MEDICINE

New Light to Seek Germs

Fluorescence, Which Illuminates Modern Beauty Shops, Offices and Stores, Traps TB Germ Under Microscope

By JANE STAFFORD

FLUORESCENCE, which lights many modern beauty parlors, barbershops, stores and offices, is now being used like a detective's flashlight by scientists stalking tuberculosis, the Great White Plague.

Uncle Sam is using it to rule out tuberculosis among the young men coming up for training in America's peacetime army. It makes possible X-ray pictures of a man's chest and lungs that show the doctor whether or not he has tuberculosis.

Latest development in this particular TB stalking is the use of miniature films which enormously cut the cost of X-ray examinations—an important item when millions of men must be examined.

When a suspicious spot is seen on these pictures of the lungs, doctors turn to the laboratory for confirmation of the diagnosis of tuberculosis. Sputum or other fluids from the body are examined under powerful microscopes in a search for the tuberculosis germ itself.

Latest aid in this part of the TB stalking is the use of the new kind of detective flashlight, fluorescence, to spot the elusive germs. Stalking tuberculosis germs with fluorescence is said to be a more sensitive method than any hitherto available in America. It promises to find the germs earlier and to make more certain that treatment has arrested the disease.

Fluorescence, or fluorescent light, is made from invisible light. To make it, ultraviolet light waves, so short they cannot be seen, are stretched, when they strike certain chemicals, into longer waves which can be seen. Fluorescent light is also made from X-rays, which are really light waves even shorter than ultraviolet waves. When an X-ray examination is made, it is the fluorescent light, made by the X-rays as they hit certain chemicals on the screen over the patient's chest, which illuminates the lungs inside the chest so they can be seen. Even for X-ray photographs, fluorescent chemicals are put in the plate, or a fluorescent screen used in contact with it, to speed up the exposure.

Without fluorescent light, TB stalking in the laboratory is done by putting a drop of sputum on a glass slide and then staining it with a red dye, carbol-fuchsin. This must be steamed into the germs and the background is then counterstained with a blue dye. The tuberculosis germs appear as slender, minute red rods against the blue background, but they are often very difficult to find. The slide is put under a high-powered microscope with a delicate oil immersion lens, and the TB stalker spends many backbreaking hours searching every tiny bit of the material on the glass slide. Frequently more than one slide must be examined, and the sputum or other material must be concentrated before examination in order to find one or two of the tiny red rods.

When the new method is used for stalking TB germs under the microscope, the suspected sputum or other material is put on the microscopic slide and soaked in a dye, carbol-auramin, which then is bleached from all the material except the bacteria, which retain it.

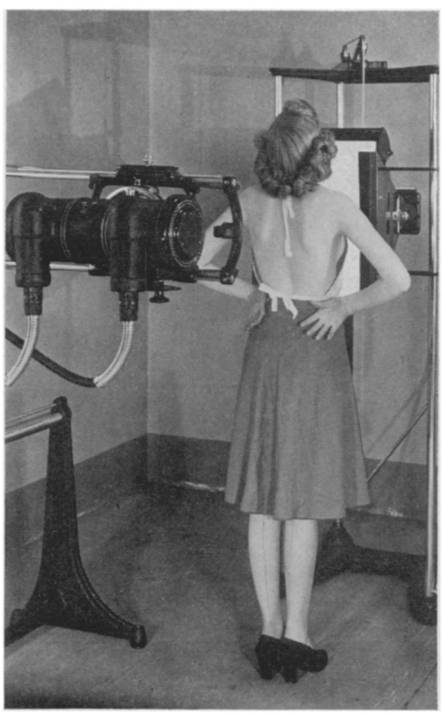
When placed under a microscope, illuminated with invisible ultraviolet light, any tuberculosis bacteria present glow as bright yellow rods easily seen against a nearly black background, since the dye has the power of fluorescence. So great is the contrast that lower power microscope objectives are sufficient to show them. Magnification of 400 diameters is enough.

