

# THE ADAPTABILITY OF PAPER ROLL FILM IN ROENTGENOGRAPHY

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WITH the increasing interest throughout the country in tuberculosis in children, there has come an increasing interest in and demand for chest roentgenograms. It is generally accepted that in the majority of cases in children physical signs, malnutrition (10 per cent or more underweight), and history of contact as obtained from the child are of little value; that a positive intradermal tuberculin reaction tells us only that at some time the child has harbored living tubercle bacilli in his body; and that in many cases the only means by which the extent and severity of a significant tuberculous pulmonary lesion can be determined is roentgenographic examination. The cost of a finished X-ray film is approximately eighty-five cents, and to this must be added the expense of personnel for the technique and the interpretation of the film. In most cases it is desirable to take one X-ray with the child facing the film and another with the child standing in an oblique position, and in some cases it is necessary, for satisfactory interpretation, to have stereoscopic films. The total cost must be in the neighborhood of \$1.25 per film, which prohibits the examination of large numbers of children, except for special studies.

Two methods have presented themselves for study as possibilities for reducing the expense of roentgenographic chest studies.

Fluoroscopy has the advantage of simple apparatus, a single operator, facility in dealing with a large number of

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children in a comparatively short time and immediate interpretation. It has the decided disadvantages that fine detail is not revealed as clearly, that there is no permanent record for later comparisons and that the interpretation is usually the opinion of a single observer.

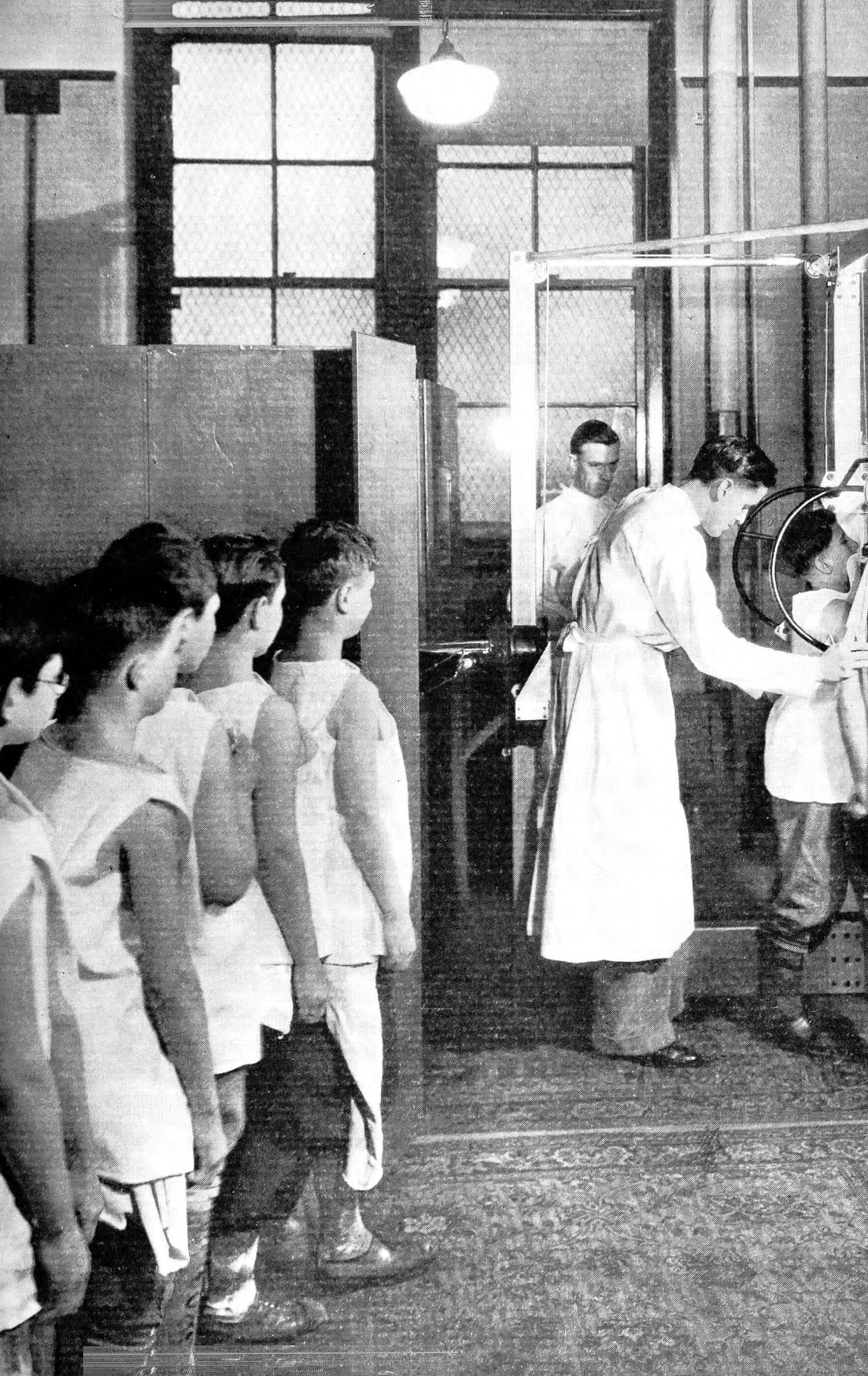
The other method is to find a film which shall be less expensive in itself, and which will lend itself to mass use with less expensive procedures and, at the same time, maintain adequately high technical standards.

