how intense is the Hungarian desire for freedom like ours. Make yourself familiar with the history of Italy's long struggle for unity and liberty—the "Young Italy" movement—the life of Mazzini and Garibaldi. So your sympathy and understanding will develop and immigration will have a new and rich significance for you. As a true American—patriotic, far-seeing and intelligent, you will say, "these people, brothers and sisters all, shall be, no longer, 'strangers within our gates,' but 'as the home-born' among us."

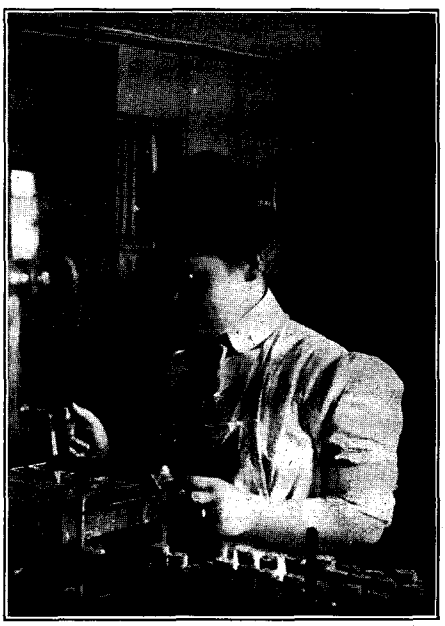
VI—A Bacteriologist at Work

By Ruth O. Pierson, Bacteriologist, Cooperating Boards of Health, Wellesley Hills, Mass.

My "work as a bacteriologist" did you say? "And what field there is open to others along this line?" That would be too long a story for me to tell in full here, but it is such interesting work that every day of my life I'm glad that I am at it. This reason prompts me to tell you some of my experiences.

Now a bacteriologist is one who examines and studies bacteria. There is some vagueness in the minds of many people as to what bacteria are, so we had best start aright by referring to a solid definition. Bacteria are microscopic plants of various shapes and sizes capable of growing and multiplying, under favorable conditions, and of doing much good or much harm, or of simply being neutral. Before you have time to ask another question let me invite you to my laboratory on the top floor of the Capitol Building, in one of our Eastern States. If you were attending the State Normal School in the same city, you would make at least one visit to the Bacteriological Laboratory of the State Board of Health. And if you attended the State University or the Technical High School, or if you had some friend who was a Senator or Representative, you might also receive an invitation to what the State House Guide once called "The Show Room of the State House." Or your visit might be to a Board of Health Laboratory in a city or in a town. At any rate accept it, for you will see many wonderful and practical things which show what almost all health departments are now doing to protect "The Common Health of the Common Wealth."

When you enter the laboratory you will find yourself in my work room. Here are glass bottles and flasks and test-tubes and one or more microscopes