Delicate oil immersion objectives no longer need be used and more of the material may be seen at the same time. Rapid searching of the slides is possible with little likelihood of missing even a single bacterium. In addition to the time saved in looking for the germs, the time of preparing the slides for examination is cut down because no counter-staining and no steaming processes are required.

This method of TB germ stalking was first devised by Dr. P. K. H. Hagemann, a German physician. The equipment has been improved, simplified and proven useful by Dr. Oscar W. Richards, in the research department of the Spencer Lens Company. Careful comparisons of results with the fluorescence technic and the old style method of looking for TB germs in sputum or other material have been made by Dr. Richards, Dr. David K. Miller, of Buffalo, and Dr. E. E. Kline and Raymond E. Leach of the Cattaraugus County, N. Y., Laboratory. These scientists all found the fluorescence technic more sensitive and quicker than the method they had been using, when measured by the number of germs found and the ease with which they were located.

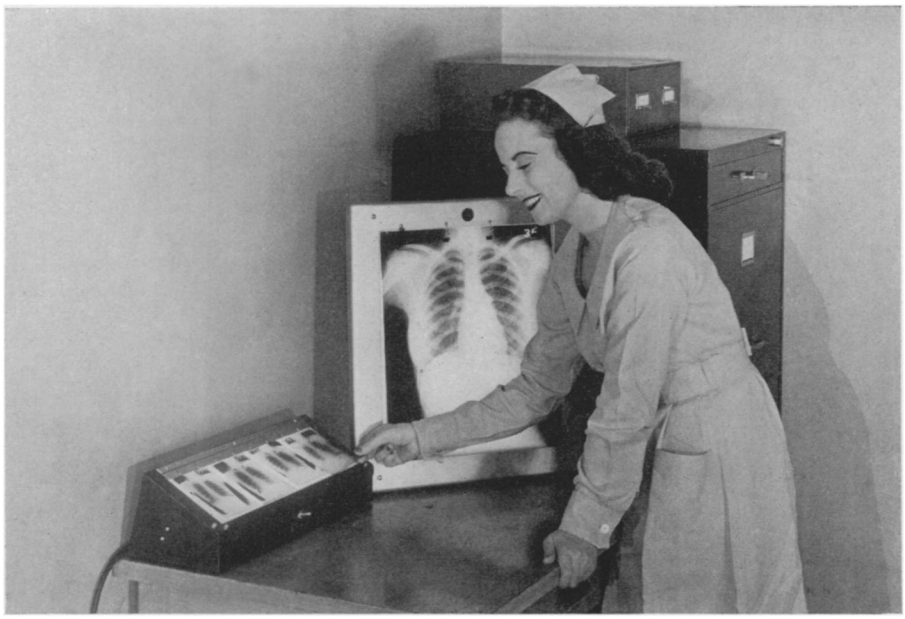
"The greater sensitivity," Dr. Richards explains, "is due to the carbol-auramin combining with more of the bacteria than does the carbol-fuchsin and being less easily removed; as well as the greater visibility of the preparations. The added sensitivity is important to establish early infection, in the examination of difficult materials, and greater assurance that proper treatment has arrested or cured the disease."

Before the disease can be treated and cured, the patients must be found, and



MINIATURE X-RAYS

A patient (not a draftee) stands in front of the new type X-ray camera that automatically reduces a large picture to a 4 x 5 inch film. The X-ray tube, of conventional type, is at the left. Just in front of the patient is the fluorescent screen, while the camera proper, which photographs it, is beyond.



LARGE AND SMALL

Comparison of the new small films with the usual size is shown to the right. Four of the reduced films are seen in the small viewer, and one of the usual size to the nurse's right.

the earlier they are found and start treatment, the greater their chance of recovery. In the early stages, however, this disease gives little sign of itself. By the time the patient is coughing, or having hemorrhages, the disease has been well established. Long before this the patient is sick, though he may not know it, and is endangering his family and associates with the germs from his body.

