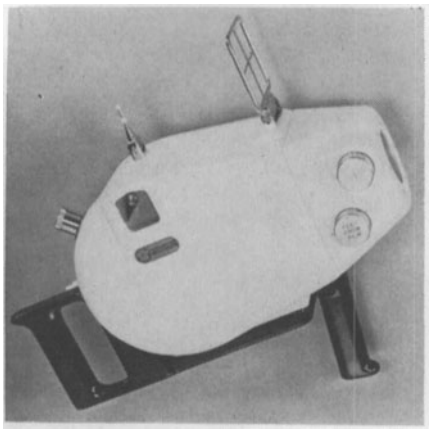
Powered by an integral 28-v d-c nickel-cadmium battery pack, the DBM 9 also has a connector for 115-v a-c remote operation. Accessories such as heater, timing lamps and shutter correlation pulse generator can also be added.

The dimensions of the camera are: length, 13½ in. (with grip 17½ in.); height, 8 in. (with grip 13¾ in.); width, 7½ in. The weight is adjustable from 1 lb positive buoyancy to 1 lb negative buoyancy. All external parts are made of 321 stainless steel, highly resistant to salt-water corrosion. No tools are required to open the door, which opens with a hand latch.



The Motion Picture as a Tool in Medical Education

By WARREN STURGIS

IN ANY AREA of science which is undergoing change, concepts and working principles develop hand in hand with equipment. Sometimes the new ideas emerge from the materials themselves; sometimes technical requirements give birth to ideas which in turn require development of new tools. Usually, as is true of the motion picture in medical education, both processes are concurrent.

Initiation

Historically, teaching medicine through motion pictures has been with us only a short time. Of the 200 years since our first medical school was founded in Philadelphia, audio-visual education has developed only in the last 25 years.

Early medical school teaching was almost entirely dependent on oral communication. Most professors trained themselves in the disciplines in use abroad, particularly in Germany where the lecture method was prevalent. However, students had little chance to practice medicine until they graduated and saw patients.

Toward the turn of the century, specific periods for laboratory work were introduced. This concept, that one learns a skill by practicing it, rather than by merely hearing about how to do it, is the basis of learning any manual skill today.

But a third medium came to prominence as the 20th century progressed — the visual one. Photography was a fairly cumbersome practice in the 19th century. Medical stills were taken but motion pictures as a teaching vehicle were not considered until World War I when the Army essayed a few, mainly as experiments. The orthocromatic film of that day was inadequate, however, because it could not differentiate between different hues of red. The 35mm film in current use (and various other sizes) was impractical because of its bulk.

The introduction of small film, standardized at 16mm, did much for visual training in the sciences. In addition, panchromatic film was introduced, answering the need for accurate gray scale rendition of colors. Then, the thirties saw the advent of 16mm color film. Although the early types tended to fade, there was some approach to proper color balance. Doctors could now record clinical conditions in which the hue of tissues was important.

As more films of significance were made, as more were demanded for teaching, it was inevitable that standards would evolve, that the early catch-as-catch-can film would be unacceptable, and that better equipment would be required. Medicine shared the demands of the other sciences.

Development

Precision cameras were needed. Both Eastman and Bell & Howell developed models which could produce predictable results. To photograph minute structures, long focal length lenses were manufactured. Their use with a succession of extension tubes made photomacrography practical.

Long accustomed to observing and taking stills through the microscope, the microbiologist now adapted the motion-picture camera to view physiologic processes such as capillary circula-

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tion. In order to record tissue cultures and cell-growth, particularly in studying cancer, time-lapse equipment came into widespread use.

On the other end of the time-scale, medical researchers wanted to slow down motion pictures of body processes. High-Speed, super-speed, and ultra-speed cameras were used to study movements of the vocal cords or of the ear drum.

Recording, meanwhile, became simpler and tape brought sound within everyone's reach. Magnetic striping of film and magnetic projectors added potential for the individual working on film in the laboratory. Also, the constant betterment in film stocks and processing and printing methods has contributed to the tremendous improvement in quality of medical films through the years.

At present, nearly all the elements of film production, with the possible exception of video tape, have come into use in the field of medical education.

Attitude Towards Films

What of the ideas which developed along with the equipment? In the early days of medical audio-visual education a handful of teaching films existed. Those that had been made were, by medical standards, quite unsatisfactory. In haste to put something on film, the enthusiasts threw away all principles of teaching. Without thought and without organization, scenes and sequences were recorded, strung together with little editing, and projected, generally with outrageously bad titles. Actually, to most scientists all films were more or less suspect.

World War II showed how learning processes could be vastly speeded up by visual training devices. Today hundreds of films fill the shelves of libraries at the American Medical Association, the American College of Surgeons, and other organizations. Literally thousands of pictures on all subjects are now catalogued. Hundreds more films are produced every year. If production costs have not gone down—despite quantity production and streamlined methods—it is because more specialized equipment has been needed. With the increase in importance of the film medium, although more money is available to underwrite them, more money is needed; more knowledge and background of experience are now required to produce a good and acceptable teaching film.

A critical eye toward every production has taken the place of automatic acceptance. Today it is absolutely necessary to be aware of the experience of those who have learned this field by trial and error, and to follow the precepts of communicating medical information by film which have grown up over the past two decades. That films can and do teach has been accepted as a truism. Today, the multiplicity of facts to be learned in any science indicates the necessity of teaching basic principles as quickly as possible, and by whatever means that exist for so doing. The medical profession can no longer remain aloof; films have to be used.

