same dose and drug. In addition, different methods of administering drugs are illustrated.

The importance of control observations and the influence of suggestion are illustrated by studying the effects of inert substances. This provides a valuable basis for the appreciation of the function of the "placebo" in therapeutic practice. The undesirable side-effects of drugs are also demonstrated, and the student learns that these effects must be taken into consideration in the choice of a drug for a particular purpose.

On the whole there was little disturbance of the normal routine of the student; the overall incidence of subjective effects in the class is shown in Table III. With the exception of five students, all the members of the class were

TABLE III.—Total Incidence of Subjective Effects in 70* Subjects Performing Experiments 1 and 3

Subjective Effects	No. Showing Effects
Nausea (without vomiting, 8; with vomiting, 13) ..	21 (30%)
Dizziness	33 (47%)
Other minor symptoms	39 (56%)
Sleep the following night:	
Sounder than usual	20 (29%)
Less sound than usual	13 (18%)
Same as usual	37 (53%)
Spent night in hospital	5 (7%)

* This number includes 11 who received dummy tablets or saline injections.

conducted safely and without incident to their home or lodgings by one or more persons not under the influence of any drug. Because of persistent vomiting or dizziness, or because the journey home involved a long period of travel, five students were accommodated overnight in hospital. For them it was an interesting experience, and they had all fully recovered by the next morning. There was little disturbance of sleep, except with those who had taken amphetamine, and this also served to illustrate the action of that drug.

Although it was clearly understood that attendance at the class was optional, all students eagerly participated and co-operated well in the arrangements necessary for the conduct of the experiments. Indeed, many of them welcomed the opportunity later of acting as subjects in further research on the action of drugs on man.

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According to *Time* magazine Dr. Willard Cole Rappleye, dean of the faculty of medicine at Columbia University, is reported to have said recently: "Medicine is becoming a social as well as a biological science. We would rather have a student with intellect . . . and a rounded capacity for life than one whose only view of humanity was gained as he passed from one laboratory to another. So-called 'premedical' education should be abolished in the colleges. . . . There is no such thing as 'premedical' education nor should students in colleges who plan to enter professional schools be regarded as pre-medical or pre-dental students. [College] education is not 'pre' anything, but should be devoted to the objective of providing as broad a cultural education as the institution can provide. It should be a preparation not for medicine or dentistry or public health, but for life."

SOME MECHANICAL AIDS TO INSTRUCTION

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Over the last two decades there has been a very marked shift of emphasis in instructional method from the aural to the visual. The two are, of course, complementary and neither can readily stand alone, but perhaps one of the greatest positive experiences emerging from the war was the wide realization of the great efficiency of the eye compared with the ear as a receptor of instruction. The Army Bureau of Current Affairs (ABCA) succinctly modernized the old Chinese proverb "One picture is worth a thousand words" to "One in the eye is worth two on the ear."

The newer methods of teaching are undoubtedly of very great value. Yet they often run the risk of being "over-sold" by their enthusiastic backers and of falling into disrepute for failing to do what they were never meant to do. They are "aids" to instruction, not instruction in themselves; they must never be used as a form of escape for the lazy teacher. To use these mechanical methods correctly requires more, not less, effort than the preparation of a lecture of the traditional type.

School-teachers have been quick to realize the value of the new methods, and many of the more enlightened local education authorities have set aside substantial resources to provide the material; to date most medical schools have lagged sadly, and the few that are progressing are often more impeded than helped by ill-informed enthusiasm. There is a widespread tendency to say, "Let's make a film of this, or a filmstrip of that," without consideration of the limitations or suitability of the media, or without proper understanding of the audience for which the

FIG. 1.—The simple type of drawing suited to the chalkboard.

NORMAL ANGIOCARDIOGRAPHY

FIG. 2.—The wall chart is usually more detailed than the chalkboard drawing, but must still retain clarity.

material is to be produced. Medical-school budgets are not elastic, and their resources must be directed to the greatest good of the greatest number.

The present article is a précis only, describing mechanical aids to instruction as they now exist and designed for the teacher who is to use them; it sets out to summarize their capabilities and their limitations.

The Blackboard

Better called the *chalkboard*, for it is easier to see when the board is blue and the chalk yellow. This is the simplest and yet the most abused class-room accessory (Fig. 1). A technique must be acquired and teachers must avoid overcrowding and poor legibility. The surface requires, but rarely receives, regular maintenance, and the local illumination should be high. It is possible to project a partially completed diagram on to a well-cleaned board, finishing it in chalk during the class, with consequent saving of time. To meet the request for a board which can be used in a darkened room at the same time as a projector, experiments are being made with ultra-violet light and fluorescent chalks.

