

ORGANIZATION OF THE DIAGNOSTIC LABORATORIES
OF THE JOHNS HOPKINS HOSPITAL
(1965)

I. RECOMMENDATIONS.

It is recommended:

A. In the Hospital:

1. That the Diagnostic Laboratories be reorganized as an autonomous hospital division with responsibility for providing diagnostic services in hematology, blood-banking, serology, microbiology, chemistry (including toxicology), electrocardiography, electrocephalography, pulmonary function, and other areas that may be agreed upon.

2. That a Committee of the Medical Board (with participation by and concurrence of the Advisory Board of the Medical Faculty) recruit a full-time Director of the Diagnostic Laboratories.

3. That the Director be given responsibility for all professional, technical, and educational activities of the Division and full authority to discharge this responsibility, including:

(a) Freedom to select and recruit necessary full-time professional staff (subject to existing rules and regulations concerning professional appointments).

(b) Authority to develop new procedures and to establish programs of research and development.

(c) Autonomy in preparing and negotiating Hospital budgets.

(d) Voting membership on the Medical Board.

B. In the Medical School:

4. That the Director of Diagnostic Laboratories be given an academic appointment appropriate to his professional abilities, responsibilities, and accomplishments.

5. That the Director of Diagnostic Laboratories be made head of a Division of Clinical Pathology in the Department of Pathology or, depending upon the urgent preference of the individual selected, head of a Division of Laboratory Medicine in another Department such as Medicine or Pediatrics.

6. That this Division be represented on the Advisory Board and in University budgetary matters by the Director of the medical school department of which it is a part.

7. That this Division take responsibility for educational activities as follows:

Retyped for printing purposes.

(a) All courses of instruction in Laboratory Diagnosis for medical students.

(b) Implementation and support of programs in the clinical departments having to do with performance of laboratory work by medical students.

(c) Residency training in Clinical Pathology.

(d) Education of medical technologists, including post-graduate and "refresher" courses.

(e) Postgraduate courses, symposia, and other types of continuing education of physicians in the field of laboratory diagnosis.

II. STATUS QUO.

A. Organization.

1. The Division of Diagnostic Laboratories of the Hospital is presently headed by Dr. C. L. Conley. Its components are:

<u>Laboratory</u>	<u>Consultant*</u>
Hematology	Dr. C. L. Conley
Blood Bank	Dr. E. E. Morse
Chemistry	Dr. K. L. Zierler
Bacteriology	Dr. F. R. Fekety
Serology	Dr. P. S. Norman
Electroencephalography	Dr. E. F. L. Niedermeyer*
Heart Station (ECG & BMR)	Dr. J. O. Humphries

*With the exception of Dr. Niedermeyer, whose appointment is in Neurosurgery, all hold academic appointments in Medicine.

2. Procedures Carried Out in Other Laboratories:

Many of the tests and procedures for which the Diagnostic Laboratories are responsible are actually performed in other laboratories under a variety of agreements and financial arrangements. Examples are:

(a) Pulmonary function tests - Dr. W. Ball's laboratory in the Department of Medicine.

(b) P.B.I., T-4 by column, serum iron-binding capacity, LDH, and aldosterone - Bioscience Labs, Los Angeles, California.

(c) Steroids and gonadotropins - Dr. C. Migeon's laboratory in the Department of Pediatrics.

(d) Aminoacids - Dr. John Menkes' laboratory in the Department of Pediatrics.

(e) VMA - Dr. John Wiswell's laboratory in the Department of Medicine at University of Maryland (no charge at present, but one probably will be levied soon).

(f) Estrogens - Dr. D. Kumar's laboratory in the Department of Gyn.-Ob.

(g) Special liver and G.I. tests - Division of Gastroenterology, Department of Medicine.

(h) Special coagulation tests, fibrinogen levels, bone-marrow, etc. - Division of Hematology, Department of Medicine ("Special Hematology").