During the summer of 1931 a film consisting of emulsion on one side of a rather heavy paper was brought forward by the Powers Reproduction Company of New York City and, at the request of the National Tuberculosis Association, the Bellevue-Yorkville Health Demonstration staff undertook to study the efficiency of these films.

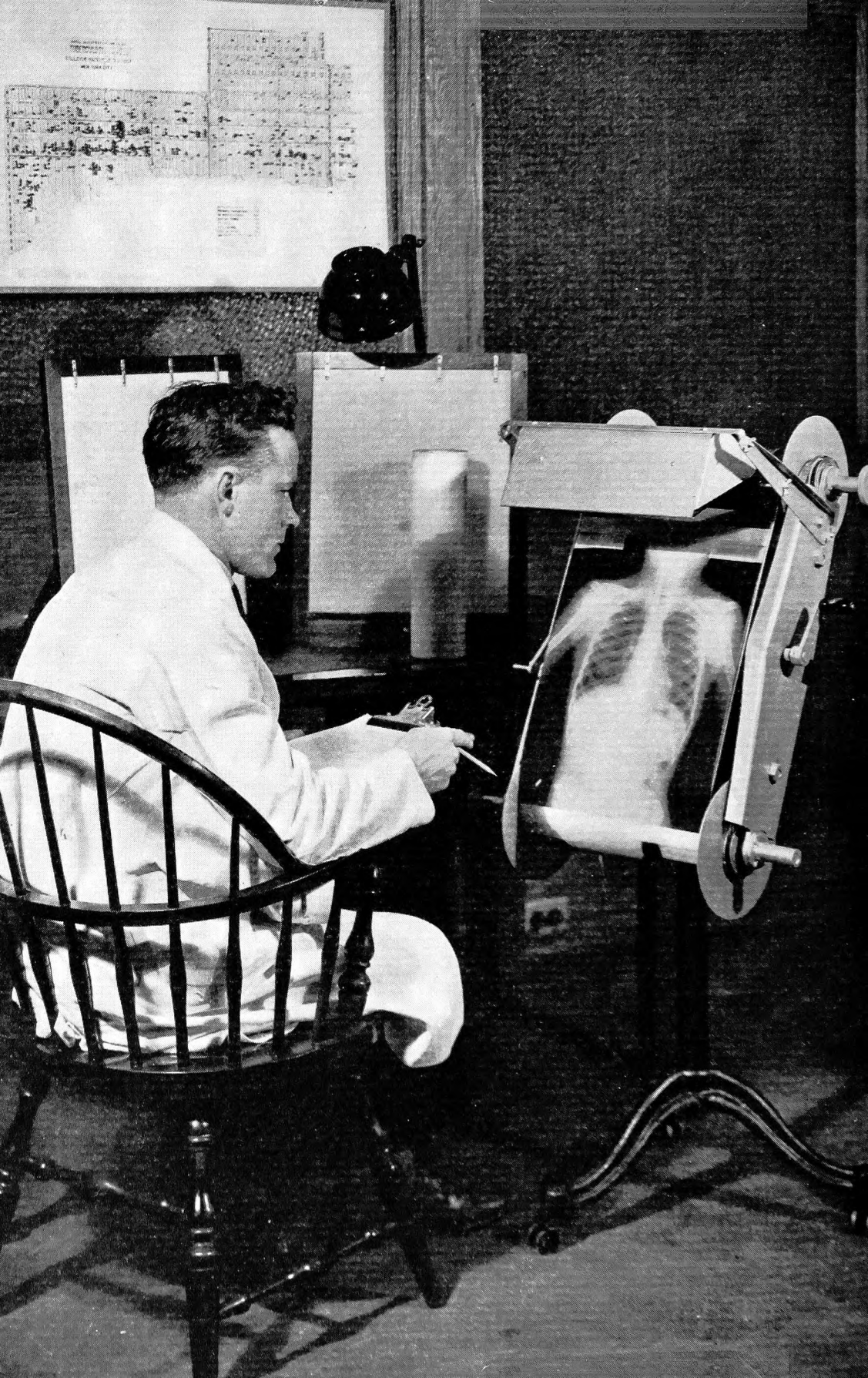
The paper, coated on one side with a photo-sensitive emulsion, may be placed in an ordinary film holder or cassette and the X-ray may be taken and developed in the usual manner. The result is an opaque positive which looks like a photographic reproduction of the transparent celluloid film which is in customary usage. It must be read by direct light instead of transillumination.