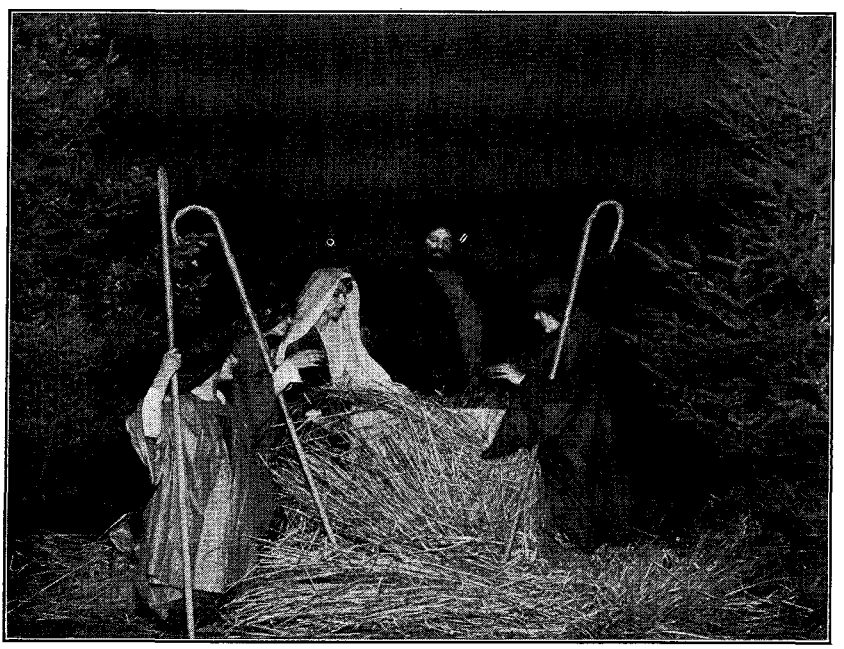


MISS RUTH O. PIERSON IN THE WELLESLEY HILLS LABORATORY

and some sterilizing ovens of different kinds, and a large copper incubator kept always at body temperature (98.6 degrees), and a refrigerator and other apparatus which is necessary for the growing and examining of bacteria. Of course the microscopes are on the long black bench in front of the windows, because we need the best light for this fine work. On the bench are various specimens laid out. At one end of the bench near the microscopes are little opened boxes—anywhere from 6 to 20 or 50 or more—arranged in rows, each one numbered. In every box are two

test tubes containing material to be examined. These are the "cultures" which were received on the morning of your visit, from physicians and school nurses to be examined for diphtheria. Each culture was taken from a person who had a sore throat or who had been exposed to a case of diphtheria. Smears were made on glass slides from these cultures and stained properly for testamination of the cultures he has sent, so that he may know whether or not his patient has diphtheria.

On another part of the work-bench are cards of glass slides with a drop of blood on each, and a number to correspond with the identification card sent by the doctor. These drops of blood came from patients who had fevers and some are to be examined for typhoid



POLISH, GREEK (MADONNA) AND ITALIAN GIRLS POSING FOR HOLY FAMILY AT CHRISTMAS FESTIVAL 1915

ing. On one of these slides placed in the microscope you would see little patches of blue color, and after adjusting the lenses carefully you would discover that the patches were made up of little fine blue lines, some parallel and some at angles, quite different from anything you ever saw before; but my long acquaintance with them makes me recognise them as one would an old friend or enemy. Some of these bacteria are harmless and some I recognise as diphtheria germs. Every morning as soon as the cultures are examined, I telephone to each physician the results of my exfever and some for malaria. Under the microscope these are wonderful pictures. But you must see them for yourself. Then we have specimens of sputum from persons who may have tuberculosis and the doctors who sent them have asked whether tubercle bacilli (the germs causing tuberculosis or consumption) are found in the specimens which they have sent. Then there are various other specimens to be examined for other communicable diseases. As soon as each set of tests is made, these results are reported to the physicians who sent the specimens, so that they may know with

greater certainty how to treat each case. This is one kind of bacteriology—the diagnosis of diseases by laboratory examinations.

There are other kinds of tests made in my laboratory, such as examinations of milk and of water and of sewage and of many other interesting things. Nowadays all the public water supplies are regularly examined either by the local boards of health or by the state. When I was connected with the State Board of Health I examined every month about a hundred samples of water and sewage. The water was from the public supplies and the sewage came from the various sewage disposal plants. In both cases the examination consisted of determining the total number of bacteria per cubic centimeter (a recognised standard amount corresponding roughly to about 16 drops). The water was further examined to discover whether or not it was safe for drinking purposes. And the sewage was tested to see if it had been sufficiently treated with chemicals to make it a harmless waste when emptied into the rivers or spread out on the disposal beds. You will readily see the need of such precautions in guarding the health of the public.