(i) Toxicology (including drugs) - Drs. Freimuth and Schweda in the Office of the State Medical Examiner.

(j) Skin biopsies for O.P.D. and outside physicians - Subdepartment of Dermatology, Department of Medicine (an arrangement now under review).

3. Expansion of Services:

There is no orderly procedure for the addition of new services by the Diagnostic Laboratories.

There are no criteria and there is no system for deciding when an examination or test which has originated as a special or experimental procedure is useful enough or has been shown to have broad enough applicability in diagnosis to warrant its becoming the "routine" responsibility of the Diagnostic Laboratories.

There is no overall program for regular collection and survey of information concerning new and potentially useful procedures, for developing simplified or more accurate methods, or for gradual systematic expansion of the services offered. Small developmental programs exist in Bacteriology and in Serology (with N.I.H. support) but these are individual efforts, introduced from outside the Division, and no Division-wide internal program exists.

When new procedures, particularly chemical determinations, are taken over as the responsibility of the Diagnostic Laboratories, the tendency is more and more to farm the test out to another laboratory rather than to arrange for its performance in the Hospital laboratories. This is far less frequent in bacteriology, serology, and the blood-bank than it is in chemistry and hematology.

No regular meetings or conferences are held for the professional staff of the Division.

B. Volume of Work.

Fig. 1 portrays the total increase in workload since 1956 and Figs. 2-4 give similar information for some of the individual laboratories.

Between July 1, 1964 and June 30, 1965, 1,009,000 tests were carried out. Projections for the future (dotted lines) were determined by the method of least squares.

Fig. 5 gives income and cost figures since 1966.

The legends for the figures give more details.

C. Professional Staff. (Because of the EEG laboratory occupying a unique position and because Dr. Niedermeyer was not consulted directly in the preparation of this report, the following statements should not be applied to him or to his situation.)

1. Qualifications. All members of the professional staff are of excellent academic standing, all are highly qualified in their clinical subspecialties, all are competent clinicians and researchers, and none has received formal training in the field of Clinical Pathology or Laboratory Medicine. None anticipates a career in Laboratory Medicine or Clinical Pathology.

2. Interests and Attitudes. Without exception, the members of the Division staff regard their roles in the Diagnostic Laboratories as entirely secondary to their main academic and professional interests in clinical teaching, research, and patient care.

They are unanimous (as one might expect a group of clinicians to be) in their concern about the vital need for excellence in hospital laboratories. Each is aware of numerous improvements needed in his own laboratory and each admits that these will be brought about only when someone (else) is willing to devote the necessary professional time and energy to the task.

All regard their responsibility to the Diagnostic Laboratories as a part-time activity or sideline; they look upon themselves as members of the Department of Medicine with their major interests, efforts, and loyalties being in activities very different from those of the Diagnostic Laboratories.

Individual attitudes include: the feeling that the job is an annoying imposition but one of the burdens to be borne if one is to remain on the full-time faculty in Medicine; that it is an interesting avocation if one doesn't let himself become embroiled in the serious problems; and strong feelings of frustration at seeing the need but being personally unwilling to divert the time and energy from other academic interests to solving problems in the Diagnostic Laboratories.

Most members of the staff admit frankly that they devote the absolute minimum of time necessary to supervising the work in the Diagnostic Laboratories and that they make a real effort to solve a problem only when pressed to the point of discomfort or when faced with an emergency. Solutions are based on expediency rather than evaluation of future needs or coordinated planning for a progressively improving enterprise.

There is essentially no coordination of effort at the professional level. Each unit operates semi-independently, the main binding force being at the administrative and personnel policy level.

In short, there is no overall professional dedication to excellence of the Diagnostic Laboratory service. Most pressures for change or improvement originate outside the Division. As an example, the longstanding request of the Department of Pediatrics for microchemical techniques is viewed as a problem of the Department of Pediatrics rather than a problem of the Division of Diagnostic Laboratories.

