraction and the risks of both extracting teeth and leaving them in place. The actual procedure is shown with simple graphics and live footage selected to increase patient confidence before surgery. All aspects of recovery are explained and the viewer has the opportunity to ask questions of former patients in a simulated interview situation. The presentation is convincing and non-threatening.

Preparing For Dental Implants

This disc provides a complete background on the principles of two-phase osseointegrated implants in terms the layman can understand. Problems of edentulism are presented along with the advantages of treatment using implants. The surgery is explained with non-threatening graphics and clear narrative. Recovery information for the patient will give patients realistic expectations about the process. A simple attitude survey allows users to compare their feelings about dentures to those of other patients before and after surgery. An interview section allows the user to select questions for implant patients about their experiences. The disc is designed to apply generally to most commercial implant products.

Orthodontics

This disc explains orthodontic treatment for both adults and children. The principle of tooth movement is presented so that patients can better understand the need for cooperation for successful treatment. All kinds of orthodontic appliances are clearly explained. Risks of treatment and non-treatment are enumerated. The user selects from interviews with patients who answer common questions. The disc can be viewed repeatedly as each new phase of treatment is introduced. Special attention is given to personal hygiene while wearing braces and the need for conscientious wearing of headgear and retainer.

Periodontal Health

This disc explores the causes and control measures for periodontal disease. The material is appropriate for both general dentistry patients and those who are candidates for periodontal treatment. Computer graphics and clear video images explain how the disease progresses and how careful cleaning helps remove plaque. All kinds of oral health care measures are taught and varieties of periodontal surgery are discussed frankly in a non-threatening manner. Long-term maintenance is stressed with an emphasis on patient responsibility.

Physics Of Sports

Videodiscovery also produced *Physics of Sports*, an interactive videodisc for analyzing the motion of athletes. This disc provides a detailed visual record of more than 20 athletic events, filmed expressly for scientific analysis. The slow motion observation and measurement of athletic performance using videodiscs can raise many questions. Because of the high interest in sports, many students who may be turned off by "science" are motivated to use formulae and solve problems. The principles and methods of physics are applied to study problems which are familiar and interesting to students. This approach reinforces student understanding of physics concepts thorough application on real world problems.

Medical Publishers

Many medical book publishers have looked at electronic publishing in general, including videodisc publishing, as a possible new venture for their company. In fact, over the past four or five years, there have been several unsuccessful attempts to market

videodisc courseware. As a result, it seems unlikely that medical publishers will be a major force in creating and distributing videodisc courseware until the market becomes more stable.

A major problem with marketing videodiscs is that, unlike textbooks, there are no established channels for acquisitions. Every institution is a little different in how it might go about purchasing videodisc programs. Decisions may be made by media centers, health science libraries, teaching departments, physicians, professors, or administrators. This decentralization means that the same marketing effort may have to be repeated many times over in any given institution in order to reach the key person.

Another major problem is demonstrating the program to interested parties—it cannot be demonstrated as easily as a textbook. The solution for most commercial vendors seems to be to create a videotape demonstration of the product for potential buyers to view. This can be followed up by an on-site demonstration if there is a sufficient sales force, or by a program preview if the potential customer already has the necessary hardware system.

Which brings up another problem area. Since there are so few videodisc hardware systems in the field, most buyers will need to invest not only in the program itself—which can range from \$750 to \$12,000 for a series of programs—but will have to buy a \$4,000 to \$8,000 hardware system as well. Most book publishers are not interested in going into the hardware sales and service business.

Publishing Arrangements

In the past, most medical publishers were interested in picking up the rights to an existing program that was developed by a health sciences school. They usually picked up exclusive rights to a program, and handled all replication, packaging, mailing, and promotion. Because the industry is new and has no established royalty standards, the developing institution is in a position to negotiate a return on sales. However, most publishers are used to returning a royalty around 10 percent, and are unlikely to deviate from that figure for videodisc programs. This creates a problem for the developer, since videodisc programs can cost anywhere from \$30,000 to \$150,000 to produce, with most school programs falling somewhere in between. Books, on the other hand, require a much smaller investment to write.

With these kinds of problems to face, most medical publishers are standing on the sidelines waiting for a better opportunity to present themselves before investing in videodisc publishing.

Mirror Systems, Inc.

Mirror Systems, a subsidiary of the publishing company Times Mirror, is a design and production company located in Cambridge, Massachusetts. In 1987 they developed the videodisc program *Introduction to Cardiovascular Examination* as a test product. Times Mirror wanted to see what they could do in the way of producing exemplary videodisc instruction as well as how well such a program would sell in the marketplace.

The first objective was achieved with flying colors, with the program being very well received by the medical and nursing communities. The program provides two to four hours of instructional content for use by a broad range of medical and healthcare profes-

sionals. The course allows the student a high degree of interactivity with images and text through touch sensitive controls, as well as the ability to navigate through the system at an individualized pace. The system supports questioning of the student for score reporting and instructor evaluation.

Distribution Ceases. *Cardiovascular Examination* plays on the IBM InfoWindow and was being offered for \$1000. However, the program failed to sell especially well, with only about 50 copies distributed by the end of 1989. As a result, Mirror Systems announced that it has discontinued sales of its *Introduction to Cardiovascular Examination* videodisc course effective November 30, 1989, and the course was withdrawn from the market.

The decision to discontinue sales of the program reflects the current state of medical videodisc publishing. The course is still highly regarded and was among the first to clearly demonstrate the effectiveness of the videodisc medium in medical and nursing education. However, the lack of a substantial installed base of compatible videodisc playback systems, together with continuing changes in optical media delivery hardware, have made it impractical for the company to continue to sell and support the product.

Mirror Systems, a part of the Times Mirror Company, is continuing to develop interactive videodisc, although nothing is planned in the way of health sciences topics. Its latest accomplishment was a joint effort with sister Times Mirror company, Learning International. Released in May and marketed as *The Sales Challenge Videodisc Series*, it consists of five single-sided discs devoted to reinforcement of interpersonal selling skills.

In the health sciences videodisc area, where *Introduction to Cardiovascular Examination* had an award-winning record, the company is continuing to evaluate opportunities both for itself and on behalf of health science publishing companies within Times Mirror.

Williams & Wilkins Publishing Company

Williams and Wilkins Publishing Company (W&W) added videodiscs to its marketing list in 1985 with the acquisition of the University of Iowa's program, *Assessment of Neuro-motor Dysfunction in Infants*. W&W had been considering the area of electronic publishing for several years, and first entered the market less than two years prior with several software programs for computer-assisted instruction.

In an attempt to market the program, W&W exhibited the program at major medical meetings that deal with neurology and pediatrics so that participants would have a chance to view it. They also performed a lot of telephone work promoting the program, encouraging people to somehow acquire the necessary equipment so they can have the program for a 30-day review period. In addition, they invited representatives from schools in Philadelphia, Baltimore, and Washington to come to their offices for demonstrations.

Though the *Assessment* program has not been a commercial success, in early 1986 W&W was still interested in acquiring additional videodisc projects, and was looking closely in the areas of anatomy, pathology, and dermatology. Other areas of interest to W&W are allied health fields such as physical therapy, occupational therapy, speech, language, and hearing. They stated that they would like to learn from their venture before they actively pursue other projects, but would entertain the idea of marketing existing videodiscs in their areas of interest.

The Electric Cadaver. In late 1988, Williams and Wilkins picked up a one-year option on the rights to an electronic textbook of human anatomy developed by Stanford University Medical Center researchers. Combining text, computer graphics and full-color video, *The Electric Cadaver* allows a user to interactively explore the structure of the human body in a way unavailable in conventional printed books.

The system displays images on two screens, one for computer graphics, the other for full-color video. A user can "jump" from picture to text to video and back, just as a reader jumps from place to place in a printed volume. Williams and Wilkins, after examining the market, failed to exercise their option.

Scott, Foresman and Company

In 1988, Scott, Foresman and Company, of Glenview, Illinois produced a Level 1 and Level 3 videodisc entitled *The Psychology Encyclopedia*. The program contains 14 minutes of motion and hundreds of still frames which define basic psychology terms. The imagery provides extensive support to Scott, Foresman and Company textbooks.

Psychology instructors will use the discs as a classroom aid to illustrate and expand upon textbook concepts and lessons. The program is divided into 11 chapters of psychology study: Intro/Methods, Biological Bases, Sensation/Perception, Developmental, Intelligence-Cognition, Learning & Memory, Testing, Motivation and Emotion, Abnormal, Social, and Human Sexuality.

In addition, computer database management software can also be used to control the program in a Level 3 mode. Scott, Foresman and Company is planning to develop controlling software to support the program. According to Darrell Schweppe, project leader, "the greatest challenge in producing *The Psychology Encyclopedia* was formatting existing transparencies for the videodisc medium. Each image had to be digitized and re-touched using the electronic paint box, including removal of all the transparency text to replace it with larger electronic text. The original transparencies were of such high quality that every effort was made to transfer that quality to the finished videodisc."

MEDCOM

In February 1984 EECO Incorporated announced the development of a new system for compressing ten seconds of audio information into every frame of video. Using the EECO system, one 30-minute videodisc could hold 54,000 frames and up to 150 hours of audio information. MEDCOM, a subsidiary of Baxter Travenol Laboratories, received their first EECO system in July 1984. It was used by TRAINEX, a division of MEDCOM, to duplicate portions of their large library of filmstrips and slide/tapes.

TRAINEX used the EECO system as the basis for what was called Autocomm Centers for self-controlled learning. The Centers were to be portable playback units containing a Commodore 64 computer, a videodisc player, and a color monitor. The first TRAINEX disc contained nearly 200 slide/tapes and filmstrips on topics in Patient Education, Physician Education, Nursing, and Allied Health. More than 140 hours of sound were programed onto the disc, which was originally expected to be available for purchase in the early part of 1985. However, technical problems, combined with the sale of MEDCOM, seem to have killed the project altogether. Recently, MEDCOM has been reex-

aming the interactive video market, although they have not announced any plans to come out with a product.

J.B. Lippincott Company

In early 1985 the J.B. Lippincott Company, a major publisher of medical and nursing books, announced their entry into the videodisc market with plans to produce a series of 12 Level III videodiscs for the health professions. The series, based on the highly successful textbook and film series, *A Guide to Physical Examination*, by Barbara Bates, M.D., was to be designed for independent study and as an instructional aid.

The series was to be produced by taking the existing film sequences and adapting them to the videodisc format. The user would learn all techniques essential for the physical examination of a patient by performing a simulated exam using the videodisc program. By the fall of 1986, however, Lippincott announced that they would no longer produce or acquire computer-assisted software--including videodisc programs. With this announcement came the dissolution of the Media Development Department of Lippincott.

W.B. Saunders Company

In 1984, the W.B. Saunders Company joined forces with the Thomas Jefferson University Hospital to produce a Level II videodisc on ultrasound called *Sight Through Sound: An Interactive Introduction to Medical Diagnostic Ultrasound*. The project was funded by CBS, which then owned Sanders, as a prototype disc to test the market. The disc was produced by now defunct Interactive Video Concepts with a budget around \$100,000, and has sold around 150 copies--about half of what is needed for Saunders to "break-even."

The disc was marketed primarily by direct mail, with some support from the Saunders regular sales force. Since Saunders was not selling videodisc hardware systems, the biggest problem they had was locating potential buyers with videodisc equipment. After about a year, Saunders stopped marketing the disc actively, although it is still available for purchase from their Electronic Publishing Department.

Evaluating *Sight Through Sound*

As part of a presentation to the Jefferson University Medical School, Larry Waldroup, Chief Technologist in Ultrasound at Thomas Jefferson University Hospital, demonstrated and discussed *Sight Through Sound*, offering some useful insights into some problems encountered by this disc.

The target population was too broadly defined. In an attempt to make the disc attractive to as broad an audience as possible, the topic focus was too diffuse and the disc lost its usefulness for any one group. Some segments addressed technologists while other segments addressed interns. Segments of the disc could be useful in an introductory course, but Waldroup feels it is impractical to use it in such a limited way.

The logistics of playback were inconvenient. Because many departments do not have their own videodisc player, the inconvenience of arranging for the loan of a machine blocked the routine use of the videodisc. As long as there were no other videodiscs on the subject, it was not practical for departments to purchase their own videodisc player.

The disc was not reliable. Either because of bugs on the disc (some have been identified) or problems with the videodisc player, the program was not completely reliable.

Plans for the Future

One Saunders representative feels the future for this type of electronic publishing may lie in the newer technologies such as CDROM or CD-I. He feels these formats will require a smaller, less-expensive delivery system that schools, hospitals, and individuals will be able to afford. He also points out that much of medical publishing does not require the motion sequences that videodisc is best suited to present. Text, graphics, and picture-quality stills represent the majority of information medical publishers are interested in distributing, all of which will be better handled by CDROM and CD-I formats.

Chapter 4

Professional Associations

Though most professional associations have limited funding available for research and development, several organizations have been involved, to varying degrees, in the development of videodisc programs for continuing education.

American Society of Clinical Pathologists

The American Society of Clinical Pathologists is marketing the first in an expected series of videodisc programs on the human organ system. The first of these modules covers lymph node pathology and is designed to help the physician diagnose diseases of lymph nodes.

The system assists the user by recommending features for which to look and tests to perform in order to solve the differential diagnosis. In addition to providing access to the large library of videodisc images, the program also provides a hypertext-style access to a textual information, including criteria for the diagnosis of the various diseases, immunology, molecular biology, and cell kinetics information. These capabilities are integrated into a mouse-driven system that can be used easily by people without any previous knowledge of computers.

The system was developed by Intellipath, of Santa Monica, California, over a five year period. Intellipath has plans to produce similar programs for each of the 40 organ systems in the human body.

American Association of Equine Practitioners

Although never actively involved in the development of videodisc instruction, The American Association of Equine Practitioners did provide film footage to Digital Equipment Corporation (DEC) in 1984 for a demonstration videodisc compiled by DEC. The disc includes a segment titled *Operative Arthroscopy: Applications in Equine Lameness* in which the learner is taken through examination, diagnosis, and arthroscopic surgery on a horse's knee to remove a bone chip. Contributors of lesson material include the University of Georgia College of Veterinary Medicine and Cornell University College of Veterinary Medicine.

American Academy of Orthopaedic Surgeons

In 1986, the American Academy of Orthopaedic Surgeons, working with the National Library of Medicine, produced a videodisc program titled *The Chronic Unstable Knee*. The program is designed to provide both a Level I and a Level III resource for orthopaedic education as well as a vehicle for Continuing Medical Education in Orthopaedic Surgery (CMEOS). The Level I side of the disc contains approximately 5,000 images which make it possible to correlate cross-sectional anatomy with electronic images. Using the slow play and step mode of the videodisc player, a viewer may follow anatomical structures through the knee in three planes.

The Level III side of the disc consists of a patient simulation which provides the learner the opportunity to take history, do physical examination (using video segments), receive laboratory tests, order radiology, and perform diagnostic arthroscopy. All this may be done using a light pen and menus or free-text entry using the computer keyboard. The program is available for testing to health science schools by contacting the National Library of Medicine. (See *MedicalDisc Directory* entry for contact information.)

American College of Radiology

The *ACR Learning File*, the American College of Radiology's highly regarded reference library of full-sized teaching films, is under preparation in a new, complementary instructional medium. Beginning with the section on pediatrics, new and revised sections will also be issued on videodisc.

Each videodisc will include all of the images in the film version, a patient history, and a comprehensive discussion of radiographic findings, and detailed teaching discussions. Additional material may include differential diagnoses, protocols and descriptions for appropriate imaging procedures, images portraying disease manifestations in different patients, and pertinent bibliography. IBM/PC and Apple Macintosh versions are available for controlling all videodisc images on the video monitor and text displays on the computer screen. No separate imaging adapters or special hardware components are needed. All program and data files needed for control and display are included; monitors and accessories are available through ACR.

Laser Barcode. The ACR also is releasing a barcoded workbook with the Learning File series of videodiscs. LaserBarcode, developed by Pioneer Communications of America, offers a simple and effective way to access videodisc programs.

The system includes a book with text and barcodes, a laserdisc containing images, a standard TV monitor, and a Pioneer Laserdisc player equipped with a barcode reader. The book contains all text, charts and graphics included with the original film-based version of the ACR Learning File. Radiographic images are stored on a laserdisc and accessed from barcodes printed next to the appropriate text. Barcodes for general operation of the Laserdisc player the complete instructions are included. The barcodes reproduced above contain commands to search for a specific frame, play a video sequence, or simply step to the next frame. All control commands can be executed through barcode.

Pediatric Videodisc

The American College of Radiology is offering the revised Pediatric Section of the ACR Learning File on videodisc. This section includes investigative techniques such as: magnetic resonance imaging, ultrasound, computed tomography, nuclear medicine, general diagnostics, and special procedures and their application to specific pediatric conditions.