In order to find these patients in the early stages, health authorities try to examine as many apparently healthy people as possible, especially those in the age groups most likely to have tuberculosis. Mass surveys in schools, industries and among other groups of people have been conducted.

Uncle Sam is on the lookout for tuberculosis in every man who comes up for training under the Selective Service Act. Army training would prove too strenuous for persons with tuberculosis, besides which the presence of unsuspected tuberculosis patients in a training camp would be a danger to other men.

The methods used for detecting early cases of tuberculosis are the tuberculin test, which is a skin test, and the X-ray examination of the chest and lungs. Cost of the X-ray films has limited the number of such examinations that could be made, although otherwise it is considered both valuable and practical for detecting unsuspected tuberculosis.

Cost of films and processing chemicals represent only a comparatively small proportion of the total cost of X-ray examinations. The major part of the cost goes for X-ray apparatus, overhead, and the professional services of the physician and his technicians. Reduction in film size, however, is considered highly important in surveying large groups of people because the expenditure for materials required by the small film method is only about one-tenth of that needed for the conventional procedure. This means that for a given amount of money to be spent for films and chemicals, ten times the number of patients can be examined with four-by-five-inch films as could be done with 14x17-inch radiographs, the ordinary X-ray pictures.

The four-by-five-inch films will be used by the Medical Corps of the U. S. Army for its TB stalking among recruits and Selective Service trainees, it is indicated by an announcement from the General Electric X-ray Corporation of an order for 45 of the units that make these small films, to be delivered as rapidly as possible.

Saving in cost of films for mass examinations can be made by using 35-millimeter films, Dr. W. Palmer Dearing and Alexander E. Turner, U. S. Public Health Service, have recently reported. In their studies, the pictures were taken with portable X-ray equipment manufactured by General Electric and by the Westinghouse X-ray Company.

Fluorescence has to be used because the short-wave X-rays, though similar to light, cannot be bent with lenses. If they could, it would only be necessary to focus them on a small film, as in the ordinary camera. Instead, they must be converted to light, and that used for the picture.

Accordingly, the new apparatus has a fluorescent screen. If you were to look at it, when the examination is being made, you would see the patient's ribs, and his lungs inside. But it is enclosed, and a fixed camera, permanently focused on the screen, and with a high speed lens to permit the shortest possible exposures, looks at it and records what it sees. The films are in long rolls, they can be quickly changed for the next picture, and records rapidly made.

Certain precautions, of course, must be taken, since film exposed directly to the X-rays will be fogged and ruined. The camera, and especially the film holder, must be made of lead, through which the rays cannot pass. Spare rolls of film must be kept in lead boxes. Fortunately, the X-rays travel only in straight lines, so a lead screen between film and tube is enough. Also, the outfits are so constructed that the X-rays are confined to the path they must follow in taking the picture. Stray radiation, which might be harmful to the attendants, is eliminated.

The 35-millimeter film is the same size that is used in theatrical motion pictures and also in some of the most popular sizes of candid cameras. It is relatively inexpensive, but the picture is so tiny that it must be magnified to see the details. However, it is used widely by libraries as "microfilm" for copying documents, and special reading machines are commercially available. These project a single picture to a ground glass screen 11x14 inches. Such a reading machine would be ideal for examining X-ray pictures, since mechanism is provided for rapidly shifting the film.

The 4x5-inch film, however, gives a picture that is large enough to be examined without magnifying, so, in some instances, it may have an advantage.

Science News Letter, February 8, 1941

RADIO

Prof. Arthur Allen, ornithologist of Cornell University, will tell of his work in recording bird sounds as guest scientist with Watson Davis, director of Science Service, on "Adventures in Science," over the coast to coast network of the Columbia Broadcasting System, Thursday, Feb. 13, 3:45 p.m. EST, 2:45 CST, 1:45 MST, 12:45 PST. Listen in on your local station. Listen in each Thursday.