D. Technical Personnel.

1. Chief Technologists. The history of the Johns Hopkins Hospital abounds with the names of extraordinarily skilled and loyal chief technologists. Excellent, indeed, superlative individuals still serve as lab chiefs and the longstanding practice of placing the main responsibility for keeping a laboratory going upon the chief technologist continues.

Without in any way detracting from the past and present services rendered by these loyal employees, it must be stated unequivocally that this traditional administrative arrangement is not only archaic and inadequate, but actually detrimental.

Numerous experiences with the chaos created by retirement, resignation, or disability of a chief technologist attest to the increasing difficulty of replacing such individuals. A survey of the present situation indicates clearly that such crises can be expected to recur. Individuals adequate to take over the position of chief technologist are present in none of the laboratories, a direct result of the outdated custom of concentrating all authority in a single senior person rather than creating a hierarchy of assistants with distribution of responsibility and the possibility of orderly succession. This steep pyramidal system lessens the ability and desire of the chief technologist to keep good assistants; his efforts are devoted almost entirely to the details of day-to-day operations; he has not time to think of improved methods or to plan for expanding the services offered.

This system also impairs the effectiveness of professional consultants who change frequently (at least 5 in 12 years in bacteriology) while the chief technologist stays on and on. Most consultants are hesitant to initiate changes, fearing that they may be regarded as hypercritical or unappreciative of past good effort. Being a part-time participant, the consultant is reluctant to be in the position of suggesting even more work for the already overburdened chief technologist.

Realistic participation and supervision at a professional level would relieve the chief technologists of many petty problems, would facilitate a distribution of technical responsibility and would eliminate the traditional (and very real) indispensability of one technologist.

The chief technologist could concentrate upon a program of development and the improvement of services, thus applying his experience and talents specifically to these challenging areas.

2. Other Technicians. It is increasingly difficult for the Division to hire adequately trained technicians. Individuals with some training in hematology or chemistry are still available but on-the-job training is always needed to make them effective. With rare exceptions, the Blood Bank, the Bacteriology Lab, and the Serology Lab fill vacancies with untrained persons and depend completely upon apprenticeship to make them effective.

The recruitment of technical staff is, beyond any question, a major problem to be faced in the future.

As an example, 6 of the 13 technicians now employed in the Bacteriology Lab will be leaving before July 1, 1966. There are no trained replacements in sight within or without the institution.

3. Recruitment.

(a) Financial. The 4 local institutions with which Johns Hopkins "competes" for technicians are Baltimore City Hospitals, Greater Baltimore Medical Center, University Hospital, and Sinai Hospital. Johns Hopkins Hospital salaries were competitive until recently but the situation is now precarious; only Sinai Hospital has a scale lower than ours.

The University Hospital has recently abandoned the title of "technologist" for "laboratory scientist." Any individual with the B.S. or B.A. degree can now start at University Hospital at \$5800 per year, receive on-the-job training, and be given a raise to \$6600 after the first year. Salaries at City Hospitals begin at \$5200/year but since December 1, 1965, one experienced chemistry technologist and two senior bacteriologists have left City Hospitals to work at University Hospital.

(b) Other Factors. The increasing competition among local hospitals in wages paid to technicians, of course, results from the overall shortage of trained personnel. While the Johns Hopkins Hospital will probably be able to increase salaries and to remain in this competition, emphasis on salaries alone is short-sighted and attractions other than money should be developed. This Hospital suffers from the same disadvantages as the others listed in that we are primarily consumers of technicians rather than producers. The establishment of an educational program for technicians would offer this distinct advantages in recruitment. There are many persons in Baltimore who would take this type of training and if a regular program were established, we would have first call upon the graduates. Such a school eventually should provide basic training for technicians, advanced training in the various special laboratories and "refresher" training for senior technologists from other institutions. Whether this program would ultimately be sponsored entirely by the Hospital, by the University, or jointly is an entirely different question.