The section contains 275 cases divided into seven subsections: Newborn Chest (31 cases), Chest (45 cases), Skeletal (55 cases), Gastrointestinal (38 cases), Genitourinary (30 cases), Neurology (41 cases), and Cardiovascular (35 cases). Each case has been selected and organized to provide both a clinical experience in pediatric radiology interpretation and a logical educational sequencing. Eight cases have been added to the cardiovascular subsection on this videodisc version. They made extensive use of the videodisc's ability to show full motion along with still images.

Chest Videodisc

The American College of Radiology also is offering the revised Chest Section of the ACR Learning File on videodisc.

The section is divided into eight subsections: Basic Principles (56 cases), Diffuse Pulmonary Disease (61 cases), Segmental Lobar Disease (41 cases), Solitary Nodules (19 cases), Cavities (22 cases), Free Fluid/Air (24 cases), Cardiovascular Disorders (54 cases), and Mediastinal Masses (35 cases). Imaging techniques such as magnetic resonance, nuclear medicine, and state of the art computed tomography, have been included. This new edition contains 158 new cases, including a dramatic review of segmental lobar collapse by Dr. Robert Heitzeman of SUNY, Syracuse. As in the entire ACR Learning File, the cases have been selected and organized in a manner that will provide a logical and effective learning experience.



Chapter 5

Public Organizations

In the past, many publicly funded organizations lead the way in the research and development of interactive videodisc programs. Although most of these programs were used only within the sponsoring organization, they served as valuable prototypes for development by other groups. In addition, these public projects support many smaller, private firms, helping to sustain them until the videodisc industry as a whole becomes more commercially viable.

National Library of Medicine

With over 3 million books, journals, and pictorial materials, the National Library of Medicine (NLM) is the world's largest research library in a single professional field. It is located just outside Washington D.C. as part of the National Institutes of Health in Bethesda, Maryland. NLM serves as a national resource for all U.S. health science libraries, providing lending and search services through a Regional Medical Library Network. This network consists of 2000 "basic unit" libraries (mostly at hospitals), 125 Resource Libraries (at medical schools), seven Regional Medical Libraries, and the NLM itself.

Lister Hill Center

The research and development arm of the Library is the Lister Hill National Center for Biomedical Communications. The Lister Hill Center was developed to explore the uses of computer, communication, and audiovisual technologies for the organization and dissemination of biomedical information. Currently the Center is investigating the potential of optical videodisc technology for document storage and retrieval, and as an interactive teaching tool for Health Sciences education. To date, the Center has produced the following videodisc projects.

Basic Medical Pathology

This is the first of the Lister Hill Center's videodisc projects, begun in 1981. The original disc covers the topics *Cellular Alterations and Adaptations* and *Cell Injury and Cell Death*--two topics presented in most courses in Medical Pathology. Each side of the disc is supported by a pretest, a study module, and a posttest.

Field testing of this disc began in June 1983 at 36 medical schools. Revisions prompted by the field tests have resulted in a new version, distributed to test sites in August 1985. The program software supports Apple and IBM PC computers and a variety of

players and interfaces. Additional videodiscs are planned to cover topics including Necrosis, Inflammation, Neoplasia, Cellular Accumulation, and Circulatory Disturbances.

Radiology.

A collaborative effort with the National Center for Devices and Radiological Health of the Food and Drug Administration, the *Radiology Videodisc* contains radiographs from twenty-two cases selected from the American College of Radiology Learning File. A computer program has been developed to permit radiology consultants to enter the content for clinical case simulations into text files that will be used to present simulations to students, radiologists, and other physicians. When at least six patient management cases have been completed, the programs will be released to schools for testing.

Dental Simulation

This project involves the presentation of a dental case simulation. The initial work was done at the University of Nebraska Dental School, where faculty developed several case simulations suitable for presentation by computer-controlled videodisc players. In 1981 one of the simulations was reformatted to videodisc and the computer program translated from TUTOR to the 8080 PILOT language. The programs are now being translated to run on Apple II and IBM PC computers and should be available for testing soon.

The Case of Frank Hall

This is the first in a series of videodiscs designed to demonstrate the use of videodisc/computer technology for the creation of instructional medical simulations. As part of the TIME project (Technological Innovations in Medical Education) *Frank Hall* is a simulated patient who comes to the emergency room complaining of weakness and abdominal pain. The user plays the part of a physician and attempts to diagnose and treat the patient. The user elicits information by speaking control words into a voice recognition unit. This lesson will eventually consist of three discs, and therefore will require three videodisc players to be interfaced with a IBM-PC/XT computer.

The Case of Patricia Fletcher

This is the second simulation in the TIME project. *Patricia Fletcher* is a morbidly obese, middle-aged college professor who is besieged with personal problems and wants a gastroplasty. This case consists of more than 300 video scenes depicting the medical, social, and psychological problems of obesity and a range of therapeutic choices ranging from an eating disorders clinic to the surgical procedure requested.

Historical Prints & Photographs

This Level II videodisc was produced as an experimental project designed to 1) evaluate the potential of laserdisc technology for improving access to still picture collections, 2) assist in determining whether the benefits of videodisc technology justify the costs involved, and 3) to provide valuable information to help guide future ventures in this area. The disc contains more than 1000 of the most requested prints and photographs from the NLM's History of Medicine Collection.

Microanatomy Tutorial

The National Library of Medicine has combined videodisc and bar code technology to produce a Tutorial Environment System (TES) for medical students. This specially constructed system enables a student to sit at a console and access an entire study plan that incorporates the senses of sight, hearing, and touch. The system consists of a series of modular cabinets which contain a videodisc system and learning materials—including bar coded textbooks and anatomic models. Seated before this array of materials, the student can interact with TES using a digital scanning wand which reads the codes placed on the models and throughout the books. These codes activate segments on the videodisc which explain or extend the material being studied.

Orthopaedic Surgery

This project is a collaborative effort between the Lister Hill Center and the American Academy of Orthopaedic Surgeons. The project goals are to produce a prototype videodisc for testing and use as a continuing education vehicle for orthopaedic surgeons, and to study the value of interactive video in a clinical continuing education setting.

The program will present a simulated patient with knee injuries. The practitioner will be required to take a history, do a physical, make a diagnosis, and propose a treatment plan. The visual database will contain audiovisual sequences that show the patient responding to history questions and undergoing knee exams. It will also show radiographs, arthrograms, and arthroscopy.

CT, MR, and Multiplanar Knee Anatomy

The flip side of the Orthopaedic videodisc contains a collection of images that can be used for instructional purposes. One such program was written at Lister Hill by Kevin W. McEnery, MD, [a recent graduate of Georgetown University School of Medicine.]

Interactive Atlas of Knee Anatomy

A videodisc based atlas of knee anatomy was developed by Kevin McEnery, MD with the American Academy of Orthopaedic Surgeons and the National Library of Medicine. The interactive atlas presents a dramatic view of knee anatomy using more than 450 knee images stored on the videodisc, including computerized tomographic, magnetic resonance, and anatomic images.

Modern radiology consists of traditional plain film examinations supplemented by computer-based modalities such as computer tomography (CT) and magnetic resonance (MR). These modalities require knowledge of cross-sectional anatomy which, until recently, was not traditionally incorporated into the medical school curriculum. Given that computers are necessary to acquire these cross-sectional images, the computer should also be used to teach their interpretation to medical students and experienced clinicians.

Using the IBM InfoWindow hardware system as a delivery system, McEnery developed an atlas which is managed by a window-based graphics interface accessed by touchscreen or keyboard. This interface gives the user complete control over image presentations, selecting parameters including modality (MR, CT, anatomy), image plane (axial, sagittal, coronal), and whether images will be viewed sequentially or individually.

At a given location (eg. the mid-knee in the sagittal plane) the user may open the "image window." By touching another modality name, eg. MR, the MR image of that exact location will be displayed. Movement through the images of this new modality may then be selected.

The atlas function of the program allows interactive learning of anatomy. The option window is opened and the user touches "atlas on." In less than a second all the anatomic structures on the image are labeled. The option is available to erase the labels and simply touch the location of a structure and an identification label will be printed next to the structure. Quiz modules present computer-created questions to test the student's knowledge of anatomy. The questions may be requested on a given image, section, modality, or the entire image database. Computer question generation eliminates redundant questions and forces the user to learn the anatomy and not the questions created to test their knowledge.

National Institute of Mental Health

An interactive videodisc curriculum on teenage suicide and depression has been developed by the National Institute of Mental Health (NIMH). The program *Suicide Intervention: Assessing Teenagers at Risk*, concentrates on developing decision-making skills and knowledge on the following areas: 1) Depression and its relationship to suicidal behavior, 2) Interviewing adolescents, 3) Assessing suicidal risk, 4) Family matters, and 5) Intervention and follow-up.

Students using the program learn about these topics by conducting interviews with adolescents, analyzing their data, and making decisions about diagnosis and treatment. Factual information is interwoven with the cases. All the cases have practical realities such as time constraints, interruptions, attitudes, conflicting demands, and limited options for intervention built into the presentations.

Four Simulated Cases

The case of *Edward* is a post-mortem review which highlights risk factors. No one responded to these risk factors which, in hindsight, were obvious indicators of the potential for suicide.

John is a depressed and potentially suicidal teenager who comes to visit his family doctor because he "feels sick." The learner controls the interview with John by selecting what questions to ask. This case also illustrates how the attitudes of a clinician may influence his or her ability to deal with a patient in a crisis.

Shari is an inarticulate 13-year-old girl who has taken a drug overdose impulsively. This case highlights techniques that can be used to draw out such a youngster and includes a "video glossary" which demonstrates various interviewing techniques.

Lisa is a 15-year-old girl whose mother brings her to the pediatrician because she refuses to go to school. This case illustrates how problem-solving techniques can be used to help relieve depression in a youngster.

The curriculum was initially designed for third and fourth year medical students who plan to specialize in pediatrics and family or general practice. The program was plot-tested in four medical schools in February 1986 and has been revised based on the results. Design and production of the disc was done by Lunaria Incorporated, with support

from the Lister Hill National Center for Biomedical Communications at the National Library of Medicine.

United States Navy

The Naval Health Sciences Education Training Command (NHSETC) has initiated the development of a large-scale videodisc network to serve their education and training needs. The Computer-Assisted Medical Interactive Video System, or CAMIS, is being used in Naval schools and hospitals for refresher training and continuing education. The Navy already has placed 150 of the IBM compatible CAMIS units in select schools across the country. By the end of 1988 the Navy will have a total of 210 videodisc systems placed in its schools and hospitals.

When asked about the Navy's interest in purchasing off-the-shelf software for these systems, one Navy representative replied, "I would say our interest in existing material would be fairly high because of the high cost of development. If there's something we can run that has applicability, either videodisc or CAI, we'd be interested in taking a look at it." The following is a sampling of programs being developed for the CAMIS system.

Basic Anatomy and Physiology is an eight-part series developed by the University of Maryland University College from existing videotape. The series consists of eight videodisc sides containing more than 20 lessons. The lessons require the corpsmen to demonstrate an understanding of the pathology underlying the medical conditions they treat.

Emergency Medical Conditions is designed to provide training to hospital corpsmen on how to recognize, treat, and report basic medical conditions such as angina pectoris, insulin shock, or myocardial infarction. It is produced from the point of view of two Navy corpsmen, with each vignette beginning with a summons to the scene. The learner is then presented with a patient who is suffering from a medical condition that he must diagnose and treat.

Combat Trauma Training is designed to train non-surgeon physicians in the diagnosis and treatment of injuries commonly suffered in battle. The program was produced under the DOD banner and will have application to all ground force combat situations. The program is designed so that the videotaped "patient" actually represents seven different patients, depending on which symptoms and sequences the computer selects.

Basic Medical Skills--Part 1 contains six major lessons: vital signs (temperature, pulse, respiration), blood pressure, assessment, hemorrhage control, shock, and soft tissue injuries. The student may study these in three different modes: Learn, Review, or Look-Up. Learn goes through all the material in a lesson in sequence. Review allows selection of a topic and exercises within a lesson. Look-Up provides information on a specific topic within a lesson.

Mediquiz. Much of medical training and evaluation involves multiple choice tests of medical fact knowledge. Medical and allied health students and practitioners often study for such tests by reviewing old examinations and/or purchasing the books and services of a thriving preparation-for-testing industry. *Mediquiz* frames such a review in the context of a medical gameshow. *Mediquiz* is a simulation in the sense that the show changes with each playing: the questions vary; moderator's patter varies and the abilities of other, computer-generated, contestants vary.

Oral Examination Assisting provides practice in dental charting including charting missing teeth, identifying various types of amalgams, recognition of amalgam shapes, and location of fillings.

Other programs being developed by the Navy include: *Intermediate Medical Skills*, and *Advanced Medical Skills, Recognition and Management of Acute Respiratory Conditions, Recognition and Management of Common Dermatologic Conditions, Recognition and Management of Acute Cardiac Conditions, Recognition and Management of Genitourinary Conditions*, and *Recognition and Management of Abdominal Pain*, all refresher training for independent duty corpsmen; and *G-Force Loss of Consciousness*, a program in Aviation Physiology.

Uniformed Services University of the Health Sciences

The Uniformed Services University of the Health Sciences (USUHS) has established the Center for Interactive Media in Medicine (CIM), a new department dedicated to the development and production of quality interactive video instruction for medical education. The mission of CIM is to provide a focus for research and development of interactive media for general medical education for the university and for graduate medical education within the Department of Defense.

CIM's team of instructional designers develop interactive video-based patient simulation programs by working with subject experts and researching existing course content. CIM also provides support to faculty for design and development of interactive courseware, and helps them evaluate software used to author interactive courseware on their own. CIM was created last summer when the university recognized its need to have a focal point for interactive video development. Joseph Henderson, MD (formerly of USUHS, now with Dartmouth Medical School) has written and produced several award-winning interactive videodisc programs

Award-winning Productions. Before CIM's creation, Dr. Henderson wrote, designed, and produced two interactive videodisc programs. In the first, *Advanced Combat Trauma Life Support (ACTLS)*, military physicians and medical students are "given orders" to report to the Ninth Combat Zone fleet hospital. Upon arrival, nurse Laurie Matthews whisks the learner, alias LT Clark, to the rear of the triage tent, where a young Marine who has been shot in the chest struggles for breath. LT Clark must correctly and speedily diagnose and treat this combat casualty to achieve a high score. The ACTLS program is used in conjunction with C4 course held at Fort Sam Houston, Texas. ACTLS won the Best-Overall Achievement Award from the Nebraska Videodisc Group in 1987, and it received the "Golden Award in Critical Care" in 1988 from the John Muir Medical Film Festival.

The second project, *MediQuiz*, provides a review and drill of basic medical knowledge in an entertaining gameshow format for the US Navy medical paraprofessionals. The project was completed with a modest budget, and is repurposable; the same videodisc can be used with different questions for different audiences. To date, *MediQuiz* projects have been completed for hospital corps "A" school personnel and for laboratory technicians (*MediQuiz: Lab Tech*). *MediQuiz* for operating room technicians (*MediQuiz: OR*) is soon to be released.

CIM has begun to work with the Department of Anatomy to produce *MediQuiz: Gross Anatomy*, for second-year students. In addition to *MediQuiz: Gross Anatomy*, CIM has

begun work with the university on a videodisc project tentatively called a *Review of Clinical Human Wrist and Hand Anatomy*.

CIM is ready to release for beta-testing the interactive videodisc program *Preventive Medicine in the Combat Theater: Regimental Surgeon*. the two-sided disc is in a full-featured computer adventure game format and centers around its Navy doctor-protagonist, who is assigned to a US Marine regiment in a hypothetical Middle Eastern combat zone. His challenge is to gain all the information he can to prevent a malaria epidemic. But he is working against time—his regiment is preparing for an encounter with the enemy in less than 48 hours. Not only that, but his superiors are less interested in supposed medical problems than they are in the tactics of the impending battle. The program includes a decision support system with online documents, icon-based maps, and a constantly changing environment.



Chapter 6

Testing & Certification

Although little use is being made of videodisc systems for testing and certification, the potential of the technology for such purposes is tremendous. With the ability of videodisc systems to simulate medical situations, they not only are ideal for training and education but for assessment as well. The most significant development in this area is taking place at the National Board of Medical Examiners in Philadelphia, where a computer and videodisc component may soon be added to the examination leading to licensure for U.S. and Canadian medical school graduates. After this system is successfully implemented, many other certifying and licensing organizations are sure to follow suit.

National Board of Medical Examiners

The National Board of Medical Examiners (NBME) has incorporated videodisc technology into its Computer-Based Examination (CBX), a new examination tool being developed for future use by the NBME. CBX is an interactive clinical simulation developed by the NBME that will be administered using regional evaluation and learning centers equipped with networked microcomputers and videodisc players.

CBX represents the result of the NBME's 18-year research effort to develop clinical simulations to evaluate physician competence. The current CBX model emphasizes patient management and dynamically responds to the movement of time. Field trials of CBX have demonstrated its validity and reliability in the assessment of physician competence.

The CBX will be used as a major component of the final NBME examination leading to certification and licensure for approximately 13,000 U.S. and Canadian medical school graduates each year. This use represents a major advance in assessment of clinical competence, adding a new dimension to the elements of competence objectively evaluated. The NBME expects that computer-based testing will also be used widely in other licensing and certifying examinations, as well as in self-assessment programs.

