# The Chronic Disease Laboratory in Public Health

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IN A TIME when the triumphs of technology have literally made real many of man's most fanciful dreams, I may be pardoned if I venture some bold ideas about the future of laboratory work in public health.

I honestly believe that we shall live to see the time when laboratory tests will penetrate the mysteries of the chronic diseases. I believe that, ultimately, laboratories will be able to identify most, if not all, of the leading chronic diseases through simple, valid tests that will be economical to perform.

For example, the "fingerprints in the blood" which we are only beginning to understand may eventually reveal through the analysis of a single blood sample the presence or absence of a whole array of chronic conditions. Most important, such future testing can detect the presence or even the threat of a chronic disease in ample time to heed the warning.

Medical science, by its conquest of the infectious diseases, has not ended an era. Rather, it has opened an even greater era, which will be known in history for victories won over the chronic diseases. And, as in years gone by, laboratories again will be the shock troops in the attack that has now commenced.

Some 70 years ago, a small room in the Marine Hospital on Staten Island, N. Y., was set aside as the first Public Health Service laboratory. It wasn't long before States set up similar laboratories all over the country. These laboratories have been landmarks in the progress of the modern public health movement in the United States.

Epidemiology, the central discipline of public health, cannot exist without the laboratory, any more than the automotive industry can exist without highways.

No reminder is necessary of the amazing progress in laboratory testing in recent decades. Progress has been equally notable in pathology, biochemistry, toxicology, bacteriology, mycology, parasitology, and serology.

In an effort to determine the extent to which State public health laboratories had expanded into the chronic disease field, the American Public Health Association's Committee on Laboratory Services in the Chronic Diseases sent out a questionnaire in 1957 to State laboratory directors.

Having been granted the privilege of quoting from the interim report based on that questionnaire, may I first commend one of its introductory statements:

"Since the chronic diseases fall for the most part in that category of illnesses . . . in which secondary levels of prevention, such as early diagnosis and treatment are important, it seems obvious that the laboratory should have a place in their control."

In connection with this philosophy, a most important finding of the questionnaire is that 20 out of 32 State laboratory directors who responded believed in the need for providing chronic disease services in their laboratories. Only 7 of those reporting did not so believe.

The interim report shows that 11 State laboratories are now performing a significant number of tests in the chronic disease field in addition to blood grouping or blood typing.

Certain States (Maryland and Wisconsin are discussed in the interim report) are already engaged in large-scale chronic disease testing

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in a wide range of areas. Surprisingly, lack of funds was given as the major reason for not expanding chronic disease laboratory services. Lack of space and lack of trained personnel were listed as other obstacles.

If funds and personnel were available, 15 States indicated they would undertake blood sugar determinations, 14 would do Papanicolaou smears, 13 would do blood grouping, and 9 would start blood chemistry. Many other types of testing would be initiated in other States.

In a supplementary inquiry, the Division of Special Health Services, Public Health Service, recently polled the State health department laboratories again, using regional office staffs to gather the data.

We were interested mainly in learning the extent to which some of the basic tests were being performed by State laboratories. The results corroborated the earlier findings. A great deal of valuable work is being done along these lines.

No fewer than 19 States reported blood sugar testing: 9 of these were engaged in screening; 5 in routine quantitative testing; and 5 reported use of the clinitron.

Nine States test for blood cholesterol.

Twelve have programs for examining Papanicolaou smears.

Five do rheumatic fever (antistreptolysin titer) testing.

Two test for rheumatoid arthritis.

A variety of other tests are being performed by one or more States, including, of course, blood grouping, blood typing, and urine analyses.

Although it appears that a significant amount of chronic disease testing is performed by many State health department laboratories, we must face the fact that 20 States reported no testing of any kind for noninfectious diseases. I believe that this picture will change. It is bound to.

### New Tests and Machines

Several exciting new tests and possibly even more exciting new machines are now being used by testing laboratories.

The Papanicolaou smear is not a new test, but its application in large-scale casefinding programs is relatively new. Recognition by the public health and medical professions of the great possibilities of the cytological test for cervical cancer is truly exciting. This simple, usable, and teachable test has brought one important phase of cancer prevention within the range of classic public health and preventive medical practice. The laboratory has made this possible.

Another exciting cancer advance is perhaps foreshadowed by the work of Dr. Claude Hitchcock of the University of Minnesota, who reports that screening for low acid content or absence of acid in the stomach is an effective means of diagnosing gastric cancer in the asymptomatic phase.

