

The TDH Laboratory...At the Forefront of Technology

National Medical Laboratory week, April 12-16, is a time to recognize the contribution medical laboratories make to health care. The Texas Department of Health Bureau of Laboratories (TDH Laboratory) has pioneered testing in many areas throughout its history and continues today to make significant contributions to public health. This report traces the TDH Laboratory's growth from its small beginnings in 1896 to its current presence as a national leader, providing state-of-the-art laboratory services to health professionals in Texas and a model to laboratories nationwide.

The need for laboratory support for public health in Texas was first recognized officially over 100 years ago. In 1896 the state health officer asked the legislature for \$2,000 per annum so the Texas Quarantine Department could add two scientists to its small staff: a microscopy expert and a chemist to analyze drinking water and perform bacteriological examinations.

In 1904 the Texas Pasteur Institute was opened as a branch of the Austin Lunatic Asylum. The Institute provided diagnostic testing of animals for rabies, prepared vaccine from desiccated spinal cords of rabbits infected with rabies virus, and administered the vaccine for emergency preventive treatment of hydrophobia. Use of the Pasteur vaccine ended in 1934 when killed vaccine, which could be shipped to local health departments, began being manufactured. In 1906 a laboratory for the analysis of food was established in Denton.

The Bacteriological Laboratory, opened in 1912, examined drinking water for use on railway trains and in cities, tested sputa for tuberculosis, tested stools for hookworm, and performed the spinal colloidal gold test for syphilis. This laboratory processed 1,082 specimens in 1912.

Throughout its history, the TDH Laboratory has been a leader in developing and improving test methods. In 1936 the laboratory was licensed by the National Institutes of Health to produce smallpox and bacterial vaccines. Production of bacterial vaccines—including tetanus toxoid, diphtheria toxoid, and pertussis whole-cell vaccine—continued until

1978. In 1938 the laboratory staff pioneered technology for large-scale production and distribution of smallpox vaccine in embryonated eggs. TDH laboratorians also developed a smallpox test that could quickly differentiate smallpox from chicken pox. This rapid diagnostic test was an important public health contribution because each of these diseases are easily mistaken for the other.

During the 1930s, 40s, and 50s, laboratory staff contributed significantly to public health promotion by developing several new tests and improving others. They developed cell culture tests for identifying viruses and serological tests for identifying viral and rickettsial diseases. Also among their accomplishments were improvements in the selective media for cultivating *Salmonella typhi* and other enteric bacteria and modifications in the precipitin test for differentiating the principal groups of hemolytic streptococci. Laboratory staff adapted the "Quellung" test for the rapid identification of pneumococci. This test was taught to laboratorians throughout the state since the identification of pneumococci was necessary for the serotherapy treatment of pneumonia caused by this organism.

The Laboratory Today

With a staff of 385 scientists, technicians, and administrative and support personnel, the TDH Laboratory is one of the largest state

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laboratories in the United States. In 1998, the TDH Laboratory processed 1,522,002 specimens in test areas such as microbiology, environmental chemistry, clinical chemistry, and genetics.

The TDH Laboratory currently consists of four divisions: Microbiological Services, Chemical Services, Environmental Sciences, and Support Services. The laboratory provides state-of-the-art biological and chemical analyses for TDH, other state agencies, and various public and private health care interests. The TDH Laboratory helps local health officials and private physicians investigate public health problems. Laboratory staff serve as ad hoc or adjunct faculty at hospitals, medical schools, and universities. TDH scientists provide excellent, low-cost training to other laboratory scientists in Texas and are also in high demand for international training and speaking engagements.

The Microbiological Services Division provides diagnostic and reference testing in bacteriology, mycobacteriology (TB), parasitology, serology/immunology, virology, and entomology. The division contains 15 separate laboratory sciences that conduct diagnostic tests on more than 400,000 specimens per year and screening tests on water, milk, shellfish, and other products. Molecular epidemiological techniques help contain the spread of illness by tracing outbreaks to their likely origins. The division's Laboratory Certification Branch certifies other laboratories that test public water supplies, milk, and shellfish consumed by the public.

The Clinical Chemistry Branch in the Chemical Services Division provides analytical testing services in support of women and children's health by providing prenatal screening for expectant mothers, blood screening for newborns, and blood testing for Texas Health Steps. This branch provides health testing services for adults through glucose, cholesterol, and genetic screening.

Begun in 1963, the Newborn Screening Branch of the Chemical Services Division is the largest of its type in the world. It is internationally recognized, especially for its achievements in the areas of automation and computerization. This laboratory processes more than 1 million specimens, accounting for more than 6 million analyses annually. Over 300,000 infants are born in Texas each year. Every newborn is tested at least twice, once at birth and again in 7 days. Each year, around 350 Texas newborns are identified as having one of the following five disorders: phenylketonuria, galactosemia, congenital hypothyroidism, sickle cell disease, and congenital adrenal hyperplasia (CAH). Numerous studies in this area have included advanced screening techniques using polymerase chain reaction (PCR) for sickle cell confirmation and extensive epidemiological studies of CAH. Staff members also have served in leadership roles on national and international committees formulating guidance materials for newborn screening.