The widespread application of simulation technology in the evaluation of physician competence is likely to have several beneficial effects. First, the use of simulation in medical education will be encouraged by the use of simulation in the evaluation process. Second, observation of clinical performance in standardized clinical situations will be possible for large numbers of individuals for the first time. Third, the ability to assess physician competence will be greatly enhanced. Finally, availability of a computer-based delivery system for CBX will encourage the development and use of other innovative computer-based methods in the evaluation of physician competence.

NBME Plans for Computer-Based Testing

In 1987, the NBME conducted a major field study of the CBX system and, as a result, has "further clarified the measurement characteristics and confirmed the value of computerized patient simulations in the assessment of clinical competence." The NBME is now making the CBX program available to selected medical schools for further evaluation. Applications have been solicited from schools, and will be selected on the basis of their program description, willingness to provide appropriate support for the CBX system, and payment of a license fee of \$1000.

The selection of schools for further use and testing of the CBX is the first of four phases designed to bring the program to the point where it can be implemented in the NBME examinations. During Phase One, the NBME will provide participating schools with copies of the CBX program, orientation material, computerized feedback questionnaires to obtain user feedback after a CBX session, and continued technical support through the use of a direct telephone line to the NBME.

The second phase began in late 1988 when subjects tests were offered to participating schools. These subject tests, consisting of selected CBX cases and multiple choice questions (MCQs) for clinical disciplines, will be made available for further study and will be administered only at participating schools. Additionally, some schools were selected as prototypes for future authorized testing centers.

Phase Three began in 1989 when fully-developed tests were offered to participating institutions for intramural evaluation. Schools were selected for designation as authorized testing centers. In Phase Four the CBX will be implemented in NBME examinations using authorized testing centers.

CBX Today

The CBX consists of patient simulations which are presented in an uncued patient management environment. The student is presented with a brief description about the condition, circumstances, and chief complaint of the simulated patient. Subsequent information about the patient depends on the student's requests for tests, procedures and/or therapies. The student is expected to diagnose and manage treatment and to monitor the patient's condition as it changes over time and in response to treatment. Over 2,000 diagnostic and therapeutic actions are possible, which the student requests by typing in orders on the computer keyboard. The results of some tests are provided using medical images from a linked videodisc.

The computer maintains a record of every action requested by the student. This record is then compared to a scoring key, which consists of actions that a committee of experts identifies as being beneficial or harmful (risks) to the patient. For initial use in medical schools, cases have been modified to compare student actions with scoring key actions at the end of each case.

There are five sets of five cases each available, and one set of eight multidisciplinary cases. The case subjects include Pediatrics, Internal Medicine, Surgery, OB/GYN, and Family Practice.

CBX Pilot Test Results

CBX was recently evaluated in a large pilot test involving 200 residents and 75 students in Chicago and Philadelphia. Each learner was administered seven cases and 140 multiple choice questions over two full days of testing. The test results were compared with MCAT scores, NBME Part I, Part II, and Part III scores, the 1987 Part III PMP (patient management problems) scores, and the rank ordering of program directors. The results were reviewed by an independent advisory panel (comments found in Chapter 16, Videodisc Research/Surveys).

Based on currently available evidence, the NBME feels the CBX is a testing method that meets both psychometric and logistic criteria for use in large-scale testing programs. Therefore, they feel it is likely that the method will prove useful in assessing competence of physicians. While several important questions have not yet been fully answered, information from the pilot testing has allowed the NBME to make the following conclusions:

Prior Computer Experience. Neither prior computer experience nor computer anxiety influences examination performance for residents. Using a survey to quantify prior exposure to and experience with typewriter keyboards and computers, a computer experience score was developed for each student and resident. Using the Computer Anxiety Index, pretest anxiety state was assessed. State of anxiety was also assessed utilizing adjective checklists. These subject characteristics were compared with performance on the CBX portion of the pilot exam. These analyses showed that residents' test performance was uncorrelated with computer experience (0.09), computer anxiety (-0.07), and the level of pretest anxiety (-0.04). In the smaller student group, the correlation between CBX performance and computer experience was higher (0.27), approaching significance at the 0.01 probability level. The explanation for this apparent difference between the student group and the resident group needs further exploration.

Standardized Test Conditions. Test conditions need not be standardized. The pilot examination was conducted at two sites. In Philadelphia, a carefully controlled testing center optimizing ergonomics of the examination environment was utilized. In Chicago, a temporary facility was constructed with little attention to ergonomic details. Chicago and Philadelphia residents did not differ in ability, nor did the difficulty of the scoring elements vary between the two locations.

Practice with CBX. Considerable practice opportunity must be provided before use of CBX for testing. Two forms of the CBX portion of the examination were given to random halves of the pilot exam sample. The first and last two cases were interchanged on the two forms. Comparison of performance on the simulation that differ only in their position in the examination allowed an assessment of learning effect on examination performance. Three of the four cases and their individual elements were more difficult for examinees when they were positioned early in the exam. While the amount of practice effect seems to be somewhat determined by the nature of the simulations encountered early in the exam, it is clear that experience with four or five simulations is required before performance will stabilize. In surveys of pilot exam participants, only 13 percent of examinees were comfortable with the mechanics of the CBX model after the orientation and practice case, while 72 percent were comfortable after the second case and nearly all were comfortable after four or five cases.

CBX Reliability. While CBX precision of measurement is equal to that of patient management problems (PMPs) when time is held constant, a single day of testing will not be adequate to reliably assess all examinees. Using eight CBX cases, required six hours of testing time, an alpha reliability of 0.75 was attained. In combining eight CBX cases with 280 multiple choice questions (the current Part III MCQ length), the expected reliability of a linear combination would be 0.82. In assessing performance of the instrument in the pass/fail range, the standard error of measurement (SEM) for residents straddling the fifth percentile was 0.50 standard deviations. While this data suggests that a two-day examination would be required to reach a combined reliability of 0.9, alternate strategies that might reduce this time include better targeting of the simulation and sequential testing, administering larger numbers of cases only to those examinees whose performance falls at the bottom of the distribution on a screening set of cases.

CBX measures something different from PMPs and multiple choice questions (MCQs). Analyses of correlations, factor analyses, regression analyses and "pass/fail" analyses all confirmed a difference between what is measured by CBX and other methods. PMP and CBX correlated 0.33 with each other. When PMP risk and benefit scores were combined to maximize their relationship with CBX, the correlation increased to only 0.34. When corrected for attenuation, these correlations are approximately 0.56. MCQ and CBX correlated 0.37 with each other. When corrected for attenuation, this correlation is 0.49. A factor analysis of MCAT, Part I MCQ, Part II MCQ, Part III, CBX and PMP scored produced three factors: Part I/Part II, MCAT and Part III. CBX did not fit in easily with any of the three factors, but has its highest loading with the Part III factor. Interestingly, CBX loaded more highly with the Part I/Part II factor than did PMP. In this analysis, the three factors which emerged explained 22 percent of the variance in CBX and 51 percent of the variance in PMP. Finally, when a theoretical pass/fail line is drawn at the fifth percentile of each group, there is substantial disagreement between CBX and PMP in classification of differences in the trait being measured or to the inherent imprecision of both measures.

Resident Specialty. There is no consistent effect of resident specialty on CBX performance. It has been shown that there is a strong specialty effect on MCQ items in Part III and a weaker specialty effect on PMPs. In CBX, two of the cases in the pilot exam showed noticeable specialty effect. Other cases, including cases in the same specialties as those with demonstrated specialty effect, showed no difference. More study is needed to determine the characteristics of a case that result in a specialty effect.

Computerization of MCQ Items. Computerization does not affect difficulty of MCQ items. Difficulty of items presented by computer did not vary from the difficulty of the same items when presented in the written Part III examination. Computer administered MCQs were answered more quickly than written MCQs, and residents expressed a marked preference for administration of MCQs by computer.

Computerization versus Written Testing. Residents and students prefer computer administered examinations to written examinations. In questionnaires administered at the end of the examination, residents preferred computer-based simulation to written simulation by a 3:1 margin, and students preferred computer administered simulations by a 9:1 margin. In expressing preference for administration of the NBME Part III examination, residents preferred computer administration by a 2.4:1 margin, and students by a 7:1

margin. Residents found CBX to be as fair a measure of clinical knowledge as MCQs. Residents preferred computerized patient simulations to written simulations or MCQs as valid assessments of overall clinical competence. Students have similar preferences, but more strongly in favor of computer administered tests.

CBX Field Testing.

The National Board of Medical Examiners has begun testing their new Computer-Based Examination (CBX) at 70 medical schools nationwide. The exam includes multiple choice questions identical to those currently administered in the Part I, II, and III paper-based exams. In addition, the CBX includes an open-ended videodisc-based simulation that is designed to provide an uncued test of patient management skills.

Each participating school or test site was required to purchase three delivery systems, each consisting of an IBM-PC XT or equivalent, and either a Pioneer LD-V6000 series, Sony LDP-1200, or LDP-1500 videodisc player. The videodisc simulation portion uses a two-screen presentation method which eliminates the need for video overlay and keeps the cost per system at about \$2,500.

While the entire CBX is still in a research phase to evaluate its effectiveness, the multiple choice part will be certified soon as a standard part of the exam process. The simulation will require additional research to determine the validity of scores for the open-ended procedure.

During 1988, 16,703 people took the part I exam, while parts II and III each were taken by more than 13,000. Stephen Clyman (CBX project director) sees the potential for multiple systems to be installed at each of the 144 medical schools in the US and Canada, with at least two sites per state.

Feedback from Test Sites. The NBME has collected and released summary evaluations provided by 23 of the CBX testing sites. A review of some of these results is provided in the chapter entitled Videodisc Research/Surveys.

American Academy of Orthopaedic Surgeons

In 1986, the American Academy of Orthopaedic Surgeons, working with the National Library of Medicine, produced a videodisc program titled *The Chronic Unstable Knee*. The program is designed to provide both a Level I and a Level III resource for orthopaedic education as well as a vehicle for Continuing Medical Education in Orthopaedic Surgery (CMEOS). The Level I side of the disc contains approximately 5,000 images which make it possible to correlate cross-sectional anatomy with electronic images. Using the slow play and step mode of the videodisc player, a viewer may follow anatomical structures through the knee in three planes.

The Level III side of the disc consists of a patient simulation which provides the learner the opportunity to take history, do physical examination (using video segments), receive laboratory tests, order radiology, and perform diagnostic arthroscopy. All this may be done using a light pen and menus or free-text entry using the computer keyboard. The program was recently tested at various medical schools across the country. Results of the testing should be available in 1990.

Northeast Regional Board of Dental Examiners

The Northeast Regional Board of Dental Examiners (NERB) is developing a videodisc that they expect to be a wide-ranging educational resource in dentistry and dental hygiene which will help insure that dental education and licensure testing are congruent with each other. The project is tentatively titled *The Encyclopedia of Dentistry* and is intended to help bridge the gap between the varying curricula taught in the schools and the candidate's level of dental comprehension and performance required by the licensure board. NERB believes that the *Encyclopedia* may help to make dental curricula and licensure testing more consistent with each other by providing an educational resource in dental education which is entirely consistent with NERB's licensure criteria.

Because the *Encyclopedia* will provide licensure candidates with a thorough review of the procedures, requirements, and content area of the NERB examination, NERB expects schools to purchase the program to, at the very least, help students do well on the NERB examinations. A second purpose of the *Encyclopedia* will be to help encourage schools to create other curricular materials which are interactive and computer-based, and thus help to convince dental educators to begin using interactive video within the curriculum.

The *Encyclopedia* also will contain an examiner training component designed to insure that all of the 280 NERB examiners fully understand the established criteria and procedures of the NERB examination. Finally, those involved in the project believe that the *Encyclopedia* may serve as a prototype for a future interactive NERB examination.

NERB Background. For the past 20 years, NERB has written and administered licensure examinations in the professions of dentistry and dental hygiene for 15 northeastern states, a consortium which licenses approximately half of the country's dental practitioners. Graduates in these states are required to pass the two parts of the National Dental Boards as well as the more clinically-oriented NERB examination in order to obtain their license to practice. The NERB battery of three simulated and two practical examinations serves roughly the same purpose as the third-year board exam in Medicine. Upon passing these exams, the successful candidate is free to practice in any state within the consortium.

The NERB examination battery consists of two general types of examination: clinical exams in which candidates actually perform dental work on patients, and simulated exams consisting of slides and multiple choice questions. The *Encyclopedia* will provide images and text-based information across all of the disciplines covered by both types of NERB examinations. The exams are given three times a year in 30 dental schools throughout the country. Each year NERB examines approximately 2,200 candidates in dentistry and about 2,000 candidates in dental hygiene.

The Encyclopedia of Dentistry. The *Encyclopedia* will consist of an interactive computer program with a supporting videodisc able to provide a vast range of dental information across 12 disciplines in dentistry. The program will run on IBM-compatible or Macintosh microcomputers coupled with a videodisc player, and will be programmed for both two-screen and single-screen systems. The videodisc will contain about 9,000 still images and approximately 15 minutes of motion video in support of the text information provided by the computer.

The official start date of the Encyclopedia project was March 1, 1988 when Lunaria, Inc. was hired to prepare the preliminary design for the project. The Project Director is Dr. Charles Cartwright who is providing management and supervision over 10 content authors, each of whom are writing the text and creating the image base for each of the 12 disciplines. Other primary parties essential to the project are Dr. William K. Collins who manages project funding, the NERB examiners who have contributed the primary funding, and Dr. John M. Straub who is the coordinator of videodisc production. The project is projected to be completed by January 1, 1991.



Chapter 7

Videodisc Research

Videodisc Effectiveness – CPR Learning System

The CPR Learning System marketed by Actronics, Inc. has been the focus of much research because it provides the identical information that is presented in a CPR classroom environment. This makes it easy to compare the videodisc training with classroom, or live instructor training. The following is a summary of a few of the available reports.

Effectiveness of Interactive Video to Teach CPR Theory and Skills (1984)

This study was initiated in response to a request by the American Heart Association to compare the effectiveness of an interactive video system of CPR instruction versus traditional instruction. Two comparison groups of 50 students each were used as control and experimental groups. Most of the population consisted of nursing students between 18 and 20 years old. Evaluation was to be performed by former CPR instructors who were to test students from either group without knowing their mode of instruction.

The results showed no significant difference between interactive video instruction and traditional instruction in both skills and knowledge, with the exception of one area: the interactive video system taught skills for obstructed airway in the adult significantly better. During this study, it took approximately six to eight hours for basic life support in both groups including certification. The study concluded that a technological means of instruction such as interactive video can be a valuable adjunct in helping to meet present demands for CPR courses. (*Ann L. Lyness, School of Nursing, University of Pittsburgh*)

An Examination of the Use of Interactive Videodisc Cardiopulmonary Resuscitation Instruction for the Lay Community (1985)

At the time this study was done there were no other studies reported investigating the use of the Actronics CPR Learning System with the lay public. Studies undertaken in the design phase of the system had included only health professionals. Therefore, the purpose of this study was to examine the efficacy of the CPR Learning System for community CPR instruction at both the Heartsaver and BCLS levels.

An experimental group was taught CPR through the interactive videodisc system while a control group was taught by the traditional classroom method. The population was 65 employees of a major oil company. All groups were tested immediately following instruction and then retested at three months and one year. To determine performance

skills, each subject was asked to provide an "examination" tape within the allotted training time (subjects were not allowed to return with a tape at a later date). Those subjects in the control group produced a traditional tape from the manikin on which they trained. Subjects in the experimental group recorded their "examination" tape on the system's computer.

Results and Summary. Overall, there were no significant differences between the control group (traditional CPR instruction) and the experimental group (CPR Learning System) along the dimensions of initial skills performance, initial cognitive knowledge score, three-month skills retention, three-month cognitive knowledge retention, one year skills retention, and one year cognitive knowledge retention. Although a study based on a population of 65 is limited in many ways, it can be postulated that the CPR learning system is at least as effective as traditional CPR instruction. A continuation study was to be conducted using a population of more than 400 people. Results from that study may provide more conclusive information. *(Margaret J.A. Edwards, R.N., M.A. and Kathryn J. Hannah, R.N., Ph.D., Faculty of Nursing, The University of Calgary)*

Effectiveness of an Interactive Video Approach for CPR Recertification of Registered Nurses (1986)

The purpose of this 1986 study was to validate a specific interactive video teaching method for CPR recertification of Registered Nurses. The few studies that have been conducted to validate the use of an interactive teaching method to teach CPR have been limited to lay subjects or nursing students learning CPR for the first time.

The quasi experimental design randomized 57 Registered Nurses into interactive video or traditional lecture/demonstration teaching groups by their clinical work area (acute care vs. non acute care units). American Heart Association content and testing materials were used. Knowledge test scores and skill test scores were analyzed using ANOVA and Pearson Product Moment Correlation statistical methods.