By becoming a producer rather than a consumer, the Hospital would not only increase the local supply of technicians but would, without necessarily spending more money on wages, make the job of a technician more attractive in this Hospital. The availability of students, the feeling that one is taking part in an educational endeavor, coupled with participation in development programs would all add to the satisfaction of being employed here. In many instances, the creation of this atmosphere would more than make up for a small financial sacrifice.

It is inevitable that an eventual solution to the problem of technical personnel will involve the establishment of an appropriate educational program and the fostering of programs of research and development in the Diagnostic Laboratories.

III. EVALUATION AND STATEMENT OF FUTURE NEEDS.

A. Professional. The complexity of modern diagnostic techniques, the constant increase in demand for these services, and the growing importance of the laboratory for proper patient care call for a reorientation of the role of the professional in the Diagnostic Laboratories of this Hospital. Modern clinical laboratories require the same constant thought, attention, and concern at the professional level that any other clinical service must have to achieve excellence. At the present time, this professional component is lacking at Johns Hopkins according to the statements of those involved. We have excellent chief technologists, but it is clear that this alone will not assure the progress that is needed in the field of Laboratory Medicine. There is need for professional staff who will look upon the Division of Diagnostic Laboratories as a full-time responsibility and interest, will utilize the laboratories for education at all levels,

and will establish programs of research and development in the important field of Laboratory Medicine.

These must be individuals who are dedicated to building and maintaining the type of laboratory service which has become a necessity for clinical excellence in the Hospital.

Reference has already been made to the need for a program of education of medical technologists. Many of the problems that now exist would be mitigated by having residents in the laboratories. Just as the presence of residents on the wards inevitably improves a clinical service, the training of residents in Clinical Pathology inevitably improved the services of the laboratories. Furthermore, it is very likely that the opportunity for establishment of residency training in this field will be a prerequisite for recruiting the type of professional staff that is needed.

B. Modernization.

1. Automation. "Modernization" of a clinical laboratory is synonymous with automation for many physicians. A tremendous advance along these lines has already been accomplished in the laboratories of this Hospital. Through the efforts of Dr. Zierler during the past two years, the chemistry laboratory is now partially automated and computerized and, while Dr. Zierler certainly deserves to be congratulated, only a beginning has been made. Furthermore, now that automated equipment is available, it will require constant attention, adjustment, and improvement. Dr. Zierler is willing to devote a part of his time to this, but he freely admits that he would much prefer to act in the capacity of an interested bystander and to leave the day-to-day burden to someone whose main concern is with the modernization of the clinical laboratory. There are many possibilities for automation in the laboratories and, in this rapidly advancing field, it behooves an institution such as the Johns Hopkins Hospital to have on its staff professionals who are actively working in this field in the development of new techniques.

The effect of automation upon the type of personnel employed in the laboratories will be an important one. It is unlikely that automation will actually reduce the number of employees on the payroll but it is highly probably that it will reduce future needs. Furthermore, the need will be for individuals with the special skills and abilities to use the electronic equipment which will soon be commonplace in clinical laboratories.

It is important also to emphasize that the term automation does not necessarily imply a single system. Therefore, the individual who comes in to head the Division of Diagnostic Laboratories must be given as much freedom as possible to set up and establish the system which he favors.

2. Expansion of Services: The rapid expansion of services offered directly by the Diagnostic Laboratories is an absolute necessity. At present, the Hospital transfers more than \$120,000 annually to the University (of which about \$65,000 is for professional salaries, \$45,000 for technicians and secretaries, and \$10,000 for supplies) all to pay for services that are the responsibility of the Hospital Diagnostic Laboratories.

Retyped for printing purposes.