Likewise the laboratory examinations of milk are as interesting as they are necessary. Much more attention is now eing paid to the supervision of the milk pplies than was formerly thought pos-sle or necessary. Now our regular r-tine laboratory tests of milk consist of etermining its cleanness by bacterial ex-ination and its richness by chemical test According to law in many states all lk sold within the limits of that state ust be of a certain richness—that is, it ist contain at least a certain per-centa of butter fat and a certain per-centag f total solids. The standards of clea ess are usually established by the loc boards of health, which provide th no milk containing over a certain nber of "bacteria per c. c." shall be d within the limits of that city or to. These milk tests are also made in the Board of Health Laboratory.

My work now covers a larger scope, for at present I am connected with a unique form of health organisation (in another eastern state). This is known as the Coöperating Boards of Health and is the organisation which renders complete health service to a group of six towns and partial service to four others. This was begun as an experiment, the first of its kind, but is now, after about three years, on a self-supporting basis. Contracts are made with each town independently, and the Director of the Coöperating Boards of Health is the "Agent" or Health Officer of the Board of Health in each of the towns to which we render complete service. Here I am bacteriologist and chemist and in the absence of the Director, his responsibilities fall upon me. This organization has its headquarters in one of the central towns, and thus provides a central office and laboratory. The work of the Coöperating Boards of Health is accomplished by a Director, a bacteriologist and chemist, three sanitary inspectors, two stenographers and an assistant. The laboratory is well equipped with apparatus and materials for making the necessary tests and analyses.

Come with me to headquarters this morning and let us see what will happen. On arrival I may find in the incubator ten cultures which have been brought during the night by messengers from physicians; these are to be examined for diphtheria. Then there are probably a few blood specimens to be examined for typhoid and malaria and some specimens for other diseases. The morning's mail may contain, among others, a letter from some resident in the town of A, stating that some store or market is allowing refuse and vegetable matter to accumulate in the back yard till it has become offensive and a nuisance to the neighbours. A letter from a tenant in the town of B may report that a trap in the kitchen sink is leaking and causing an unsanitary con-

dition in that house. One of the sanitary inspectors starts on his motorcycle to inspect the two complaints, for A is on the road to B and he can attend to both on one trip. The telephone rings and a new case of scarlet fever is reported in the town of C. The family may be poor and not able to afford the necessary care for the patient at home and to have at the same time the bread-winner quarantined, so arrangements must be made with a nearby hospital. This is done by telephone and the ambulance ordered, but an inspector must go to the house, after the case is removed, and fumigate and give instructions concerning disinfection and further precautions to be taken against the spread of scarlet fever in that home. (Some day fumigation will be replaced entirely by disinfection.) In the meantime the examinations of the cultures show that a child in the town E has diphtheria. This is a very quickly progressing disease and must be attended to at once. The result is telephoned to the doctor and our Director himself may go out on this case, as soon as the automobile returns. One of the inspectors has been out with the auto since three o'clock in the morning collecting, from milk wagons in the town of D, samples of milk to be analyzed at the laboratory. The Director takes with him some antitoxin which the physician has requested, and some disinfectant and a placard. The placard he leaves on the outside of the door and inside he meets the doctor, who has taken cultures from the other members of the family who have been exposed. The doctor uses the antitoxin and the Director instructs the family concerning their quarantine, and gives his orders as to what precautions to use to prevent the spread of diphtheria. Then he brings the cultures to the laboratory. If the doctor had not been at the house the Director would have taken the cultures himself. These cultures must be left in the incubator for several hours to grow, and will be examined the next morning.

The afternoon will be spent by the Director and one of the inspectors in keeping office hours in the other towns. The inspector who was out early will probably sleep all the afternoon. The other inspector may spend the afternoon making sanitary inspections or inspecting dairies. The stenographers will be kept busy with dictated letters, reports and records. The assistant will probably be occupied with laboratory routine, and my time will be divided between the laboratory and the office.