Summary of Results. There was no significant difference found in knowledge or skill test scores between participants of the two teaching methods or between participants from different work areas. In addition, there was no correlation found between the number of CPR experiences a subject witnessed or performed in the clinical setting with knowledge or skill performance scores. Nurses who experienced the interactive teaching method preferred the interactive video method two to one. Instructor time was reduced 87 percent and participant time was reduced 11 percent on the interactive systems to learn the same content equally well. *(Doctoral Dissertation by Mary Elizabeth Aukerman, R.N., Ph.D., University of Pittsburgh. Sponsored by the Shadyside Hospital, Division of Nursing, Pittsburgh, Pennsylvania)*

Evaluation and Attitude Survey of the Actronics CPR Learning System (1986)

As part of the requirements to fulfill a New Jersey Department of Higher Education Computers in Curricula grant on *Improved Teaching of Cardiopulmonary Resuscitation*, the County College of Morris (CCM) conducted an evaluation and attitude survey among students who completed the college's CPR instruction program on the Actronics Learning System.

The survey was developed using a "forced choice" response method where students were asked to strongly agree, agree, disagree, or strongly disagree to each of 31 statements evaluating their use of the CPR system. There was no neutral response permitted on the survey form. An additional ten questions asked for a "yes" or "no" answer. Student comments were solicited on the form as well. A total of 87 surveys were mailed, with 31 returned (35.6 percent).

General Summary and Conclusions. The general trend of student responses indicated very positive attitudes about computer-based instruction. With very few exceptions, students were receptive to this type of instruction, noting that the most valuable aspect of this instruction was the ability to learn at one's own pace (100%). More than half of the students felt that the Actronics system was like "real people" teaching CPR (64.6%), 90.3 percent liked practicing CPR without a human instructor watching, and 80.7 percent enjoyed working alone.

Another very positive result of this instructional program is indicated by the students' willingness to recommend the interactive CPR course to other students (96.8%), and their willingness to take another interactive-based course if one were available in an area of interest (90.3%).

Student receptivity to the interactive CPR instruction program was high, with 96.8 percent indicating that they enjoyed using the system. Although 19.1 percent said they were frustrated by the system at first, the percentage dropped to 9.7 percent frustration at the end of the course.

There was a significant time savings for the students, with the average time to achieve Basic Rescuer certification being 7.56 hours (compared with 12 to 15 hours in a regular CPR class). A look at overall student records and testing results reveals a high level of mastery of the subject matter with 97.7 percent of all students completing certification in CPR on the system. This compares favorably with a traditional CPR class passing rate of approximately 80 percent.

Other Videodisc Effectiveness Studies

Full-Scale Pilot Testing of Florida's Videodisc Training Project (1984)

Florida's Department of Health and Rehabilitative Services decided in 1979 to train certain of its newly hired workers (approximately 500 annually) with a microcomputer-driven interactive videodisc program. Pilot testing of the 160-hour training program proved an average reduction in training time (over traditional delivery) of 25 percent. Upon taking a final exam following completion of the course, more trainees receiving the videodisc training passed the test (66%) than did trainees in the conventional program (50%). In general, trainees indicated a preference for computer-based instruction over traditional classroom instruction. (Smith, Richard C., *Full-Scale Pilot Testing of Florida's Videodisc Training Project*, Office of Interactive Technology and Training, The University of West Florida, Pensacola, Florida 32514)

University of Texas-Houston (1985)

A comparison of noninteractive and interactive video instruction about smokeless tobacco was conducted at the University of Houston, the results of which will be published

soon. After viewing a linear or interactive version of a videotape, experimental and control groups completed a questionnaire to ascertain knowledge and attitudes about smokeless tobacco and lesson satisfaction. The interactive video group demonstrated the most accurate and comprehensive recall. Additionally, the interactive video group was more willing to promote cessation among users. Learner satisfaction with the interactive video equipment and lesson was high. For additional information, contact Dr. Phyllis Levenson, Department of HPER, College of Education, University of Houston, Houston, TX 77004, 713/749-4386 or 713/721-4134.

Instructional Effectiveness of an Intelligent Videodisc in Biology (1984)

WICAT Systems, Inc. produced a "proof-of-concept" instructional videodisc in college biology with support from the National Science Foundation. Student learning with videodisc instruction was compared to traditional lecture learning in introductory biology courses at three different colleges. Videodisc students consistently displayed greater learning and retention gains, reduced study times, and higher productivity ratios. These findings were in agreement with the extensive literature on individualized instruction, both with respect to learning gains and time savings. Increased student confidence is also commonly reported in autotutorial courses. The values of imagery and experiential learning (direct and vicarious) are also widely touted, although less documented by hard data. (Bunderson, C.V., Baillio, B., Olsen, J.B., Lipson, J.I., Fisher, K.M., *Interactive Effectiveness of an Intelligent Videodisc in Biology*, Machine-Mediated Learning, V.1, No. 2, 1984.

Chemistry Videodisc (1986)

The Chemistry Department of the University of Illinois, through a grant from IBM, has developed Project EXCEL, a system of interactive videodisc and PC work stations to teach basic chemistry to incoming students. They have 16 work stations available 14 hours a day. The stations were Beta-tested in the spring session by students who had not taken any chemistry courses in high school. Test results showed a higher understanding of the material by those students who used the disc systems as opposed to those who only had lab experience.

The Evaluation of Science Lab Videodiscs (1984)

Educators at the University of California in Berkeley compared use of videodiscs simulating science laboratory experiments with actual laboratory experience. The videodiscs used were produced by the University of Nebraska with a grant from the Annenberg/CPB Project. The subjects covered by the programs were physics, chemistry, and biology. The researchers found that students using videodisc typically work through an experiment more quickly than those in a conventional lab setting, due primarily to the "instant" results available with the videodisc program. The videodisc simulation also enabled students to examine a wider variety of conditions than is possible in a traditional lab.

Observations revealed that students using the videodisc appeared less confused about what to do than students in the traditional lab, who frequently checked with the Teaching Assistant to make sure the experiment was being conducted accurately. It was also found that the videodisc students exhibited more task-oriented behavior and self-suffi-

ciency. Videodisc students performed as well or better than their lab counterparts when given tests following the lab experience. (Paper presented at Fifth Annual Nebraska Videodisc Symposium, August 1984 by Barbara Gross Davis, University of California, Berkeley, CA 94720)

GM's Hazardous Materials Training

Hazard communication training at GM

In 1985, the UAW-GM National Joint Committee on Health and Safety appointed a task force to develop a hazardous materials training program for GM employees. The result of their efforts was the UAW-GM Hazard Communication Training Program. There are nine modules in the interactive video training program that address various types of hazardous materials handled by GM workers. A second version of the training using video tape was also produced. This version has the same nine modules as the interactive video. It also has a comprehensive trainer's guide for conducting an effective classroom training program.

The Evaluation. It was decided that, following completion of the development of the Hazard Communication Training Program, an in-house evaluation would be conducted as well. Two-hundred and nine workers from 15 GM plants in the Midwest participated in the evaluation. They came to the UAW-GM Human Resource Center in Madison Heights where the evaluation was conducted.

The module on solvents was used for the evaluation. Participants who had not had training on this module were used. Training was done using the interactive Laser Disc System and a "best case" classroom training involving an expert trainer who followed carefully developed procedures. The amount of learning of the content of the training and of attitudes were tested.

Results. The results of the evaluation showed positive results for the interactive laser disc training. When the Interactive Laser Disc Training was compared with a "best case" classroom training, the Interactive Laser Disc Training produced more learning. The average scores on the 16-point test were: laser disc group = 13 (81%); classroom group = 10 (63%). The ILDS group scored 26% better than the classroom group. The workers who did the best and worst on the test were compared. Most of the workers who did the best (high achievers) had been trained on the Interactive Laser Disc System. Most who did the poorest (low achievers) had been trained in the classroom instruction.

Attitude Toward Interactive Training. In the comparison of the two training methods, attitudes about the Interactive Laser Disc training were the most positive. Eighty percent of the workers preferred the Interactive Laser Disc training to the classroom. Seventy percent felt it was easier to pay attention to the Interactive Laser Disc training. Seventy-eight percent felt they learned more from Interactive Laser Disc training. Ninety-eight percent felt it was easy to use the Interactive Laser Disc System.

All workers performed equally well on the Interactive Laser Disc System. Age, sex, amount of education, and years of employment at GM did not limit their success in training. In addition, attitudes toward the System were not affected by any of these factors. The attitudes were highly positive in all groups.

The average time to complete the ILDS instruction was 33.87 minutes/student. The average time to complete the classroom instruction was 33.25 minutes/student. The difference in training time was minimal.

Conclusion. The evaluation showed that the Interactive Laser Disc System was very effective in achieving training objectives, strongly preferred by workers, and competitive with the classroom method in the amount of time taken to complete the training.

National Board of Medical Examiners—Computer-based Testing Program (1987)

The computer-based simulation test (CBX) developed by the National Board of Medical Examiners was evaluated in a large pilot test. Results of this pilot test were reviewed by an independent advisory panel which concluded the following, which is quoted from the Interim Report of the Computer-Based Testing Advisory Panel, September 15, 1987:

- CBX succeeded in measuring a quality not measured by multiple-choice questions (MCQ) or written patient management problems (PMP) that may reasonably be considered to be related to "general clinical competence." Scores tended to be consistent across varied cases; only a few cases were clearly easier for the residents in the "matching" clinical specialty.
- The procedures for developing cases and scoring keys have progressed to the point of being clinically and psychometrically acceptable. They are now practical for an operational test, though there is much room for improvement. . . Although general computer experience as such had no influence on scores, CBX showed a strong practice effect in the pilot study. This and other evidence implied the need for extended examinee familiarization prior to taking the test.
- Precision of measurement at the low end of the scale is a major concern. . . With present cases and scoring methods, CBX and PMP have about equal precision when the testing time is held constant. However, the error of measurement is large. Changes in length and difficulty of cases and in decision rules, including sequential and/or adaptive testing, have been suggested for trial. It is hoped that these will permit a one-day computer-based test for all but borderline candidates.
- The Computer-based Testing Advisory Panel has reviewed the status of the NBME CBT project following pilot studies on medical students and residents and is impressed by the progress that has been made. Now, for the first time, software and cases are ready for dissemination beyond settings controlled by NBME. On the other hand, we conclude that CBT should be used for certification and licensing only after the model and selected cases have been made available for student practice and experimentation in most LCME-accredited medical schools.
- In summary, we strongly recommend that NBME continue to support CBT. . . We believe the NBME should continue its current level of developmental activity on the CBT project directed at ultimate use in the NBME certification sequence.

Additional results are available in the chapter entitled Testing & Certification.

Field Testing at Medical Schools. The National Board of Medical Examiners also is testing their new Computer-Based Examination (CBX) at 70 medical schools nationwide.

The exam includes multiple choice questions identical to those currently administered in the Part I, II, and III paper-based exams. In addition, the CBX includes an open-ended videodisc-based simulation that is designed to provide an uncued test of patient management skills.

Each participating school or test site was required to purchase three delivery systems, each consisting of an IBM-PC XT or equivalent, and either a Pioneer LD-V6000 series, Sony LDP-1200, or LDP-1500 videodisc player. The videodisc simulation portion uses a two-screen presentation method which eliminates the need for video overlay and keeps the cost per system at about \$2,500.

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Feedback from Test Sites. The NBME has collected and released summary evaluations provided by 23 of the CBX testing sites. The following is a review of these results.

The majority of students using the CBX cases were third year students (71.4%). They were scheduled to go through the cases either as tests or as preparation for class discussion. As each case was completed, printouts of actions, and the sequence of actions taken by each student, were made available to faculty.

The Medical College of Pennsylvania was the first to receive the CBX cases fifteen months ago, where they have been used extensively in the surgical department. Faculty at this institution reported that the greatest values of the CBX include assisting students to learn problem-solving, establishing priorities, and patient management. After running the CBX cases, students attended tutorial sessions where their cases were reviewed. The faculty and students discussed different approaches to each patient problem and the establishment of priorities. They also discussed how to ration time and how to distinguish between what constitutes an emergency and what is routine. Students reported that the CBX cases made it possible to achieve goals that were not otherwise attainable. Specifically, they cited the opportunity to actively play the role of a physician. Another advantage they noted was that anxiety was considerably reduced in working with the computer as compared to the anxiety experienced at the bedside.

A significant finding at George Washington University was reported. Fifty senior students ran ten cases each. In reviewing the simulation printouts, faculty found that six senior students took actions that were deemed highly inappropriate and raised questions about their problem-solving skills. What surprised the faculty was that, in all but one instance, these behaviors were not discovered from clinical evaluations of the students. According to Dr. Piemme, these simulations may be powerful tools to identify inappropriate behavior that cannot be evaluated clinically, such as "the ability to do parallel processing."

During their exit interviews, senior students commented that they learned more in a day of running the simulations than they could have learned in weeks in the clinical setting. As a consequence of the positive results achieved through use of the CBX simula-

tions, the department of medicine at George Washington began requiring other computer simulations. In addition, the obstetrics and gynecology department now administers their final examination by computer.

An unanticipated benefit was reported by the University of Michigan. "When many of the students neglected critical areas of patient diagnosis or management, there was much discussion among the faculty about methodologies for improving the teaching of those concepts."

At Johns Hopkins University, 56 students assigned the CBX cases scored significantly higher on the case management problems in their final examination than did the 138 preceding students (p.008). In addition, their self-assessment scores were higher for "identification of critical aspects of patient problems, recognition of life-threatening situations, recognition of psychosocial/patient education issues, and institution of timely interventions (p.001)."

In reviewing these 23 reports, several commonalities emerge: 1) student interest and enthusiasm for the simulations mirrored that of their faculty; 2) when student experiences were positive, awareness among faculty expanded and many implemented simulations from other sources; and 3) faculty believed that the CBX measures behaviors and skills that are not measured by other examinations.

Evaluation of Videodisc Use and Development at MSU.

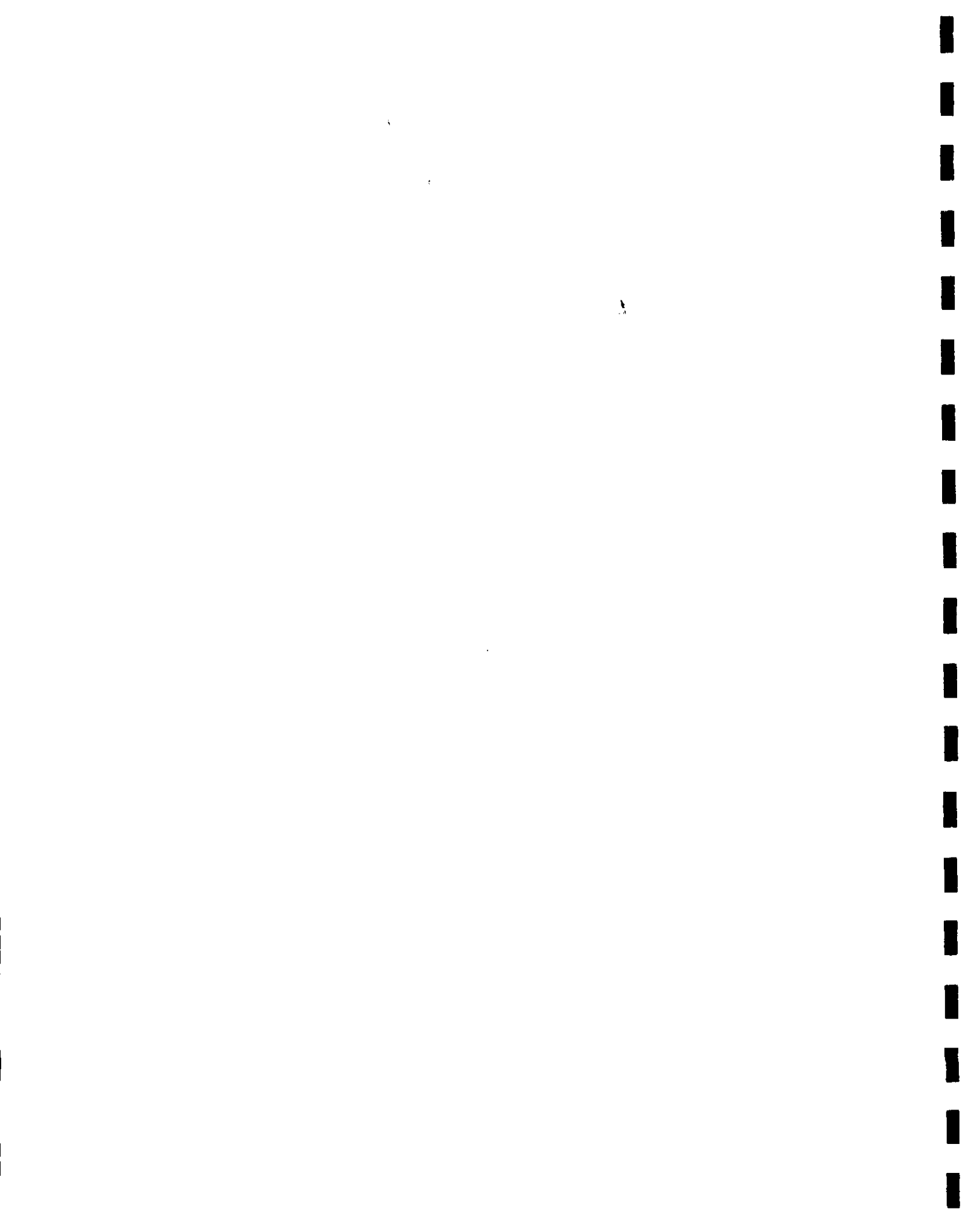
The Pathology Department at Michigan State University has developed instructional units on Neuropathology using two types of videodisc systems: an IBM InfoWindow system and a two-screen Macintosh system. The purpose of this exercise was to determine undergraduate medical student response to this type of educational technology, to assess differences in development, and to obtain student evaluations of specific features of each system.