Screening 12,000 men and women over a 10½-year period, Dr. Hitchcock found the incidence of cancer 4½ times greater among patients with no acid or a low acid content of the stomach. He recommends annual gastrointestinal X-ray examination for the latter group and an examination every 9 months for the former group.

In the bentonite flocculation test, a type of colloidal clay (bentonite) is mixed with normal human gamma globulin. When the test is positive the clumping or flocculation of the mixture can be seen under a microscope in a few minutes. This test was positive 85 percent of the time when used on 82 verified cases of rheumatoid arthritis at the National Institutes of Health.

A new approach to the prevention of rheumatic fever is heralded by a testing process employing a fluorescent dye to "tag" serum antibodies. (See *Public Health Reports*, October 1958, p. 884.) This method, if it proves applicable, promises to be fast and simple. Positive results may be reported on slides containing only 200 bacteria. Conventional tests require as many as 100 million organisms, the culturing of which may take a week or more. Most laboratory technicians can perform the fluorescent dye tag test, given the training and equipment.

Never in the 70-year history of public health laboratories in this country has the development of new laboratory tests moved at so rapid a pace as during the last decade. Fresh progress is reported monthly.

To mention only a few of the testing machines, machines that are as exciting as the new tests themselves, the great utility of the Papanicolaou smear may now be enhanced tremendously by an electronic machine called the cytoanalyzer. This device supplements the technician in the microscopic search for malignant cells. Abnormal cells are counted electronically on the basis of structural characteristics. The cytoanalyzer, when perfected, has the potentiality of screening thousands of slides daily. Seldom has an invention more perfectly fitted the needs of casefinding.

For blood analysis, among several new machines introduced on an experimental basis is the autoanalyzer which performs, through the use of automatic colorimetric analysis, routine determinations of urea, sugar in blood, and calcium in serum. The results of the analysis of the blood sample, indicating the concentration of certain substances in the blood, are permanently recorded every 90 seconds, permitting 40 determinations an hour.

### Disease "Fashions" and the Laboratory

Laboratory practices reflect the current "fashion" of prevailing disease. Today, blood is being fractionated and the characteristics of these fractions are being determined by many new methods: spectroscopy, electrophoresis, and paper chromatography. A whole new armamentarium of disease detection is slowly but steadily being developed.

During the early decades of the 20th century when such diseases as smallpox, malaria, diphtheria, pneumonia, typhoid fever, tuberculosis, dysentery, and the communicable diseases of childhood were the primary threat to life, laboratory practices reflected the logistical importance of these diseases.

With the aging of our population and the relative increase in incidence and importance of the chronic noninfectious diseases, laboratory practices are slowly but steadily beginning to reflect the growing importance of these currently more "popular" diseases.

There has been a significant lag in the widespread use of available tests for noninfectious diseases, few as they are, partially because of difficulties in retraining professional and other laboratory personnel in new methods of laboratory analysis. Some of the lag can be attributed also to the belief that public health laboratories should not become involved in tests for noninfectious diseases; and some of it has been caused by the scarcity of precise and economical tests.

But much of the lag, in my opinion, can be traced to inadequate funds and inadequate staffing of public health laboratories. These inadequacies, of course, are attributable in large part to the lack of appreciation of the value of laboratory procedures in the early detection, diagnosis, and control of the chronic, noninfectious diseases, and the lack of public and professional support for expansion of these activities.

When mass chest X-ray programs were first introduced, the demands for the services of private radiologists increased because of the many new cases of treatable tuberculosis that were found. I am confident that this phenomenon will be repeated when adequate methods and facilities are developed and put into widespread use to insure the early detection of unsuspected cancer, diabetes, heart disease, and arthritis. In fact it seems that the importance and stature of clinical pathologists will rise in direct proportion to the expansion in the number of laboratory tests that are done on apparently well persons for the purpose of identifying asymptomatic diseases.

The battle against these noninfectious killers is a common battle. The private physician and the clinical pathologist are fitted to lead and direct the various campaigns against them. Public health physicians and their staffs and the directors of State and local health department laboratories and their staffs are in a position to give invaluable assistance to private physicians and clinical pathologists so that the efforts of all of the professional groups concerned may be effectively coordinated. Through their joint action, the public is bound to benefit.