There is also a need for a systematic program to develop procedures to carry out tests here that are presently referred to outside laboratories. For example, until the fall of 1959, patients who needed tests of thyroid function were referred to Dr. Asper's "Radioiodine Tracer Laboratory." At that time, if a PBI or related test was needed, a specimen was sent to the Bioscience Laboratory in Los Angeles and the Hospital would bill the patient individually for the cost of having this test performed. The number of these tests was relatively small because patients were "screened" by specialists before a determination was requested. When tests of thyroid function became generally available through the Diagnostic Laboratories, patients were no longer screened as closely and requests for these tests mounted rapidly. In 1960-61, the diagnostic laboratories budgeted \$13,500 to pay for these outside tests and actually expended \$19,437. In 1963-64, \$21,500 was budgeted and the actual expenditure was about \$48,000. The vast majority of this sum went to pay for tests of thyroid function. If professional time and attention could be given to this problem it might be worthwhile to develop the capability for performing these tests in the laboratories of the Hospital. When one realizes that now nearly \$50,000 is paid out each year for PBI's, it is clear that the possibility of doing the test deserves exploration here. Additionally, other institutions in this area are faced with a similar problem with these determinations and it is highly probable that arrangements to do the tests for other hospitals in this area could be developed.

The establishment and maintenance of an excellent Diagnostic Laboratory service requires the full-time professional attention of individuals interested in all developments in the field. The literature should be carefully pursued and staff meetings held to consider at intervals newly developed tests for inclusion in the services in the services of the laboratory. Programs of research and development are a necessity if a laboratory is to be first-rate. Additionally, evidence has already accumulated from the small developmental programs in Serology and Bacteriology, that the inclusion of the opportunity to develop new techniques is exciting to the technologists and is another inducement for them to seek employment in this Hospital. Indeed, the present chief technologist in Serology would not have accepted the position had there not been the opportunity for participation in development of new techniques.

C. Other Needs. Future planning in the Hospital will, of necessity, require a careful consideration of diagnostic laboratory services. Questions concerning the decentralization of certain laboratory services will have to be studied and answered. It seems clear that efficiency can be increased in some areas by decentralization but that it will be impaired in others if services are made too diffuse. Similarly, the whole problem of "emergency" laboratory determinations (including toxicology) is in need of review (as is true of OPD services and Radiology). Careful attention at a professional level will be necessary if the Hospital is to meet its needs in the future and the importance of these needs is such as to demand full time professional consideration.

Another matter that will certainly need to be considered carefully by a new division of Diagnostic Laboratories will be the possible role of The Johns Hopkins Hospital laboratory as a regional resource. Under the Medicare

legislation this type of facility will be needed by many smaller hospitals. Similarly, under the Cancer, Stroke, and Heart Disease Center Program, there will be an increased need for laboratory determinations in smaller institutions. It might be advantageous if the Johns Hopkins Hospital laboratories, with the advent of automation and an "open-ended system" for carrying out determinations to serve as a supplemental laboratory for those of small institutions.

In several institutions in the United States, there have been tremendous advances in the use of electronic data processing equipment in connection with the clinical laboratories. This is not only an approach to keeping appropriate records and levying charges, but it is also possible to monitor procedures and to program for automatic repetition of any determination that gives an abnormal value. This type of system then guarantees the attending physician who receives a report that test has been double checked and might eliminate the frequent practice of sending another specimen to make sure that the original determination was correct.

The needs that have been cited are only a few of those that we will face in the future and it seems clear that the first step is to find a good man to head the laboratories and to give him the support and authority necessary to discharge his responsibilities.

Persons consulted in preparing this report:

- Dr. P. S. Norman
- Dr. F. R. Fekety
- Dr. E. E. Morse
- Dr. K. L. Zierler
- Dr. John Carter (Prof. of Pathology, Univ. of Kansas)
- Dr. Robert Wissler (Prof. of Pathology, Univ. of Chicago)
- Dr. Fred Stone (Director, National Institute of General Medical Sciences,
Bethesda, Md.)
- Dr. Chalmers Sherwin (Deputy Director, Office of Defense Research and
Engineering, Dept. of Defense)
- Dr. James Hartgering (Director of Research, American Hospital Association,
Chicago)
- Dr. George Vennaert (Prof. of Clinical Pathology, Medical College of Virginia,
Richmond, Va.)