Using the *Slice of Life* videodisc distributed by the University of Utah, a unit on *Central Nervous System Neoplasms* was developed as a HyperCard stack for the Macintosh system, and a unit on *Cerebrovascular Disorders* was developed for the InfoWindow system using the LS-1 authoring system. Each unit consisted of five parts: a pretest, and instructional lesson, a post-test, a clinical simulation emphasizing reinforcement of concepts and problem-solving related to neuroanatomy, neuropathology and neurology, and a glossary.

The units were recommended to students for use on a supplemental basis and subjective evaluation was conducted. During the fall term of 1988, 68 of 119 students completed an evaluation form for at least one of the units and 52 of 119 completed forms for both units. The time spent by students on the lesson and case simulation sections was assessed.

The content and presentation for both were rated very good to excellent. Features that students emphasized as desirable included: 1) flexibility in controlling locations within sections (e.g. ability to go to the previous screen and randomly access any topic in the Macintosh unit), 2) easy access to glossary definitions, 3) diagrams and images, 4) availability of help screens, 5) high screen resolution, 6) integration of information from several disciplines, and 7) application of clinical and basic science information in a problem-solving case history format.

A one-screen system was not preferred in this setting. Difficulties experienced by students using each type of unit for the first time were assessed for future changes in Learning Resource Center procedures and program format. In comparison of development efficiency, the Macintosh HyperCard unit required less authoring time. In general, the availability of Neuropathology interactive videodisc instruction on both systems was enthusiastically received by the medical students and the features rated by students as most important were determined for consideration in development of additional units.



Chapter 8

Resources

The following is a listing of various resources for the optical disc industry. The listings in each category are meant to be used as a starting point for inquiries, and are not necessarily comprehensive.

Periodicals

Actronics Reporter is published by Actronics, Inc., producers and marketers of the Actronics Interactive Video Learning System. This free publication covers topics of interest to users of the system and the American Heart Association CPR/ACLS courseware. Actronics, 810 River Avenue, Pittsburgh, PA 15212; 412/231-6200.

CD Data Report focuses on the development of compact disc-read only memory (CD-ROM). Published monthly by DDRI, 510 North Washington Street, Suite 401, Falls Church, VA 22046-3537; 703/237-0682. Cost: \$295 per year.

CD-ROM Enduser is a magazine for buyers and users of CD-ROM products and services. Subscriptions are free to qualified readers. Published monthly by DDRI, Incorporated, 510 North Washington Street, Suite 401, Falls Church, VA 22046-3537; 703/237-0682.

IBM MultiMedia Solutions is a promotional newsletter published by IBM Corporation's MultiMedia Solutions Division, PO Box 2150, Atlanta, GA 30055; 404/238-4646.

Interactive Media International Newsletter is a newsletter published in England by PLF Communications, Cross Street Court, Cross Street, Peterborough PE1 1UF England; 44/733-60535.

Interactive Healthcare Newsletter covers the development of videodisc, CD-ROM, digital optical disc and related technology in the health sciences. Published monthly by Stewart Publishing, Inc., 6471 Merritt Court, Alexandria, VA 22312; 703/354-8155. Cost: \$70 per year.

IICS Reporter is the newsletter of the International Interactive Communications Society (IICS). Free with membership. The IICS is an association of communications industry professionals dedicated to the advancement of interactive technologies. The Society provides a forum for users and vendors to share ideas, applications, and techniques for the effective use of interactive media. Executive offices located at 2120 Steiner Street, San Francisco, CA 94115.

The Laserdisk Professional is a journal devoted to optical disc technology in the library and information center markets. Published by Pemberton Press, 11 Tannery Lane, Weston, CT 06880; 203/227-8466.

The Lasertrader is a newsletter for those interested in buying, selling, and trading videodiscs. Consumer oriented. P.O. Box 2111, Huntington, WV 25721.

Medical Documentation Update reports on issues surrounding the medical records industry. Includes information on the use of digital optical discs and optical cards. Institute for Medical Records Economics, 121 Mount Vernon Street, Boston, MA 02108; 617/720-2229.

MegaBite: A Computing and Informatics Newsletter for Dental Educators contains equal parts DOS and Macintosh computer news, with the remainder devoted to general issues pertaining to dental informatics, including American Association of Dental Schools (AADS) infotech consortia news, courseware development, videodisc initiatives, and hardware/software compatibility issues. Subscriptions are \$20 for the year. Contact John Williams, Department of Oral Health, Health Sciences Center, University of Louisville, Louisville, KY 40292.

Memoires Optiques is an international videodisc, CD-ROM, and digital optical disk journal. Published monthly by ARCA Editions (France). Administrative office: *Memoires Optiques*, P.O. Box 303, 56007 VANNES CEDEX, FRANCE; phone 33.97.63.77.30.

Multimedia Computing, will be published quarterly beginning with the Winter 1990 issue and will provide end-user readers information that will help them implement and use multimedia computing. The subscription price is \$77 (personal subscriptions are \$29). Meckler Corporation, 11 Ferry Lane West, Westport, CT 06880; 203/226-6967.

Nebraska Videodisc Design/Production Group News provides information on the activities of the Nebraska Group and the use of videodisc technology for education and training. Published quarterly by the Nebraska Group, KUON-TV, University of Nebraska-Lincoln, P.O. Box 83111, Lincoln, NE 68501-3111; 402/472-3611. Cost: Free.

Nursing Educators Microworld is a newsletter that reports on the use of microcomputer and videodisc instruction for nursing education. Published bi-monthly by Christine Bolwell, RN, MSN, 13740 Harleigh Court, Saratoga, CA 95070; 408/741-0156. Cost: \$54/year, half-price (\$27/year) for nurse educators.

Optical Information Systems magazine presents articles on the development and uses of optical media in publishing, teaching, storage, and training. Published bi-monthly by Meckler Corporation, 11 Ferry Lane West, Westport, CT 06880; 203/226-6967. Cost: \$95 per year.

Optical Information Systems Update (ISSN 0887-5162) is the companion newsletter to *Optical Information Systems* magazine and covers all optical-based storage media. Published twice monthly by Meckler Corporation, 11 Ferry Lane West, Westport, CT 06880; 203/226-6967. Cost: \$189.50 per year.

Optical Memory News is a detailed monthly industry newsletter that focuses on mass storage of data, storage of document images, and read-only and interactive videodisc applications. Cost: \$295 per year. Rothchild Consultants, 256 Laguna Honda Blvd., San Francisco, CA 94116; 415/681-3700.

The Videodisc Monitor (ISSN 0739-7089) covers application, innovation, and technology within interactive video, compact disc, and related fields. Published monthly by Fu-

ture Systems, Incorporated, Post Office Box 26, Falls Church VA 22046-0026; 703/241-1799. Cost: \$227 per year.

Books

Advanced Interactive Video Design (\$45). This publication reviews the latest applications of interactive videodisc technology, delineates design principals, and explains the steps to developing a videodisc program. Published in 1988 by Knowledge Industry Publications (ISBN 0-86729-0790X).

Authoring Systems (\$36.95). This book provides a guide for readers to compare, contrast, and select from dozens of computer packages that help users to program computer-assisted instruction. Published in 1988 by Meckler Corporation (ISBN 0-88736-0840X).

CD-I: A Designer's Overview (\$39.95). This 240-page book was written by Philips engineers and technicians and is an introduction to CD-I technology. The seven chapters covers the basics of the technology as well as proposed applications of the new technology. Published in 1988 by Kluwer Technical Books (The Netherlands) and distributed in the U.S. by McGraw-Hill, Suite 4-19, 11 West-19th Street, New York, NY 10011

CD-I and Interactive Videodisc Technology (\$24.95). Systems and applications experts explain how videodisc and CD-I formats are alike, how they differ, and what their co-existence means to designers, marketers, and users. Published by Howard Sams and Company in 1986 (ISBN 0-672-22513-1).

CD-ROM Handbook (\$59.95). A compendium of information on CD-ROM hardware, software, and manufacturing written by acknowledged experts in the industry. Chapters on CD-ROM and LANs, DVI, designing a CD-ROM information structure, artificial intelligence and expert systems, and more. Published in 1988 by Intertext Publications and McGraw Hill (ISBN 0-07-056578-3).

CD-ROM Yearbook: 1989-1990 (\$79.95). This is a dynamic sourcebook of facts, statistics, forecasts, articles, reviews, profiles, and analysis of the CD-ROM industry and its products. Includes articles, listings, and projections for and about CD-ROM and related technologies such as CD-I and DVI. Published in 1989 by Microsoft Press (ISBN 1-55615-179-9).

CD-ROM: The New Papyrus (\$21.95). Microsoft Press asked Bill Gates, David Hon, Rockley Miller, and other leading experts to submit their perceptions and recommendations on the technology and future of CD-ROM. Published by Microsoft Press in 1986 (ISBN 0-914845-74-8).

CD-ROM 2: Optical Publishing (\$20.95). This second volume from Microsoft Press is designed to give publishers, technical managers, and entrepreneurs a comprehensive, timely overview of the entire optical publishing process. (ISBN 1-55615-000-8).

Compact Disc-Interactive: A Designer's Overview (\$39.95). A detailed, comprehensive primer on the technology, design, and applications of CD-I. Published in 1988 by McGraw-Hill (ISBN 0-07-049816-4).

Digital Video in the PC Environment (\$39.95). A complete introduction to the combination of personal computer technology and digital audio/video. The book brings readers of diverse technological backgrounds up to date with current Intel Digital Video Interactive (DVI) technology. Published in 1989 by McGraw Hill (ISBN 0-07-039176-9).

The Disconnection: Interactive Video and Optical Disc Media (\$45). This book illustrates how interactive video is succeeding in point-of-purchase sales, employee training, classroom teaching, and information storage. Published in 1988 by Knowledge Industry Publications (ISBN 0-86729-218-0).

Educator's Handbook to Videodisc (\$22.95). Revised in 1987, this book presents basic facts about the technology, augmented with extensive appendices detailing available players, interfaces, monitors, peripherals, systems, educational titles, mastering options, authoring languages, and resources. Published by the Association for Educational Communications and Technology in 1987 (ISBN 0-89240-049-8).

The Compact Disc Book (\$12.95). Offers a history of the technology, guide to consumer players and discs, and a look at the future of the medium. Published in 1988 by Harcourt Brace Jovanovich, Inc. 111 Fifth Avenue, New York, NY 10003; 212/614-3000.

Interactive Optical Technology in Education and Training: Markets and Trends (\$39.95). Describes the current use of interactive optical technologies in the major education and training markets: industrial training, management/professional education, medicine, government, and public/higher/adult education. Published by Meckler Corporation, 11 Ferry Lane West, Westport, CT 06880; 203/226-6967.

Interactive Video (\$24.95). Part of the Educational Technology Anthology Series, this book is a compilation of thirty articles that recently appeared in Educational Technology magazine dealing with interactive video. Published in 1989 by Educational Technology Publications (ISBN 0-87778-206-7).

Interactive Video (\$19.95). This book provides the basics of the technology and explains which training problems interactive video will solve. Describes step-by-step design, production, pre-mastering, review, and approval of the finished program. Published in 1988 by Educational Technology Publications (ISBN 0-87778-206-7).

Nursing Educators MicroWorld Volume One—Plus (\$37.95). Includes the first six issues of the newsletter of the same name, a list of discounted software, directories of IBM and Apple computer software, directory of videodisc courseware, and index, and other resources. Published by Discovery, 13740 Harleigh Court, Saratoga, CA 95070; 408/741-0156.

Opening Minds: The Evolution of Videodiscs and Interactive Learning (\$29.95). A historical perspective on the use of technology in public education and a comprehensive chronology of videodisc technology from the 1890s to the present. Published in 1989 by Future Systems, Inc. (ISBN 0-8403-5191-7).

Practical Guide to Interactive Video Design (\$34.95) Disc veteran Nick Iuppa offers a blueprint of techniques for the design and production of interactive video programs. Shows how interactive video programs can be used in training, retail, educational, and other applications. Published in 1984 by Knowledge Industry Publications (ISBN 0-86729-041-2).

Should Schools Use Videodiscs? (\$35). The Institute for the Transfer of Technology to Education assembled this special report to help its members weigh the merits of interactive technology in the classroom. Published by the National School Boards Association in 1986.

Using Video: Interactive and Linear Designs (\$34.95). This book promotes the importance of good design in its treatment of 40 techniques that are both creative and practi-

cal. Includes 18 linear and 22 interactive techniques to help readers plan their own productions. Published by Educational Technology Publications in 1989 (ISBN 0-87778-199-0).

The Videodisc Book (\$25). Published in 1984 by John Wiley and Sons, this book contains a compilation of articles in the industry as well as a directory of production and development sources.

Videodisc Repurposing is a monograph written by Craig Locatis, PhD and published by the Lister Hill National Center for Biomedical Communications, a branch of the National Library of Medicine. Educational Technology Branch, Lister Hill National Center for Biomedical Communications, National Library of Medicine, Bethesda, MD 20894; 301/496-6280.

Videodisc Technology was written by Eldon Ullmer, PhD and published by the Lister Hill National Center for Biomedical Communications, a branch of the National Library of Medicine. It consists of four sections covering videodisc technology and formats, compact disc systems, and factors to consider when selecting a videodisc system. Educational Technology Branch, Lister Hill National Center for Biomedical Communications, National Library of Medicine, Bethesda, MD 20894; 301/496-6280.

Directories/Reference

CD-ROMs in Print: 1990 (\$37.50). A comprehensive listing of CD-ROM products, providers, and distributors. Published in 1989 by Meckler Corporation (ISBN 0-887636-359-8).

CD-ROM Sourcebook (\$725). This regularly updated manual is a thorough reference work of hardware, software, and services in the growing field of CD-ROM. Contains sections on mastering and replication, CD-ROM drives, CD-ROM systems, search software, data preparation, CD-ROM titles, interfaces and controllers, licensees, publications and articles, and consultants. Published by Diversified Data Resources, Inc., 510 North Washington Street, Suite 401, Falls Church, VA 22046-3537; 703/237-0682.

Complete Interactive Video Courseware Directory (\$60). This volume contains information on more than 250 interactive video available course for computer, electronics, financial, manufacturing, medicine, and sales/management. Published in 1989 by Convergent Technologies Associates.

IBM MultMedia Courseware Pocket Guide (G5804033). Contains a listing of In-fowindow Touch Display courseware and vendor sources for both custom and generic software. Available from local IBM marketing representatives.

Interactive Video Compatibility Guide (\$49). A long-awaited guide to compatibility for the videodisc industry. Contains clear and concise summaries of compatibility issues, cabling guides, hardware specifications, comparative tables, and pro-con evaluations of the most popular hardware components and systems. Published in 1990 by Stewart Publishing, Inc. (ISBN 0-936999-11-X).

Interactive Video Directory (\$65). Contains references to over 1000 producers, manufacturers, universities, and users of interactive video. Published in 1987 by Applied Interactive Technology (ISSN 0743-4537).

Interactive Video Primer: Medical Education (\$49). Provides an overview of the use of interactive video for medical education. Chapters include videodisc and videodisc hard-

ware, commercial courseware, medical schools, professional associations, research, and resources. Published in 1990 by Stewart Publishing, Inc. (ISBN 0-936999-13-6).

Interactive Video Primer: Nursing Education (\$39). Provides an overview of the use of interactive video for nursing education. Chapters include videodisc and videodisc hardware, commercial courseware, nursing schools, testing & certification, research, and resources. Published in 1990 by Stewart Publishing, Inc. (ISBN 0-936999-12-8).

International Directory of Interactive Multimedia Producers (\$35). Lists 350 companies and individuals who are in the business of creating and producing interactive multimedia. Published by Multimedia Computing Corp., 2900 Gordon Avenue, Suite 100, Santa Clara, CA 95051; 408/245-4750.

International Interactive Communication Society Membership Directory list the members of this professional society. Membership is \$50 per year for individuals.

Laser Videodisc Companion (\$16.95). A guide to the best and worst laser videodiscs. A 432-page volume which reviews 1200 entertainment, education, and imported discs. Published in 1988 by New York Zoetrope, 838 Broadway, New York, NY 10003; 800/242-7546 or 212/420-0590.