The Environmental Sciences Division provides testing services to monitor environmental quality. This division is the principle drinking water testing laboratory for the State of Texas, performing the federal Safe Drinking Water Act compliance tests. The division's testing programs monitor consumer product safety, identify lead contamination sources, test for shellfish safety, and assess levels of environmental pollution components. As a government laboratory certified and audited directly by the United States Environmental Protection Agency (EPA), the laboratory has the unique responsibility to adhere to EPA specifications for testing and to maintain unquestioned expertise and impartiality in the provision of laboratory testing services. This division processes more than 40,000 specimens annually.

The Support Services Division provides operational and administrative services for the other three divisions. In addition

The Newborn Screening Branch... is the largest of its type in the world....

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to its Administrative, Automation, and Financial Branches, this division has a central receiving and data entry area, the Specimen Acquisition Branch, and the Laboratory Results Reporting Branch to process the thousands of specimens submitted each month.

A Laboratory for Tomorrow

To meet the changing needs of public health, the TDH Laboratory continues to pursue excellence in its various testing areas. The following project descriptions provide a few highlights of the many accomplishments the laboratory has achieved over the past 10 years.

In 1995 the Microbiological Investigation Section was one of four US state health laboratories chosen to perform pulsed-field gel electrophoresis (PFGE) of *Escherichia coli* O157:H7. This section uses PFGE to examine strain relatedness of *E. coli* and other foodborne pathogens.

The TB Identification Section developed a more sensitive fluorescence method for detection of mycobacterial mycolic acids by high performance liquid chromatography. This method allows the rapid presumptive identification of *Mycobacterium tuberculosis* on sputa with strongly positive smears. The recent addition of a new cultivation technology in the TB Clinical Section provides for the presumptive identification of TB with only a few days growth.

The Medical Serology Branch developed a polymerase chain reaction (PCR) procedure to detect *Borrelia lonestarii* from ticks in 1998. *B. lonestarii* may be the causative agent of Lyme disease in Texas. The branch is investigating the use of PCR to test specimens from humans suspected of having Lyme disease.

In 1989 the Rabies-Arbovirus Section adapted a procedure to type animal rabies virus isolates using monoclonal antibodies to monitor the spread of the disease across the state. This test was further refined in 1994 to use PCR

techniques to further differentiate among rabies virus strains. The section provides this molecular typing of rabies virus strains for other state laboratories and has hosted two workshops on rabies testing attended by laboratorians from across the United States.

The last week in March 1999, the Medical Parasitology Section began setting up its newly acquired digital imaging system that will enable laboratory staff to send digital images of their findings directly to other appropriately equipped sites. The Centers for Disease Control and Prevention funded this purchase as part of a collaborative effort to create an interactive web site for laboratorians and other health professionals nationwide who are interested in parasitic disease diagnosis and surveillance. This section has also recently been approved to receive grant money from a federally funded minority health project to screen for parasitic disease in the border communities of Texas. This will be the first screening project of its kind to be done on the United States/Mexico border.

Many of the issues facing the TDH Laboratory in the early part of the century are still public health concerns today. Rabies remains an ongoing problem in Texas: more than 200 animal cases were reported in 1998. Recent outbreaks of illness due to *Escherichia coli* O157:H7 and *Listeria monocytogenes* contamination of prepared and fresh foods underscore significance of food safety as a continuing public health challenge. *Cryptosporidium parvum* has been recently recognized as a waterborne pathogen. In the past decade, tuberculosis reemerged as a public health threat, with multidrug-resistant *Mycobacteria tuberculosis* on the rise. International travel has resulted in dramatic increases each year in reported cases of infestation with intestinal parasites. Approximately 5,000 cases of syphilis continue to be identified in Texas each year.

The Medical Parasitology Section will screen for parasitic disease in the border communities....

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Access to the best laboratory methods and staff is a critical component of the best diagnosis, treatment, and prevention measures for all adverse health conditions.

The TDH Laboratory remains at the forefront of technology, providing state-of-the-art services through development of new tests, adaptation of available tests, and collaboration with other public health agencies. It offers

testing services, training, and certification of laboratories and laboratorians, and assistance to appropriate health care agencies and providers to help promote public health. Laboratory services are an integral component of a complete health care program.



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Laboratory Information Resources

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The TDH Laboratory is currently working on setting up its own home page at the TDH Website, with links to other sites containing key laboratory information. Until this web page is completed, extensive laboratory information is available by topic search at the TDH and CDC websites. The CDC DPDx interactive website provides information on parasitic disease.

TDH <http://www.tdh.state.tx.us>

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