Procedure

By experimenting, medical educators have come to look at each visual problem within a framework; asking themselves in effect the three questions: *why* — *what* — *how*? These are not novel questions and are often answered automatically. They are important in the consideration of any audio-visual device, and especially the medical teaching film.

Why is a film to be made? It is because some one person wishes to communicate certain knowledge to someone else. The initiating party can be dismissed quickly. He exists, but who is the recipient? The audience for any film must be known in advance. In medicine it should be fairly confined. A health picture for the public is generally of little use to the physician. A technical film for the doctor will be over the heads of the public. Within the profession itself, the picture for the specialist will hardly do for the general practitioner.

What is the knowledge to be communicated? Are there facts to deal with, theories to develop, ideas to pursue or motivations to engender? What is the subject matter?

How — With the purpose established, the audience in mind, and the general subject matter known, *how* is the story to be told? The general precepts for good medical film production differ in no particular way from those for any other type. However, the scrupulous accuracy necessary and inherent in medicine makes it all the more vital to follow the rules through the three phases of production.

(1) Careful Planning: This involves the doctor, as technical advisor, the script-writer and the budget maker. The creative experience which makes or breaks a film is the important ingredient for this phase of the work. Discussions are held to settle on format, to bring out needed information, to plan a script for a budgeted film. A script finally emerges; it is criticized, changed, redrafted and corrected until it emerges in satisfactory form. A storyboard is planned with an artist if animation is to be used. The extra touches that will dress up the film by means of x-rays, cinefluoroscopy, models, etc., are visualized.

(2) Thorough Execution: It should be axiomatic that the photography, art and animation are well executed. If a good rapport is established with

the doctor or technical advisor, the director and cameraman should have little trouble, whether it be a research problem, a clinical study or a surgical operation. Although specialized equipment may be required, for instance in the operating room or a research study, there is not space here for a full discussion.

(3) During the *Organization* and *Completion* phase, as with any other production, the tag-ends fall into place. The animation is dropped in. Narration and live sound are mixed with effects and music, if desirable. Final editing, matching, dubbing and printing are done. Through the production of medical films there is one important matter to remember: the necessity for constant checking with Technical Advisor at all stages. It is not enough to rely on scrupulous adherence to a script and storyboard. What appears on the screen may not be what was expected from reading the script; drawings look different when animated from the way they did on a story-board. Errors which must be corrected (and they must for scientific accuracy) at a late stage, are very costly.

Content

In addition to filming procedure it is necessary to consider film content. What types of films are there in this field? The most truly scientific of all are those in which the camera is used as a research tool. The best examples are the two mentioned earlier, high-speed and time-lapse, wherein data are discovered and analyzed on the film itself.

A second type is the record film an unusual clinical case is diagnosed, an operation is to be done which may never be repeated. The American College of Surgeons puts on an evening session during their program once a year, at which these "spectaculars" are featured. Another use of these records is to compare a patient's progress under therapy. Such records also may be important for medico-legal purposes.

In the demonstration film the professor shows an experiment which he wishes his students to follow closely in their own laboratory work or the surgeon shows his residents how to perform operations in a particular fashion. The details of such special procedures can be shown with as little or as much elaboration as the teacher believes necessary.

Clinical films delineate, more fully than simple demonstrations, the course of a disease process as related to patients and their therapy. The cooperation of patients being photographed is generally freely given.

What is today called the "orientation" film is a further expansion of the clinical. A wealth of material may be added, in the form of animation or other devices, to give a rounded story on a subject like arthritis or hypertension. Often sponsored by pharmaceutical companies, these films may deal with drugs and their use in treatment.

Finally, there is the motivation film in which an even more personal approach is introduced. This type of production is planned to make the audience react in a certain way, to engender a subjective response through telling a documentary story.

None of these are inflexible categories, and often their characteristics tend to overlap. The general type which a film assumes grows out of the purpose for which it is produced and the audience at which it is aimed. A knowledge of these two facts is a requisite before production is started, as has been stressed previously.

Photographer

The doctor with a vague idea about photographing his work is a babe in the woods who little knows what he is getting into. If he chooses a neophyte cameraman on his staff to save expense, the results are usually disastrous. Even with a trained cameraman, whose higher fees he reluctantly agrees to pay, the problems of this cooperative effort are great.

A good medical cameraman must possess tact; his relationship with the doctor (who may have prima donna tendencies) must always be carefully managed. Suggestion, demonstration and compromise, may be tried, but never coercion. He must have a background of photographic experience and intelligence, just as any technician in a scientific field, and some medical training. He should be imaginative to some degree so that his results show taste and artistry.

Armed with an interest in scientific truth, some knowledge of medicine as well as of audio-visual principles, and the ability to use equipment properly, the photographer's final desirable attribute is an inquiring mind ever on the lookout for new ideas to portray, new methods to adopt, and new techniques to develop.

Conclusion

Medical teaching films have made great strides in the last twenty-five years, because those who make them and those who use them have studied the necessary ingredients, and because manufacturers have provided more specialized equipment for production. Competition has stimulated producers and teachers to make better films, forcing them to be scrupulously critical of their own work.

Note: At the Convention the author projected eight short film clips to illustrate the types of film he discussed.