MedicalDisc Directory (\$90). A listing of more than 430 health-related videodisc projects and CD-ROM data bases. Updated annually. Published by Stewart Publishing, Inc., 6471 Merritt Court, Alexandria, VA 22312; 703/354-8155.

Optical Information Systems Buyer's Guide & Consultant Directory. A listing of names and address of more than 5,000 contacts involved with optical information systems. Annual issue of journal with same name, available to subscribers from Meckler Corporation.

Software for Health Sciences Education: An Interactive Resource (\$45). A series of HyperCard stacks which describe educational computer software currently available to health science students and professionals. Published by Learning Resource Center, University of Michigan Medical Center, 1135 East Catherine, Ann Arbor, MI 48109-0726.

Sony View System Courseware and Authoring Guide catalogs videodisc programs that play on the Sony View system. Available from local Sony sales representatives.

Videodisc & Related Technology: A Glossary of Terms (\$7.95). The editors of *The Videodisc Monitor* have compiled a complete dictionary of over 500 definitions of key terms. Published by Future Systems, Inc. in 1986 (ISBN 0-938907-02-6).

Videodisc Compendium for Education & Training (\$12.50). Lists more than 600 videodisc titles in 36 subject areas, ranging from arts and literature, math and science, to career guidance and computer training. Published in 1989 by Emerging Technology Consultants, PO Box 12444, St. Paul, MN 55112; 612/639-3973.

The Videodisc Connection: A Directory of Service Suppliers is a free listing of vendors who provide videodisc design, production, premastering, programming, etc. Published by the Optical Recording Project/3M, Building 225-4s, 3M Center, St. Paul, MN 55144-1000; 612/733-2142.

Videodiscs in Education: A Directory lists videodiscs appropriate for the education marketplace. Published by the Minnesota Educational Computing Consortium, 3490 Lexington Avenue North, St. Paul, MN 55126.

Market/Research Reports

Electronic Retailing (\$250). Offers a comprehensive view of the emerging market structure and outlines objectives, opportunities, and pitfalls faced by industry participants. Published in 1986 by Knowledge Industry Publications.

CD-ROM Software: Textual Retrieval and Networking Issues (\$1990). An analysis of the CD-ROM software industry. Published in 1987 by Information Workstation Group, 501 Queen Street, Alexandria, VA 22314; 703/548-4320.

Key Vertical Markets: The Impact of Optical Publishing. Addresses the use of CD-ROM technology in five market areas: medical, financial, legal, marketing and demographics, and architecture/engineering. Published in 1987 by LINK Resources Corporation, 79 Fifth Avenue, New York, NY 10003; 212/620-3099.

Non-Consumer Market for Videodisc Technology (\$1800). This report predicts sales of non-consumer videodisc programs will rise in dollar value from \$140 million in 1987 to \$605.56 million by 1991. Hardware forecast to rise from \$209.25 million to \$453.06 million in the same period. Published in 1987 by Frost and Sullivan, 106 Fulton Street, New York, NY 10038; 212/233-1080.

Nursing Education, A Promising Market for Interactive Video (\$240). Provides a look at a market that spends an estimated \$10- \$18 billion annually on education and training. Chapters include an overview of the hospital and nursing school markets, penetration of microcomputers in nursing education, the emerging role of interactive video, factors affecting software and hardware sales, and sales projections for the 1990s. Included in the report are more than 50 charts and graphs detailing key figures and trends. Also included is a complete description of videodisc programs for nursing education. Published in 1990 by Stewart Publishing, Inc., 6471 Merritt Court, Alexandria, VA 22312; 703/354-8155.

Optical Disc Strategies for Electronic Publishers (\$750). Examines potential changes in electronic publishing from the emergence of optical discs in data distribution. Breaks the electronic publishing market into eight specific application areas and provides estimates of market size and shares, plus CD-ROM and videodisc player penetration in each area. Published in 1984 by LINK Resources.

Optical Technology's Impact on Paper, Microform, and Magnetic Disk and Tape Storage (\$1,500). This report describes the growth opportunities and applications for CD-ROM, CD-I, WORM, and erasable optical drives. Published in 1988 by Electronic Trend Publications (ISBN 0-914405-23-3).

State of the CD-ROM Industry: Applications, Players, and Products (\$1590). This two-volume set features market and technology forecasts, vertical market analyses, an industry directory, charts, and guidelines. Published in 1988 by Information Workstation Group, 501 Queen Street, Alexandria, VA 22314; 703/548-4320.

The U.S. Videodisc Market (\$795). Features a concise and thorough review of individual sub-markets and includes complete forecasts of sales, installed base, and growth rate of each submarket through 1990. Published in 1985 by Future Systems, Inc.

Use and Effectiveness of Videodisc Training (\$49.95). Surveys the results of comprehensive studies evaluating the effectiveness of interactive videodisc as a training medium.

Includes 30 studies by corporate, government, military, and educational users conducted between 1980 and 1987. Published in 1988 by Future Systems, Inc.

Videodisc in Electronic Selling (\$750). Examines the use of interactive videodisc in the point-of-purchase and electronic marketing industry. Includes an industry overview, case studies, vendor profiles, implementation strategies, and market projections. Published in 1984 by LINK Resources.

Videodisc Training: A Cost Analysis (\$49.95). Provides a cost comparison of classroom versus self-paced interactive instruction. Includes brief history of videodisc technology, guidelines for choosing your courseware delivery system, cost analysis, calculations for a sample course, and break-even analysis. Published in 1987 by Future Systems Inc.

Videodiscs in Museums (\$49.95). Features an international listing of museums that use videodiscs and a directory of resources. Published in 1987 by Future Systems, Inc.

Videodiscs in Healthcare: A Guide to the Industry (\$135). A complete desk reference on the use of optical disc technology in the healthcare industry. Contains a wealth of information on how interactive video is being used by companies, schools, and other organizations in the healthcare field. Published in 1989 by Stewart Publishing, Inc. (ISBN 0-936999-08-X).

Computer Software

Interactive Toolkit (\$104.50). This package for the PC is a workbook and software program that teaches novices to design and produce computer-based training and interactive videodisc programs. Included are models, worksheets, and flowcharts plus Arthur, a demonstration authoring system for MS-DOS computers. Published in 1987 by OmniCom Associates (ISBN 0-944650-01-5).

Training Cost Model (\$49.95). This program allows the user to insert base costs, training numbers, and other pertinent data—then it compares per-person training costs for interactive video or CBT versus traditional lecture-based courses. Published in 1988 by Future Systems Inc. (ISBN 0-938907-11-5).

Videotapes/Videodiscs

Interactive Healthcare Demos (VHS \$45) is a 90-minute tape contains videotaped demonstrations of the best commercial videodisc programs as well as award-winning programs by the National Library of Medicine, U.S. Navy, and various health sciences schools. Available from Stewart Publishing, Inc.

Creating Slice of Life (VHS \$45) is a 90-minute demonstration videotape which reviews the process of transferring medical images to videodisc and the educational applications designed using the University of Utah's *Slice of Life* videodisc. Available from Stewart Publishing, Inc.

Interactive Healthcare Demos II—Nursing (VHS \$35) is a 45-minute demonstration of four commercially available videodisc programs which are suitable for nursing education. Available from Stewart Publishing, Inc.

Interact 87 (Two VHS Videotapes, \$75). This video conference on interactive videodisc design features a demonstration of the award-winning Oxyacetylene Welding

simulator by David Hon (Ixon) and Greek Vases, an interactive exhibit by Interac Corporation for the J. Paul Getty Museum. Published in 1987 by the IICS.

Interactive Video Archive (VHS \$25) is compiled from tapes presented during the CAIV Showcase held in Atlanta the annual Association for Educational Communications Technology (AECT) conference. Contact Dr. John F. Moore, Educational Technologies Division, Learning Resource Center, Old Security Building, Blacksburg, VA 24061.

Interactive Winner's Circle (VHS \$129, CLV Videodisc, \$149). This program is a teleconference sponsored by the IICS and the Nebraska Group in conjunction with the 1987 Nebraska Videodisc Symposium. Features presentations from the 1987 Nebraska Award winners. Published by the IICS. Available from Future Systems, Inc.

Optical Discs: An Information Revolution (Three VHS Videotapes, \$250). The IEEE satellite video conference took place in 1987 and brought together top experts in the field to examine the economics, technological and application trends and major players in the business. Published by the IEEE. Available from Future Systems, Inc.

Conferences/Workshops

Association for the Development of Computer-Based Instructional Systems (ADCIS), Miller Hall 409, Western Washington University, Bellingham, WA 98225; 206/676-2860. A professional association with many special interest groups (SIGs), including the Interactive Video-Audio SIG and the Health SIG. Both SIGs focus heavily on videodisc applications in the health sciences. Annual meetings held in November.

Fuld Institute for Technology in Nursing Education (FITNE), 28 Station Street, Athens, OH 45701; 614/592-2511. FITNE hosts workshops to teach interactive video development. The 4-1/2 day, hands-on workshops focus on design and authoring techniques. Working in small teams, participants actually develop an interactive lesson during the session. Participants will learn the *Quest* authoring system as well as the *Interactive Video Design Toolkit* program. Production and videodisc premastering techniques also are presented.

Health Sciences Communications Association (HeSCA), 6105 Lindell Blvd., St. Louis, MO 63112; 314/725-4722. Heavily oriented toward video production, HeSCA annual meetings, held in March, are increasingly including presentations on videodisc applications.

The Institute for Graphic Communication, 375 Commonwealth Avenue, Boston, MA 02115; 617/267-9425. Sponsors a series of small conferences, usually in Florida and California, on optical disc applications. Recent titles include "Outlook for Compact & Videodisc Systems and Applications" and "CD-I: Birth of a Billion Dollar Industry". Two and one half days of presentations.

Institute For Medical Record Economics, Inc., 121 Mount Vernon Street, Boston, MA 02108; 617/720-2229. Sponsors the Computerization of Medical Records conference annually in the spring. Three days of presentations, including the use of optical discs.

Learned Information, Inc., 143 Old Marlton Pike, Medford, NJ 08055; 609/654-6266. Sponsors the Optical Publishing conference (USA) and the Optica conference (Amsterdam 1987). Three days of presentations and exhibits.

Meckler Publishing Corporation, 11 Ferry Lane West, Westport, CT 06880; 203/226-6967. Sponsors the Optical Information Systems (OIS) conference held annually in December. OIS is three days of conference sessions and exhibits.

Nebraska Videodisc Design/Production Group, KUON-TV/University of Nebraska-Lincoln, P.O. Box 83111, Lincoln, NE 68501; 402/472-3611. Sponsors the Nebraska Videodisc Symposium annually in September. Three days of presentations and exhibits. Also sponsors a series of Nebraska Videodisc Workshops where participants actually design and produce an interactive videodisc. Offers Basic, Intermediate, and Advanced workshops several times a year.

Online International Inc., 989 Avenue of the Americas, New York, NY 10018; 212/279-8890. Sponsors CD-I/The Future conference, held May 1987 in San Francisco. Two and one-half days of presentations.

Rothchild Consultants, 256 Laguna Honda Blvd., San Francisco, CA 94116; 415/681-3700. Sponsors a series of conferences on optical storage technology. Recent titles include "Optical Storage for Small Systems" and "The Future of Optical Memory Technology". Three days of presentations.

Society of Photo-Optical Instrumentation Engineers (SPIE), P.O. Box 10, Bellingham, WA 98227; 206/676-3290. Sponsors the Optical Mass Data Storage conference, the 1986 program held in October in San Diego. Four and one-half days of conference sessions and exhibits.

Stewart Publishing, Inc. 6471 Merritt Court, Alexandria, VA 22312; 703/354-8155. Sponsors periodic symposium and conferences on videodisc, optical disc, CD-ROM, and related technology—including the Interactive Healthcare conference held in June each year. Three days of presentations, exhibits, and workshops.

Symposium Computer Applications in Medical Care (SCAMC), c/o Continuing Medical Education, George Washington University, 2300 Eye Street, NW, Washington, DC 20037; 202/994-8928. The annual SCAMC meeting is designed to inform physicians, healthcare administrators, biomedical scientists, engineers, nurses, and other healthcare professionals about current and potential applications of computer technology to healthcare and to identify areas of research and development that need to be addressed. Annual meeting held in November.

Associations/Special Interest Groups

Association for the Development of Computer-Based Instructional Systems (ADCIS), Miller Hall 409, Western Washington University, Bellingham, WA 98225; 206/676-2860. A professional association with many special interest groups (SIGs), including the Interactive Video-Audio SIG and the Health SIG. Both SIGs focus heavily on videodisc applications in the health sciences.

British Interactive Video Association, is a professional group bringing together about 40 British companies who have made an interactive videodisc. The organization is funded by contributions from its members. For information about the BIVA, contact the National Interactive Video Centre, 24-32 Stephenson Way, London NW1 2HD; 1/387-2233.

Fuld Institute for Technology in Nursing Education, 28 Station Street, Athens, OH 45701; 614/592-2433. Funded by the Helene Fuld Health Trust, the Institute serves as a

clearing house for both hardware and software related to the use of computer and interactive video technology in nursing education. FITNE makes use of newsletters, electronic bulletin boards, and a telephone support service.

Health Sciences Communications Association (HeSCA), 6105 Lindell Blvd., St. Louis, MO 63112; 314/725-4722. Heavily oriented toward video production, HeSCA meetings are increasingly including presentations on videodisc applications.

Healthcare Interactive Videodisc Consortium (HCIVC). Organized in 1988 by IBM Corporation, the HCIVC consists of 14 medical and nursing schools in the US and Canada who have entered into a contract to develop five videodisc modules each on health sciences topics. In return for developing these programs, IBM provides some technical and hardware support. The programs will be made available for distribution. For more information, contact Paula O'Neill, HCIVC Chairperson, Instructional Resources, The University of Texas, MD Anderson Cancer Center, 1515 Holcombe Blvd., Houston, TX 77030; 713/792-6730.

Health Sciences Consortium, 201 Silver Cedar Court, Chapel Hill, NC 27514; 919/942-8731. The HSC is a nonprofit cooperative created in 1971 to enable health sciences institutions to share instructional materials. The HSC will be distributing some of the HCIVC programs. Membership is \$1,000 per year.

Interactive Healthcare Consortium, c/o Stewart Publishing, Inc., 6471 Merritt Court, Alexandria, VA 22312; 703/354-8155. The Interactive Healthcare Consortium (IHC), formerly the MDR Videodisc Consortium (MDRVC), is an educational publishing cooperative dedicated to the development and distribution of interactive videodisc courseware in the health sciences. Membership includes schools of medicine, nursing, dentistry, allied health, pharmacy, and public health as well as hospitals, professional organizations, and pharmaceutical companies. Membership is \$300 per year (\$150/year for schools of nursing). Members receive the Interactive Healthcare newsletter (published monthly) and discounts on the purchase of videodisc courseware, hardware, and authoring tools.

Interactive Video Industry Association (IVIA), 1700 North Moore Street, Suite 1905, Arlington, VA 22209; 703/408-1000. The IVIA is a trade association serving the interactive video industry by promoting interactive video technology to business and government and by working toward the establishment of universal industry standards. The IVIA is the administrative body of Tech 2000, a showcase for interactive media located in the Techworld Trade Center in Washington, D.C.

***International Interactive Communications Society (IICS)**, 2120 Steiner Street, San Francisco, CA 94115; 415/922-0214. A professional association which promotes the use of interactive communications in business, industry, medicine, education, and the arts through the sharing of ideas, information, and experiences. There are 25 established and organizing chapters located throughout the U.S., Canada, England, France, and Germany

Medical Interactive Video Consortium (MIVC). The MIVC was formed in 1987 to increase the effective use of interactive video in medicine and medical education. For more information, contact the MIVC c/o Frank Toth, Uniformed Services University of the Health Sciences (USUHS), 4301 Jones Bridge Road, Bethesda, MD 20814; 202/295-6261.

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CONVINCE (Consortium of North American Veterinary Interactive New Concept Education) is a not-for-profit organization allied with the American Veterinary Medical Associa-

tion. The primary purpose of CONVINCe is to encourage cooperative development and sharing of interactive video and hypermedia programs for veterinary medical education. For more information about CONVINCe, contact Dr. W.F. Keller, President, College of Veterinary Medicine, Michigan State University, East Lansing, MI 48824-1316; 517/355-7624.

Film Festivals/Awards

Nebraska Awards. Each year videodisc awards are made at the Nebraska Videodisc Symposium. Award categories are Best Educational Achievement, Best Industrial/Military Training Achievement, Best Consumer Achievement, Best Data Bank Achievement, and Best Overall Achievement. In 1984, two health-related videodisc projects received honors: The University of Iowa's *Assessment of Neuromotor Dysfunction In Infants* and the University of West Florida's interactive training system to teach skills to social workers. 1986 recipients included two health-related productions that shared the Best Educational Achievement award. They were *Shotgun Wound to the Abdomen* by Intelligent Images, Inc. and *The Case of Frank Hall* by the National Library of Medicine.