There are other fields in bacteriology which I have not mentioned, but which are likewise attractive. Among these may be cited the large field of prophylactics—the vaccines, antitoxins, and different kinds of serum used to cure some diseases and to immunize against others. Recently an invitation came to me to fill the position of head of the Bacterial Vaccine Department of a large commercial manufacturing company in the middle western part of the country. I did not accept it because I am personally more attached to public health work than to commercial enterprises. At another time I was invited to take up the production of one of the artificially soured milks, such as go popularly under the names of lactone and lactab and lactobacilline, the various kinds of buttermilks, and so on.

Thus you see that bacteriology opens a field of various opportunities—even many more than I have mentioned. The public is realising more than eve before that some bacteria are healthf and some are harmful, and that it quires a bacteriologist to decide wh are our friends and which are our fs.

In the future, we can hope to ve longer, because specialists are wo ng on this very problem of saving an reserving health. The health artments are cleaning up our citi and towns and discovering and pre ting the spread of diseases. The man cturing concerns are producing vac s and similar cures. And certain mi laboratories are providing the variou inds of buttermilk, which are so m in demand for building up our co tutions.

A NEW AGE OF MIRACLES

BY JOHN HAYNES HOLMES

Dr. Holmes is the minister of the Church of the Messiah (Unitarian) of New York City. This article is the outcome of a sermon on miracles recently preached before his New York congregation. The subject, "The Angels of Mons" and the other alleged supernatural events of the European battlefield, is arousing a widespread interest especially in religious circles. In this article Dr. Holmes presents a rationalistic or scientific exposition of these events In an early issue of THE BOOKMAN *Rev. Joseph H. McMahon, rector of Our Lady of Lourdes (Roman Catholic) of New York City, will discuss this subject from another point of view. While recommending these articles as the sincere work of scholarly and distinguished men* THE BOOKMAN *does not stand sponsor for the opinions expressed therein.*

EVER since the Higher Criticism became a factor in religious thought it has been the wish of theologians, historians, and Biblical students generally, that a new age of miracles might, by some belated miracle itself, dawn upon the world. In modern times the phenomena of the miraculous have practically disappeared, with the result that the study of these alleged events is as difficult as the similar study of extinct forms of animal and vegetable life. What we need, say the scientists, is a reappearance of the miraculous in nature, or a recrudesence in the human mind of a belief in the miraculous. Then could we study the facts involved at first-hand, and come to an understanding perhaps of all that is reported to have taken place in this peculiar field of history.

Rumours which have for months, now, been drifting to us from across the seas, would seem to indicate that at last, after years of waiting, the hoped-for new age of miracles has arrived. From Russia comes the assertion that angels, clothed in white and crowned with gold, have been seen leading the host of the Czar into battle. From "somewhere in France" comes more than one report that Jean d'Arc has revealed herself to French officers, and guarded them upon the field of honour. From England comes the thrilling story that the drum of Sir Francis Drake, reported to sound whenever "merrie England" is in dire peril, has again and again sent its mystic roll of thunder across the plains of Devon. Unique, however, among all the narratives of the miraculous, for its poetic beauty as well as its alleged authenticity, is the wondrous tale of the Shining Bowmen of Mons. It was during the Retreat of the Eighty Thousand, so we are told, that an English "Tommy," hard pressed by the Prussian hosts, bethought himself by chance of a rude figure of St. George and its accompanying motto, *Adsit Angles Sanctus Georgius,* which he had once seen on the plates of a London resaurant. Thinking that now was the time, if ever, for the Saint to protect his worshippers, this soldier offered up the Latin prayer as he vigourously worked his musket—and lo, the miracle! Suddenly upon the field of battle, between the Germans and the English, appeared a host of bowmen, ghostly warriors from the ancient field of Agincourt close by. Loud above the roar of rifles and of cannon sounded the shout, like thunder in the skies, "St. George for England." And the hosts of Germans, like clouds before the sun, were scattered, and the English army saved. Curious confirmations of this occurrence have appeared.