The Wall Chart

Not unlike a permanent blackboard, the wall chart can be prepared in greater detail, as this is done in advance (Fig. 2). As with the blackboard, overfilling should be avoided, and the maximum use may be made of symbols on the lines of the familiar "isotype." To leave several charts exposed during the whole of a class is merely to distract the attention of the audience, and arrangements should be made for a chart not in actual use to be covered or rolled. In the preparation of instructional charts much can be gained from a study of the best class of advertising, though it should be remembered that a wall chart is for study and a poster is for instant reaction.

Models

The use of models is rather restricted in medicine, except in association with museum display (Fig. 3). The modern plastics have opened up a new field in the presentation of anatomical material, and for the more elementary forms of instruction plastic bones and viscera are more robust than the earlier plaster casts (*B.M.J.*, 1950). Serial scale reproductions of histological sections, cut in plastic sheet and cemented together, provide striking three-dimensional reconstructions in such fields as embryology. If a model is to be used in the lecture theatre it must be big enough for all to see, and great care is needed to light it to advantage.

The Epidiascope

There are two main methods of projection of material on to a screen. The image of an opaque original may be transferred to the screen by intense reflected light in an *episcope*, or a transparent original, the more familiar lantern slide, may be lit by transmitted light and projected on to the screen in a *diascope*. The *epidiascope*, most commonly seen in lecture theatres, is a double instrument designed to fulfil either of these functions at choice (Fig. 4).

Opaque projection can never make efficient use of the available light, for reflection never approaches 100%, but in spite of this the episcope offers certain advantages. Material from books or existing photographs may be employed, and subject to a limitation on depth of about 2 cm. it is possible to project solid objects such as instruments. The field size varies slightly with the maker, but

FIG. 3.—Model in conjunction with other exhibits.

FIG. 4.—A modern epidiascope.

in general the effective area of the original may be taken as a 6-in. (15-cm.) square. This area should be *filled* if the projected image is to fill the screen, and much episcopic projection fails because of the selection of too small an original; few books, in fact, have figures of adequate size, nor is it possible to change the pages of a book without much distracting "fiddling," all of which is thrown on the screen. It is therefore desirable to have material of more than ephemeral value mounted on standard 8-in. (20-cm.) cards, or a series may be mounted on a fan-fold strip for ease in storage or filing. It will be seen that the proper use of this instrument involves rather more than merely picking a book off the shelf and marking the page. Because of the greater contrast, the episcopes is most effective with line material.

Subilluminators

Certain epidiascopes have provision for lighting the platform from below. This enables the full area to be used for large transparencies—e.g., an $8\frac{1}{2}$ by $6\frac{1}{2}$ -in. (21.5 by 16.5-cm.) radiograph or the larger sizes of colour transparency. A warning is, however, necessary regarding the density of the diagnostic radiograph, which is rarely seen to advantage by this method. A special instrument accepting 17 by 14-in. (43 by 35.5-cm.) radiographs has been described (Dillon and Murphy, 1949); but on this the smaller sizes of film will not fill the screen, and there seems little advantage, as the preparation of a reduced transparency is not unduly difficult.

An instrument of perhaps greater possibilities has been marketed recently. In this the subilluminator throws its light through a horizontal band of transparent plastic on which the lecturer writes in grease pencil. The image is thrown on the screen as he writes. The use of this on a second screen while slides are thrown on the main screen suggests another possible means of communicating with a class in a darkened projection theatre.

Lantern Slides

The *diascope*, the oldest and best known of the optical aids, needs little introduction, yet, like the blackboard, even the slide is not always used to the best advantage. As stated above, the transparency makes far better use of the available light than does any form of opaque projection, although it generally involves rather more work in its preparation. The common British size is $3\frac{1}{4}$ in. (8 cm.) square, though organizers of international meetings should not forget that the American slide is $3\frac{1}{4}$ by 4 in. (8 by 10 cm.) and the Continental sizes are 83 mm. square and 9 by 12 cm. The projector should be equipped with carriers for all these sizes. A more recent introduction is the 2-in. (5-cm.) square slide, which is discussed below (Fig. 5). The marking of the slide to ensure correct positioning in the lantern is now international (British Standard 777: 1947), consisting of a single spot in the lower left corner when the slide is held to be viewed in the hand. The older British system of two spots in the top corners is obsolete and should be discontinued.

One of the most vexed questions is the amount of information which may be included on a single slide. While not going to the extremes of a peripatetic correspondent of the *Lancet* (*Lancet*, 1947), who needed a telescope in the back row, it must be admitted that the obscure overcrowded slide is far too common. The textual slide should bear the same relation to the lecture as the headlines of the evening paper do to the news. It is rarely necessary to throw a mass of figures or a long involved statement on the screen. A few salient words will canalize the audience's attention while the lecturer supplies the verbal detail. Visibility is paramount, and it is not reasonable to assume that the back row of the audience have better vision than 6/6 Snellen. It is easy, by a simple similar triangle relation, to estimate the distance at which a slide should be viewed in the hand in order to produce the impression of its size when projected on a screen of known size.