In 1987, three health-related productions received awards. *Combat Trauma Training* (U.S. Navy) received the Best Overall Production award, *Introduction to Cardiovascular Examination* (Mirror Systems) received the Best Education Production award, and *The Suicidal Adolescent* (National Institute of Mental Health) received an Honorable Mention. 1988 recipients included three health-related videodisc projects which received Certificates of Merit this year: *A Right to Die?* *The Case of Dax Cowart*, submitted by the Center for Design of Educational Computing, Carnegie Mellon University, Pittsburgh, Pennsylvania, *Recognition & Management of Abdominal Conditions*, submitted by Lunaria Incorporated, and *The Second Slice of Life*, submitted by the University of Utah, Salt Lake City, Utah.

John Muir Medical Film Festival, 1601 Ygnacio Valley Road, Walnut Creek, CA 94598; 415/947-5303. Three medical videodiscs were pronounced award-winning productions by the judges of the 1986 John Muir Medical Film Festival. In all, there were 33 winners and 43 Silver Certificate Award recipients in a contest that involved more than 400 entries from across the United States and eleven foreign countries. All entries were placed in one of more than 50 medical content categories and judged based on content, production value, and instructional design.

Shotgun Wound to the Abdomen the now familiar production done by the Lunaria group for Intelligent Images, Inc. was the winner in the Emergency Medicine category. Two other videodiscs received second place Silver Certificate Awards: *The Case of Frank Hall*, produced by the National Library of Medicine, and *The Active Knee*, produced by the Alive Center with the Sandy Corporation. The winning productions from the festival were shown at the National Library of Medicine in Bethesda, Maryland as part of the library's 150th Anniversary Celebration in October.

Association of Visual Communicators (AVC) Cindy Awards. As an adjunct to the CINDY Awards competition, AVC hosted a month-long Showcase of Interactive Videodisc Technology. The Showcase featured hands-on demonstrations of a broad range of computer/videodisc systems, including those offered by IBM, Sony, Pioneer, and Visage. More than 35 videodisc programs were entered, four having a health care theme. These were the *BioSci Videodisc* by Videodiscovery, *The Active Knee* by the ALIVE Center, *The*

Challenge of Antibiotics by Lancit Media Productions, and *Abdominal Stab Wounds: Donnie Brooks* by Intelligent Images.

The Interactive Videodisc category was introduced into the AVC CINDY competition for the first time in 1985. Gold, Silver, Bronze, Honorable Mention, and Special Achievement Awards are given in various categories. 1986 health-related winners were *Abdominal Stab Wounds*, which won a Gold award in the Education category, and *the BioSci Videodisc*, which was presented a Special Achievement Award for pioneering work in visual database.

Demonstration Centers/Clearing Houses

National Library of Medicine

The National Learning Center for Interactive Technology opened in March 1985 at the National Library of Medicine as a central location where various computer-video information and educational technologies are demonstrated, reviewed, and evaluated. The Learning Center a hands-on laboratory where visiting medical educators and scientists can explore the comparative applications and various uses of interactive educational technology in the health sciences. The Center is part of the Lister Hill National Center for Biomedical Communications, the branch of the Library responsible for conducting research in health communications.

The staff of the Learning Center acquire working prototypes and commercially available products for health science education. Visitors are encouraged to try out the programs and study the assumptions underlying their design. The Learning Center staff provide individual and small group tutorials and demonstrate the diversity of courseware and the alternative approaches available when designing interactive programs.

The Learning Center's collection consists of course-ware for use with microcomputer systems, often in conjunction with touchscreen, bar code reader, digital speech, voice recognition, CD-ROM, reflective videodisc, and write-once optical disc technology. The following are some of the videodisc and CD-ROM applications housed at the Learning Center for Interactive Technology:

The NLM Video Picture List demonstrates the use of videodisc technology as a visual database and catalog of pictures from the NLM History of Medicine collection.

The Microanatomy Video Library takes the concept of the visual database to the next technology level. Over 2,000 microanatomical images located on a videodisc are accessed by the user through a free-text database program running on an attached micro-computer.

The Anatomy of the Knee contains a library of anatomic, magnetic resonance, and computer tomography images of the human knee in three planes (sagittal, axial, and coronal). These images can be used under computer control to compare anatomical and electronic images of the knee in all three planes. A series of test questions is included to assess the student's mastery of this content area.

Visual Database with Barcode Access demonstrates the use of barcodes for the random selection access of videodisc images and sound. With texts retrofitted with barcodes, or with texts specifically designed to incorporate them, the student has the flexibility of augmenting the information provided by the text as needed.

Medical Emergency Simulation with Touchscreen (DxTER) is a Level III application with touchscreen developed by Intelligent Images, Inc. The simulation is a realistic, highly interactive emergency situation done in real time.

Teenage Suicide Prevention is an application for mental health students to help raise their consciousness level concerning the hidden signs of an impending teenage suicide. This videodisc program includes a series of simulations of depressed adolescents.

Technological Innovations in Medical Education (TIME) are voice-activated patient management simulations. The microcomputer is trained to recognize the user's voice with a selected vocabulary of medical words and phrases which provide the basis for interacting with the program.

AI/RHEUM is an artificial intelligence consultant system in rheumatology intended for the use of practicing physicians not having specialty training in that field.

PathMac was developed at Cornell University and demonstrates the concept of hypertext/hypermedia. The program is Macintosh-based and uses a recordable WORM videodisc for the delivery of conventional video images and the computer's hard disk and screen for the delivery of digitized images.

The Echocardiography Videodisc Encyclopedia was developed with Yale University and is a videodisc-based library of echocardiographs. The accompanying program uses a hypermedia environment to teach echocardiographic image interpretation using online text, animated graphics, and digitized sound.

The Electric Cadaver was designed at Stanford University as a general prototype of electronic multimedia books. Using the Macintosh computer in a hypermedia environment, the system displays images on two screens. The text, graphics, and video are extensively cross-referenced, making it possible for a user to jump from picture to text to video and back.

Medline on CD-ROM demonstrates the use of Compact Disc-Read-Only Memory technology. A subset of the Medline database and an associated search algorithm are stored on a compact disc for quick and easy access.

The National Board of Medical Examiners' CBX System is a series of interactive patient simulations. Each CBX case presents a simulated patient in an uncued, patient management environment. The student is expected to diagnose, treat, and monitor the patient's condition as it changes over time and in response to treatment.

Computer-based Curriculum Delivery System in Pathology is a series of 10 videodisc lessons developed at Lister Hill and designed for use in the medical school basic pathology curriculum.

E.T.Net Electronic Bulletin Board is billed as "an online computer conference dedicated to users of computers in medical education." E.T.Net is designed to electronically link developers and users of interactive technology in health care education. Its primary purpose is to help alleviate a major problem faced by medical educators today, i.e. the lack of good information on medical interactive courseware. E.T.Net provides information on what courseware is available, where it can be obtained, which programs are useful, and what needs to be developed.

Users of E.T.Net are able to share software, hardware, and videodisc reviews; information on current and upcoming courseware and videodiscs; and news on new applications of interactive technology in medical education. E.T.Net is open to professionals engaged

in either the development or use of interactive technology in medical education. It is available at no cost, 24-hours a day, seven days a week, 365-days a year. The service may be accessed via the Telenet network by a local phone call to your local Telenet node. The Telenet address is 301 565. To register for your fee account, call E.T.Net and gain access by typing etnet in lower case letters. E.T.Net will provide further instructions. Help and a User's Guide are available online. A pocket Quick Reference Guide may be requested from the Learning Center for Interactive Technology.

TECH 2000

The Interactive Video Industry Association (IVIA), in conjunction with Techworld developer International Developers Inc. have established the Tech 2000 showcase and gallery in Techworld Plaza, Washington, DC. Billed as a museum of the future, Tech 2000 is the first major interactive information technology demonstration site open to the general public. The Techworld World Technology Trade Center is strategically located between the Capitol and the White House and directly opposite the Washington Convention Center. Tech 2000 occupies 10,000 square feet and provides a high-profile center for the display and interpretation of emerging technologies, with an emphasis on interactive systems and media.

Tech 2000 houses award-winning programs and new product introductions. The exhibits are accessible through self-guided tours (for walk-in visitors), guided tours (for focus groups from various user markets) and in-depth demonstrations of specific interactive programs. Staff members are available to answer questions and give more detailed explanations to visitors. (901 Eighth Street, NW, Washington, DC 20001; 202/682-2190.

Smithsonian Institution

The National Demonstration Laboratory for Interactive Educational Technologies (NDL) has been established as a cooperative effort of the Smithsonian Institution and the Interactive Video Consortium (IVC), an organization of public broadcasting stations. The center, located within the Smithsonian's National Museum of Natural History, will be available to leaders in the fields of museology, education, publishing, and broadcasting, as well as legislators and public policy specialists.

According to Glen Hoptman, Director of the NDL, "The NDL is a technical assistance center to support individual efforts in the broad field of education. It is also a research and development center where we will look at issues and develop applications, explore the further reaches of interactive educational technologies and electronic publishing. We will also sponsor collaborative efforts among universities through the research consortium which we have established, and anticipate a quarterly publication called the *Journal of Hypermedia Studies*."

The Center is industry supported and is accepting donations of appropriate hardware systems and software programs to exhibit. The NDL opened on February 24, 1987. For more information or to schedule a visit, contact Glenn Hoptman, Director, National Demonstration Laboratory, Smithsonian Institution, Washington, D.C. 20560; 202/357-4748.

Videodisc Mastering Companies

- **LaserVideo**, 1 East Wacker Drive, Chicago, IL 60601; 312/467-6755.
- **Pioneer Video, Inc.**, 600 E. Crescent Ave., Upper Saddle River, NJ 07458; 201/327-6400.
- **Sony Communications**, Sony Drive, Park Ridge, NJ 07656; 201/930-6177.
- **Technidisc**, 2250 Meijer Drive, Troy, MI 48084, 313/435-7430 or 800/321-9610.
- **3M Optical Recording Project**, 3M Center, Building 223-56, St. Paul, MN 55144; 612/733-2142.

Glossary

ANALOG INFORMATION: Data that has a steady flow from one value to another--a continuous range of value. Films and videotapes store analog information as opposed to digital information, which is stored on computer floppys. Analogy: An analog clock has minute and hour hands that have a sweeping movement--a continuous range of motion. A digital clock changes by the minute or second in discrete units.

ARCHIVAL: Of, in, or containing archives--records, documents, photographs, etc. Archival laserdiscs may store medical records, X-rays, medical databases, or any other information for later retrieval.

ARTIFICIAL INTELLIGENCE: A computer-driven program that, in effect, learns from its experience, therefore improving its performance over time. This type of adaptation is normally associated with human intelligence. An example would be a program to help physicians diagnose patients that becomes more sophisticated with each case--remembering and building on the "experience" it gained from all previous cases combined.

AUTHORING LANGUAGE: A code system uniquely suited for programming instruction--simplifies and short-cuts computer-programming with PROGRAMMING LANGUAGES. Although they use plain-English commands, authoring languages do not prompt the author and are usually cumbersome for non-programmers. AUTHORING SYSTEMS are better suited to the non-programmer.

AUTHORING SYSTEM: A code system for programming instruction, designed to be used by non-programmers. Authoring systems prompt authors to enter instructions in plain English and have underlying programs controlling actual computer programming.

BAR CODE: A block of parallel lines which are read by a scanner or wand and send codes to a computer. Now appear on almost all food packaging. Also used by the American Medical Association and the National Library of Medicine in textbooks and on other material to provide access to a laserdisc player.

BRANCHING: A common element of interactive videodisc instruction where the program jumps from one area of instruction to another. For example, when a learner selects from a multiple choice question on the screen, the program will "branch" to different areas of the lesson depending on the learners choice.

CAD: Computer-Aided Design.

CAI: Computer-Aided (or assisted) Instruction.

CAL: Computer-Aided Learning.

CAPACITANCE VIDEODISCS: Two incompatible systems that use a stylus or sensor to read recorded data. Electrical, not optical systems. Operate by storing an electrical charge which is picked up by the stylus. See also CED and VHD.

CAV: Constant Angular Velocity. A videodisc format where the disc rotates at a constant speed at all times (1800 rpm). Up to 30 minutes of motion video may be stored on

a 12-inch videodisc using this format. Also permits freeze-frame and slow motion options on playback. See also CLV.

CD: Compact Disc. 12-centimeter (4.75 inches) laserdisc that stores digitally-encoded information in CLV format. Well-known as the popular format for commercial music.

CD-I: Compact Disc-Interactive. Announced in March 1986, CD-I is to be fully compatible with CD and CD-ROM formats, while, at the same time, adding a few capabilities. CD-I video will be stored in digital form, and may be played back as full-frame stills or reduced motion (1/9 of screen size and only 6 frames/second). Audio will be stored in seven modes with four different quality levels. The CD-I will be marketed as a self-contained viewing unit and is expected to impact heavily on the education and entertainment markets.

CD-ROM: Compact Disc-Read Only Memory. Sometimes CD-ROM. A 12-centimeter laserdisc that stores digitally-encoded information in CLV format. Differs from CDs in the amount of error-correction information encoded. Used heavily for the storage of large medical databases--holds about 550 megabytes of data.

CD-V: Compact Disc-Video. Another compact disc format, announced in 1987, that will hold five minutes of analog video and up to 20 minutes of conventional CD audio.

CED: Capacitance Electronic Disc. A grooved videodisc that requires a stylus ("needle") to read information. Not an optical system. Developed by RCA and marketed to the consumer/home market as SELECTAVISION. Discontinued by RCA in 1984.

CHAPTER STOP: Code which can be imbedded in a videodisc to signal the break between two separate chapters. Allows specific chapters to be accessed using the chapter search control of the videodisc player.

CHECK DISC: A videodisc used to confirm the placement and quality of recorded data. Usually inferior in quality to the final product.

CLV: Constant Linear Velocity. One of two formats for reflective optical videodiscs, CLV permits twice as much play time than CAV--up to one hour per side. CLV discs rotate at speeds that vary from 600 rpm to 1800 rpm, depending on the portion of the disc being read. CLV discs can not provide freeze-frame or slow motion playback options.

COMPACT DISC: See CD.

COMPACT DISC-READ ONLY MEMORY: See CD-ROM.

COMPACT DISC-INTERACTIVE: See CD-I.

COMPACT DISC-VIDEO: See CD-V.

COMPACT VIDEO DISC: See CVD.

COMPOSITE VIDEO: The various elements needed to produce a color video single-used by television sets. Includes chromatic and luminance picture information, blanking pedestal, field, line, and color sync pulses, and field equalizing pulses. As opposed to RGB display--used in color computer monitors--comprised of red, green, and blue signals. See also RGB.

COMPRESSED AUDIO: See STILL-FRAME AUDIO.

CVD: Compact Video Disc. Introduced by Interactive Video Systems, the CVD is a 12 cm disc able to hold 20 minutes of analog video in CLV format, 12.5 minutes in CAV

mode, or 22,000 still frames. Will also be compatible with CD audio format. Not a product of Philips/Sony who develop all of the compact disc formats.

DIGITAL INFORMATION: Information expressed in binary form--on or off, ones or zeros. Computers work with digital information. As opposed to analog information.

DIGITAL OPTICAL DISC: Technically, all forms of optical disc that store digital information, such as the CD and CD-ROM, are considered digital optical discs. However, the 12- and 14-inch optical discs used to store records and documents in digital form are often referred to as digital optical discs to distinguish them from other formats..

DIGITAL VIDEO INTERACTIVE: See DVI.

DRAW: Direct-Read-After-Write. Optical disc technology that permits discs to be recorded in local environments such as hospital departments. DRAW discs may be recorded once and not erased. However, data may be recorded onto the disc in small increments over a period of time until the disc is full.

DVI: Digital Video Interactive: Announced March 1987, the DVI compresses digital video information to hold 72 minutes of full-motion, full-screen video. DVI was developed by General Electric/RCA.

EIDS: Electronic Information Delivery System. The hardware configuration selected by the Department of Defense for delivery of their interactive videodisc materials.

EMULATOR: A system designed to simulate interactive videodisc programs before mastering. Uses computer-controlled videotapes to simulate the final disc operation.

EXTERNAL COMPUTER: Any computer of any size which is connected to a disc player via some sort of cabling device. As opposed to an ONBOARD MICROPROCESSOR with limited processing capability contained in Level II videodisc players.

FRAME: A single picture or image on a videodisc.

FRAME ADDRESS: See FRAME NUMBER.

FREEZE FRAME: A single frame from a motion sequence that is held motionless on the screen. Should be distinguished from a STILL FRAME, which is a single frame meant to be shown without motion--such as a slide or photograph which has been transferred to videodisc.

GENERIC VIDEODISC: Videodisc which contains a collection of material--usually slides, short motion sequences, etc.--on a topic or topics. Generic discs are intended to provide material with which others may program their own instructional or reference material, and is not usually sold with accompanying computer programs or course of instruction. An early proponent of this approach was the University of Washington Health Sciences Learning Resources Center.

GRAPHIC OVERLAY: See OVERLAY.