The technique of exposure is regulated in the same manner as with celluloid films. The tube target-film distance, the milliamperage, and the time of exposure are maintained as constant factors, the voltage being adjusted according to the thickness and development of the chest. At present, the tube target-film distance is forty inches for the posterior-anterior exposure and thirty-six inches for the oblique. The X-ray apparatus (Kelley-Koett 100-100) is set at 100 milliamperes, the time at 0.2 second, and the voltage is varied from fifty-two to eighty-eight K.V.P.

Although other solutions may be used, the best results







have been obtained by using a developer supplied by the manufacturers of the paper films.

In reading the films, there must be even illumination to avoid glare and reflection, which might cause errors in interpretation. The best method seems to be obtained from a 100-watt bulb behind a sheet of "daylight" glass.

To test the efficiency of these new films, a preliminary study<sup>2</sup> was made at the Bellevue-Yorkville Health Center of 100 cases, in which the clinical data and the findings of the celluloid film and paper film were all recorded separately, and then compared.

Generally speaking, the celluloid films are appreciably superior in showing fine detail. However, the paper films tally very closely and practically no significant lesions were missed in the 100 cases studied. It would seem that these new films would have a definite use as substitutes for the more expensive celluloid films in certain instances.

As a coarse screen to select cases for further intensive study from a large group, such as school children, food handlers, or factory employees, it is believed that these paper films would prove acceptable. As routine clinic records to show the extent of definite lesions or to record the progress of cases such as pneumothorax, they would be quite acceptable and much less expensive. For intensive study of fine detail and questionable lesions, one would probably need to check by means of celluloid films.

A further development in the use of the films and the reduction of cost is apparatus utilizing rolls of film with standardized, simplified technique, which makes possible the taking of two X-rays per minute with a fair degree of uni-

<sup>2</sup>Barnard, Margaret Witter; Amberson, J. Burns, Jr.; and Loew, Marion Franklin: Technique of Using Paper Films for Roentgenograms of the Chest. To appear in the *American Review of Tuberculosis*, June, 1932.

formity of quality. The roll of 250 films may be sent to the factory for developing and may then be read, still in the roll form, on a new viewing box equipped to handle the roll and illuminate it directly. Since the cutting, packaging, and wrapping of separate films adds greatly to their cost, and the placing of separate films in a viewing box takes considerable time and effort on the part of the interpreter, these new procedures to utilize roll films have reduced the cost to about one-third that of celluloid films. If an acceptable completed film, with its interpretation, could be accomplished for forty cents instead of \$1.25, a great deal more tuberculosis work, particularly among children, would be possible.

A more extensive study of 1,000 cases is now under way at the Bellevue-Yorkville Health Center. In this inquiry, as in the preliminary one, the clinical data and the findings of the celluloid film and paper film are being kept separately for subsequent comparison. It is anticipated that this second study will be concluded before the fall of 1932.

The Queensboro Tuberculosis Association is now using these new roll films in its project of X-raying 10,000 school children each year for four years. The X-ray apparatus is transportable and is set up in the school building.

After such large scale tests, it will be possible more closely to evaluate the assets and limitations of the paper films.