In general, typescript should be avoided, but where some better form of lettering is not available it may be assumed that only the amount of ordinary typescript which will fit on a postcard will be legible on the screen. Furthermore, typescript for reproduction must be perfect, and be preferably done through a new carbon without a ribbon, after

FIG. 5.—The two British standards of lantern slides (showing correct spotting) and an emergency carrier for 2-in. slides in a $3\frac{1}{4}$ -in. projector.

FIG. 6.—Special typewriter faces—showing the advantage of a clear image on an opaque ground.

cleaning the type. Certain bold-type machines are available and are of value (Fig. 6). It is the boldness rather than the size of the type which tells. Script is always more legible when projected as a white image on a black field than in the more usual black on white, as the glare is lessened; this has the additional advantage that selected words or lines may be washed in easily with transparent colour.

While discussing clarity it may not be inopportune to stress the need for regular cleaning and maintenance of both projectors and screens.

The 3½-in. slide is firmly entrenched in British teaching, and it will not easily be replaced, if only because there are very large collections in existence. Furthermore, this size of slide is just big enough to be viewed directly when set up on an illuminator, and can thus be made part of a static display.

The Miniature Projector

Why, then, has the 2-in. slide made its appearance, and what are its advantages? The original demand arose from the provision of 35-mm. colour material for use in cameras of the Leica or Contax type, which produced small transparencies (24 by 36 mm.) requiring projection. These were too small when mounted up for 3½-in. projectors, and

FIG. 7.—A modern miniature projector.

special instruments were produced. From this idea the modern miniature projector (Fig. 7) has evolved as an extremely efficient optical instrument designed not only for the small slide but also for the handling of 35-mm. film in continuous lengths, the filmstrip, while several models can be fitted with a head for medium-power microscopical projection. The 2-in. slide may be mounted in glass in the traditional manner, or it can be satisfactorily preserved as a section of film in a cardboard mask, a method valuable in these days of air travel. It has every virtue of the large slide except the possibility of direct viewing, while it has the enormous advantage of being cheap, light, and virtually unbreakable. And it is an international standard, a point of increasing importance with the post-war resurgence of international conferences.

The miniature projector provides a meeting-point between the slide and the filmstrip, a medium generally less well understood. The 35-mm. filmstrip (Fig. 8), a series

FIG. 8.—A 35-mm. medical filmstrip with its teaching notes and storage can.

of still pictures, with or without captions, is not merely a convenient substitute for a set of slides. Indeed, if that were the case the slides would be more suitable, for their sequence is easily changed. The strip is designed as a coherent whole, and the sequence must be logical and must evolve as a train of thought. The relation is far closer to the motion-picture film than to the slide. For the experimentally minded teacher it is, of course, perfectly simple to have a duplicate of the strip cut up and made into separate 2-in. slides, and if major changes are needed a strip can be reprinted. But essentially it is as complete as a book, and must be as carefully prepared and used.

There is a fairly wide range of filmstrips commercially available, but any teacher with a good illustration department behind him should be in a position to produce his own material. Furthermore, the projector is light and easy to handle, and there is much to be said for a medical school possessing a machine which the staff can borrow when they go afield to lecture to societies. This at least brings independence of the local projectionist, and ensures that the

machine will fit the film. It must not be forgotten, however, that there are still places where the electrical supply is not 230 volts 50 cycles A.C.

The Motion Picture

This is probably the most attractive and certainly the most dangerous of the mechanical aids to instruction (Fig. 9) : in most schools the film has not yet outgrown

FIG. 9.—A 16-mm. sound film projector with its loudspeaker unit.

the status of an "extra"—a distraction thrown in, but not really part of the instructional sequence. In spite of this there exist many excellent films, due almost entirely to the enthusiasm of individuals ; such films are made by the teacher for his own ends, and because of this they are often parochial in outlook and are therefore rarely shown except by the maker. In view of the amount of money and work expended in making it the film is thus often uneconomical. The real value of the film will begin to be seen when the schools co-ordinate their production and the "prestige" film is no more.

The great need, which can be met with comparative ease within the schools, is for the short factual film which can be used with as little self-consciousness as a lantern-slide or a blackboard. Many simple techniques can be initially taught by film when they involve movement. Where there are, on the other hand, a series of static stages, the filmstrip is the better medium. A repetitive movement, or any

FIG. 10.—16-mm. silent film (double perforated) and sound film (single perforated), showing the sound-track.

cyclical event, is suited to the *film-loop*—a few feet of film joined end to end and allowed to run continuously, repeating the movement as often as required (for example, a kine-radiograph of a joint movement).