INTERACTIVE: A computer or video application involving the participation and input of the user to determine the direction and flow of information. INTERACTIVE VIDEO involves a videodisc player or random-access videotape player--often under computer control. As opposed to LINEAR, which proceeds from beginning to end without user input or control.

INTERACTIVE VIDEO: See INTERACTIVE.

INTERFACE: The link between two pieces of equipment, ie. between a computer and videodisc player. The INTERFACE DEVICE provides communication between the two, allowing them to "talk" to each other.

ISD: Instructional Systems Design.

IVD: Interactive Videodisc

KEYPAD: A hand-held device--similar to a remote control used for television sets--which contains alphanumeric and other keys. Used to communicate with a computer or videodisc player.

KIOSK: A stand-alone display used to house a computer and/or videodisc player, monitor, and input devices (keypad, touchscreen, etc.). Usually located in public access areas and used to dispense advertising, promotional, or other information. Associated with POINT-OF-PURCHASE, and POINT-OF-SALE applications.

LASER: Light Amplification by Stimulation of Emission of Radiation. In laserdisc systems, a low-power laser is used to read microscopic pits which contain the coded material.

LASERCARD: A credit-card-sized plastic card with a metallic strip on which data can be stored and read using a laser source. LaserCard is a trademark of the Drexler Technology Corporation. A LaserCard holds up to 1 megabyte of information and is being used by a few companies to store medical histories and other medical records.

LASERDISC: Also Laser Disc. Common or generic name for REFLECTIVE OPTICAL VIDEODISCS. The word form "LaserDisc" (no space, capital D) is a trademark of Pioneer Electronics for its reflective optical videodisc products.

LASERFILM: Form of optical disc that consists of a photographic film base and is read with a laser that passes through the disc (TRANSMISSIVE). Trade name for McDonnell Douglas Electronics Company.

LASERVISION: The trade name for the reflective optical videodisc format used by Pioneer, Philips, Hitachi, and others. LaserVision videodiscs have become the industry standard.

LEVELS OF INTERACTIVITY: Three degrees of interactivity for videodisc systems. Proposed by the Nebraska Videodisc Design/Production Group in 1980.

Level I involves use of the videodisc player controls only--still/freeze frame, picture stop, chapter stop, frame address, and dual-channel audio features--with little or no processing.

Level II is controlled by a small microprocessor built into some videodisc players. Level II videodiscs have small "data dumps" in them that are loaded into the processor when the disc is played. Level II provides some programming features such as branching at multiple choice questions, continuous video loops, and the like.

Level III consists of the Level I or Level II players interfaced with an external computer. Level III, like level II, provides programmed instruction. However, because the capabilities of the external computer are greater than the processors in Level II players, Level III programs can be far more sophisticated. Computers commonly used in Level III systems are IBM PC (and compatibles) and the Apple computers.

LIGHT PEN: A small, pen-like input device used to interact with videodisc or computer programs. The user touches the screen or monitor with the light pen.

LINEAR: Programs meant to be played from beginning to end without input or interruption. Most films and videotape programs are linear.

MASTER: Either 1) the original tape or film used to make copies or 2) the process of producing a "master" videodisc from which all other copies are replicated.

MENU: In a videodisc program, the menu provides a listing of options available to the user--much like a table of contents. Often there is a series of sub-menus as well.

NTSC: National Television Systems Committee that prepared the commercial standards for color broadcasting. NTSC standards are used in the United States, while PAL format is used in Europe, with the exception of France, which uses SECAM format. These formats are not compatible--PAL videodiscs will not play on NTSC standard players.

OMDR: Optical Memory Disc Recorder. A line of videodisc recorders made by Matsushita Panasonic. Many hospitals have installed the OMDRs to record the various medical imaging formats directly to disc.

ONBOARD MICROPROCESSOR: Small microprocessor built into Level II videodisc players. Programming code from the videodisc is "dumped" into the processor and permits a greater level of interactivity than players with out the processor, but less than players connected to an EXTERNAL COMPUTER.

OPTICAL DIGITAL DATA DISC: Refers to any optical disc used to store digital information.

OPTICAL DISC: Technically, any disc format that uses a light source, usually a laser, to read and write information. See also Digital Optical Disc.

OPTICAL MEMORY: A generic term for technology that stores and reads information through the use of a light source, usually laser. Includes the terms optical disc, laserdisc, videodisc, CD, CD-ROM, CD-I, and LaserCard.

OROM: Optical Read-Only Memory. A 5.25-inch laser-encoded optical memory storage medium. The concentric circle format and constant angular velocity (CAV) of the OROM gives it a faster access time than CD-ROM discs, but less storage space (250 MB instead of 550 MB).

PAL: Phase Alternation Line. The European standard for color television, except in France. Not compatible with the U.S. standard, NTSC.

PICTURE STOP: The ability of some videodisc players to stop on a specific frame during play. Also the instruction encoded in the disc to cause it to stop on the predetermined frame.

POI: See Point-of-Information.

POINT-OF-INFORMATION: See Point-of-Purchase.

POINT-OF-PURCHASE: Interactive video systems (often housed in a kiosk) set up in public places to demonstrate products or encourage sales. Also Point-of-Information (POI) and Point-of-Sales (POS).

POINT-OF-SALE: See Point-of-Purchase.

POP: See Point-of-Purchase.

POS: See Point-of-Purchase.

PRE-MASTERING: The stage of producing a videodisc where the master videotape is checked and prepared for final transfer onto the master disc. Master videotapes are usually 1-inch Type C NTSC helical.

PROGRAMMING LANGUAGE: Multipurpose codes used by programmers to communicate instructions to a computer. Common programming languages include BASIC, COBOL, FORTRAN, Pascal, and C. To be distinguished from **AUTHORING LANGUAGES** like PILOT, which are code systems uniquely suited for creating instruction and **AUTHORING SYSTEMS** for instruction, which involve little coding and can be used by non-programmers.

RANDOM-ACCESS: A method of storing information so it can be accessed in any order. Unlike film, for example, which must be played all the way through to get from beginning to end, random-access videodisc players can "jump" from information stored at the beginning to information stored at the end in a few seconds.

REFLECTIVE VIDEODISCS: Contains information imbedded as pits or holes in surfaces which reflect laser light onto a mirror and into a decoder. As opposed to **TRANSMISSIVE VIDEODISCS** in which the laser light may pass through the disc.

RGB: Red-Green-Blue. A type of color output to computer display consisting of red, green, and blue signals. As opposed to **COMPOSITE VIDEO** used in television sets. RGB usually offers higher picture resolution than composite.

RS-232C: Standard serial interface between a computer and its peripherals, including some videodisc players.

SEARCH TIME: Time required by a computer or disc player to locate a specific frame or other piece of information.

SECAM: Sequential Couleur a Memoire. Color television format in France and Russia. Not compatible with the U.S. standard (NTSC) or the European standard (PAL).

SIMULATION: The realistic portrayal or representation of a situation or device--with varying degrees of realism. In medicine, computers and videodiscs are used to create patient simulations that provide physicians and nurses with the opportunity to practice diagnosing and treating various medical conditions. Medical equipment may also be simulated for operator training.

SPEECH RECOGNITION: See Voice Recognition.

SPEECH SYNTHESIZER: A device that produces human speech sounds from recorded input, usually stored in a computer.

STAND-ALONE SYSTEMS: Equipment this functions on its own-- such as Level II videodisc players--without being connected to a larger network (such as an external computer).

STEP FRAME: A function of optical videodisc players to "step" from one frame to another, forward or backward.

STILL-FRAME AUDIO: A method of storing several seconds of voice-quality audio in a single frame of a disc. The voice must be digitally encoded, stored on the disc, then dumped into a decoder for playback. MEDCOM tried this approach on a disc contains several hundred slide/tape programs using the EECO still-frame audio system.

TOUCH SCREEN: A video and/or computer screen which acts as an input device to a computer with the touch of a finger. The user is often asked to touch an area of the screen in response to a question. Different technologies are used in touch screens, including infrared grids, small wires separated by air spaces, changes in electronic capacitance, acceleration detection, and others.

TRANSMISSIVE OPTICAL VIDEODISC: A transparent videodisc that allows the laser to pass through the disc to the decoder. First system was developed by Thompson/CSF and is no longer manufactured. Only transmissive system on market today is the McDonnell Douglas Electronics Company (MDEC) LaserFilm system.

TURNKEY SYSTEM: An off-the-shelf hardware system that is ready to run on delivery—just "turn the key".

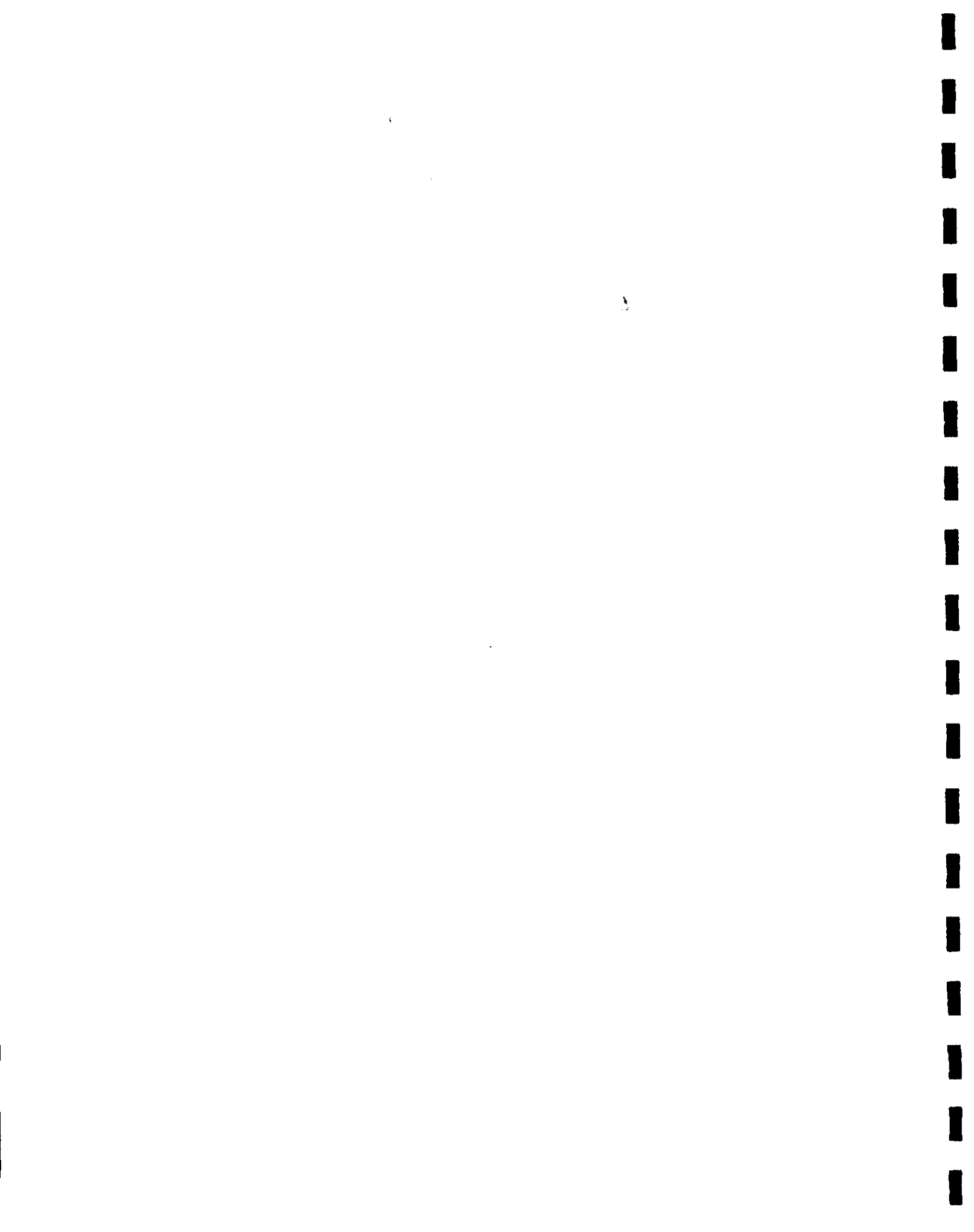
VHD: Video High Density. A format for videodisc that uses a grooveless capacitance videodisc and a broad stylus to pick up data. Not an optical system. The format was developed by Matsushita/JVC and can both NTSC and PAL format discs.

VIDEODISC: A generic term used to describe any discs of various formats (optical and capacitance) used to store video for playback. May also store audio and data signals.

VIDEODISC FORMATS: One of four types of videodiscs: Reflective Optical Videodisc, Transmissive Optical Videodisc, Capacitive Electronic Disc (CED), and Video High Density (VHD).

VIDEOTEX: Low-resolution text and graphics stored in a computer and displayed using special decoders.

VOICE RECOGNITION: Technology which allows computer and videodisc programs to be controlled by voice commands. The TIME Project at the Library of Medicine is pioneering approach to videodisc-based patient simulations.



Appendix

ACCESS NETWORK
295 MIDPARK WAY S.E.
CALGARY, ALB T2G 4S6 CANADA
403/297-4952

ACTRONICS INC
810 RIVER AVENUE
PITTSBURGH, PA 15212
800/851-3780

ALEXANDER DESIGN
200 SOUTH DESPLAINES STREET
CHICAGO, IL 60606
312/648-9880

ALIVE CENTER
1248 WEATHERVANE LANE
AKRON, OH 44313
216/869-9623

ALLEN COMMUNICATIONS
140 LAKESIDE PLAZA/5225 WILEY POST
SALT LAKE CITY, UT 84116
801/537-7800

AMERICAN ACAD ORTHOPAEDIC SURGEONS
222 SOUTH PROSPECT AVENUE
PARK RIDGE, IL 60068
312/823-7186

AMERICAN COLLEGE OF RADIOLOGY INST
1891 PRESTON WHITE DRIVE
RESTON, VA 22091
703/648-8989

AMERICAN MEDICAL ASSOCIATION
532 NORTH DEARBORN STREET
CHICAGO, IL 60610

AMERICAN SOC CLINICAL PATHOLOGISTS
2100 WEST HARRISON STREET
CHICAGO, IL 60612
312/738-4857

APPLE COMPUTER
MARKETING DEPARTMENT
10201 TORRE AVENUE MS 47A
CUPERTINO, CA 95014

APPLE COMPUTERS MS36N
MGR MEDICAL MARKET
20525 MARIANA AVENUE
CUPERTINO, CA 95014

APPLIED INTERACTIVE TECHNOLOGY
621 LAKELAND EAST DRIVE
JACKSON, MS 39208
601/939-2987

APPLIED VIDEO TECHNOLOGY
5118 WESTMINSTER PLACE
ST LOUIS, MO 63108

ARGOSY NETWORK CORPORATION
120 30TH AVENUE NORTH
NASHVILLE, TN 37203
615/320-0777

ARIES SYSTEMS CORP.
ONE DUNDEE PARK
ANDOVER, MA 01810
617/457-7200

ARTEMIS
14 SHORT TRAIL
STANFORD, CT 06903
203/329-1815

AUBURN UNIVERSITY
COLLEGE OF VETERINARY MEDICINE
AUBURN, AL 36849
205/826-4425

AUTHORWARE
8500 NORMANDE LAKE BLVD 9TH FL
MINNEAPOLIS, MN 55437

BAKER VIDEOACTIVE
4159 MAIN STREET
PHILADELPHIA, PA 19127
215/482-2900

BALL COMMUNICATIONS
11001 NORTH FULTON AVENUE
EVANSVILLE, IN 60611
812/428-2300

BLOOMSBURG UNIVERSITY
CTR FOR INSTR SYS DVPMT
BLOOMSBURG, PA 17815
717/389-4506

BOSTON MUSEUM OF SCIENCE
SCIENCE PARK
BOSTON, MA 02114
617/589-0154

BOSTON UNIV SCHOOL OF MEDICINE
80 EAST CONCORD STREET
BOSTON, MA 02118
617/638-4194

BOWMAN GRAY SCHOOL OF MEDICINE
COORD EDUCATIONAL COMPUTING
300 SOUTH HAWTHORNE DRIVE
WINSTON-SALEM, NC 27103
919/748-2046

BRITISH COLUMBIA INST OF TECHNOLOGY
COMPUTER-BASED EDUCATION
3700 WILLINGDON AVENUE
BURNABY, BC V5G 3H2 CANADA
604/432-8803

BRS INFORMATION TECHNOLOGIES
555 EAST LANCASTER AVENUE 4TH FLOOR
ST. DAVID, PA 19087
800/468-0908

C.V. MOSBY
SR VP EDITORIAL
11830 WESTLINE INDUSTRIAL DR
ST LOUIS, MO 63146

CAB INTERNATIONAL
845 NORTH PARK AVENUE
TUCSON, AZ 85719
602/621-7897

CALIFORNIA STATE UNIVERSITY-CHICO
SCHOOL OF NURSING
FIRST & NORMAL
CHICO, CA 95929
916/895-5610

CANADIAN CTR OCCUPATIONAL HLTH &
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