The instructional film is almost invariably made on 16-mm. stock, and may be either silent or sound (Fig. 10). Silent film, perforated along both edges, runs at 16 frames a second. Sound film is perforated on one edge only and runs at 24 frames a second. All sound projectors may be set to run at 16 f.p.s., and will project silent film satisfactorily. Silent projectors, having teeth on both sides of the driving sprockets, cannot be used to project sound film, and, moreover, would ruin the film. It is therefore essential to examine a film with great care before projecting it, to determine its type and to ensure that it is correctly wound, in order to avoid this disaster.

Many teachers, using films which they know in great detail, have been accustomed to speak a commentary while the film is run silent. This of course limits use of the film to occasions when the maker is present, and a new development has made it possible to get over this difficulty.

Tape and Wire Recorders

In these machines sound is recorded magnetically on a moving tape or wire which can be played back any number of times. Sections can be erased and re-recorded at will.

FIG. 11.—A tape recording outfit coupled to a 16-mm. projector.

A modern machine of this type is designed to be coupled to a film projector (Fig. 11) and thus, by simple synchronization marks at the beginning of the tape and the film, it is possible to fit a commentary to a film without the elaborate procedure of recording and placing the sound-track actually on the film. This machine has other uses which may be of value in the medical school. It can record discussions ; a lecturer may practise, and may hear himself (often a chastening experience) ; and commentaries for film may be rehearsed and polished before proceeding to the expense of a final recording session on film. The organizers of international conferences may find in the tape recorder a solution to the language problem when showing films.

Screens

Various types of projector have been mentioned; it is necessary also briefly to discuss the screen. In most lecture theatres this is a neglected piece of apparatus, dirty and sagging. Yet as much care should be given to its selection as to the projector. The screen surface may be *silvered* (approximating to a mirror and therefore suited only to a long narrow room); *glass-beaded* (efficient, but costly and difficult to keep clean); or, best of all, a pure *matt white*, sprayed rather than brushed with zinc or titanium white, which does not darken in an industrial atmosphere. The size is a matter of some importance, and must be related to the projection equipment and to the room (Fig. 12).

FIG. 12.—The recommended proportions of a projection theatre using a matt white screen.

The picture should not be wider than half the distance from the front row of seats, nor less than one-sixth of the distance from the back row. The frame should be of dead black material, to absorb any "overspill" of the projected picture. In many of the older theatres it will be found that certain side seats are quite unsuitable, as they put the observer at a very oblique angle to the screen. When possible, these seats should be removed. With a matt screen the permissible angle is 30 degrees either side of the projector axis.

Screen brightness is an involved subject, and it is not proposed to discuss absolute levels in foot-lamberts, but a practical test should aim at permitting a level of house-lighting which will allow the student to make essential notes without noticeable degradation of the screen image (*B.M.J. Supplement*, 1950). Where a higher light level is required, the possibility of *rear-projection* on to a well-hooded translucent screen should be considered. Many local education authorities have provided this equipment so that the teacher may have greater control over the class than is possible in a darkened room.

Television

The latest newcomer to the field of instruction is the television camera (*B.M.J.*, 1949; *Lancet*, 1950) (Fig. 13), now transmitting colour over closed circuits. It would seem that this is likely to be of value to the postgraduate audience in surgery, but that its applications to medicine beyond this will be rather limited, and its very novelty may make it dangerous—in the same way as the motion picture.

FIG. 13.—Television equipment in an operating theatre at Guy's Hospital.

Certainly television from the operating theatre permits of no cutting or editing, and it may well prove to be merely boring—as so many operations already are to the onlooker.

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A G.P. ON HIS CLINICAL TRAINING

BY

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My opening gambit in this article must be to shift the responsibility for what I have to say to higher authority in the shape of my friend, the Editor. First, in that he asked me to write this account of "what I found both good and bad" in my own hospital education as a preparation for general practice. Secondly, in that, despite my evasive assurances that anything I could possibly say seemed to be covered by those numerous excellent reports that are the feature of these enlightened times, he has insisted on my delving back into those dark ages of 25 years ago when, no doubt in expiation of the sins of some former incarnation, I was for the space of two years and six months a hospital student at one of our older teaching hospitals.

Though I have a natural reluctance to make sweeping remarks, particularly when they are damnatory, in a scientific journal, I have no alternative as regards the hospital part of my education 25 years ago, for I believe it was wholly bad. It had certain minor features that might be described as good, but they did not redeem the whole.