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The Turnover Time Of Phosphorus In Normal Sickle Cell Trait And Sickle Cell Anemia Blood in Vitro as Measured With P32

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Analysis of Career Opportunities in Scientific Libraries for the Science Student

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For sometime we have been aware of the tremendous changes taking place in chemistry, medicine, and engineering. The vast amount of research accomplished in producing atomic energy has been accompanied by a correspondingly large quantity of new terms and new words—words which were not new to the chemist and physicist, but unheard of by the public majority. Nevertheless, these terms which were pushed upon us by the impact of war and/or progress came to form an essential part of our vocabulary.

We look upon the service of libraries and librarians as something inherited. This same service accepted traditionally is basically the root of all concepts in chemistry, medicine, engineering and other allied fields. The librarians training and experience place her at the liaison point between research and administration in all fields. Heretofore, it has been observed that the problem of consistency arising in trying to meet each change in growing libraries was founded on the principle of shaping former means to meet present ends with the hope that as each need arose, so would past techniques be adaptable and even prove adequate. Such a theory is no longer true. The self-critical librarians realize this gap between past and present techniques; they have begun to meditate over these fundamental failures, pondering over the future with hope of attracting more people into the special library profession who have had training in the subject and an open eye to librarianship. For it is more evident that as the need for highly

specialized research becomes more insistent and far-flung, the demand for librarians with special knowledge of the subject and adaptable techniques will be far greater than ever before. We must begin to prepare now—today.

Library service to scientific institutions has less to do with orderly rows of books on specified shelves. Assistance is basically concerned with the interior of the science. Some years ago, the chief requirements for a librarian were said to be comprised of a good general education, knowledge of books, and an interest in working with people. Today these qualities are still essential and emphasized, but special subject training is taking its place in the limelight.

Our young scholars who are interested in entering the library field should first find out which schools are accredited by the Board of Education for Librarianship of the American Library Association. Some of them, and most of us, never realize how important this one issue is until we face some personnel director. Too, they should give careful consideration, between the time when they enter the liberal arts college and their matriculation into library school, as to what subject field of library work they wish to enter. Most of our library schools equip the student for work in public libraries. Some schools have emphasized training for positions in universities, colleges, and other institutions. A limited number, e.g., University of Michigan, University of Minnesota, offer courses in the administration of special libraries, namely — hospital libraries,

medical school libraries and engineering libraries.

Through the ages libraries have been accepted as the central point for information in any organization, with this point becoming decentralized as time brought about changes. As most institutions developed to meet the needs of its special clientele so have the requirements for librarians as expert information organizers increased. The special library is perhaps more simply described as being a special collection servicing one special professional group and using special methods for the purpose. A number of scientific and technical collections have "sprung-up" on our larger university and college campuses.

The scientific collections may branch into departmental libraries as on the Howard University campus engrossing the medical school library, chemistry library, and the engineering library. Qualifications necessary for librarians in charge of such collections should be basic. It is essential that the store-keeper know his products and it is equally essential that the librarian know her subject. It is a fact, it is the law, a law librarian must have a degree in law or some equivalent. The same criterion must be reached in servicing our scientific collections. To acquire, maintain and service any collection of books requires a knowledge of library technics, routines and administration. These points are essential and unavoidable. Librarians in the field of medicine, chemistry, and engineering, have a great responsibility and the character and extent of the demands they must meet are more varied, thus making their qualifications more exacting. So a more comprehensive knowledge of the literature they sell must be required. A librarian in charge of a chemical library should have a degree in chemistry. Too, the librarian with the medical library should have a degree in the biological sciences, and further, the librarian with the engineering library would do well to

have a degree in the physical sciences and a number of survey courses on the subject. An engineer once remarked: "Imagine an engineer finding an engineer's book. There would be less confusion in terminology; you are speaking to a capable person." The subject is always the point at issue.

A knowledge of the terminology is becoming essential. The literature in technical collections is too complicated for our present generation of librarians. The librarians of tomorrow must be well equipped in the subject field in order to serve her special clientele efficiently. The time has come when we must provide some common denominator, some medium to be used in selecting for positions in this group. It is becoming a thing of the past to say that special librarians need librarianship most and a general acquaintance with technical and scientific terms. Of course, our library schools cannot be expected to teach the subject fields—all they can be expected to accomplish in the allotted time is to expose the student to a knowledge of the subject indexes, the bibliographies, catalogs and histories devoted to these fields. Nevertheless the most valuable prerequisite is a below the surface knowledge of the terminology, procedures, and fundamental principles of the subject matter in the collection involved. We must, within this generation, attract more people who have done work in zoology, bacteriology, chemistry, physiology, comparative anatomy, embryology, mathematics and physics. This must be the goal—the common denominator in selection.

The Chemistry Library

A chemist once remarked: "Women never make very good laboratory assistants and I think it is a wise move for women chemists to become special librarians." Whether women make good laboratory assistants is not relevant for purposes concerned herewith. However it is certain the chemistry major has a broad overview of chemistry and is

able to set forth in the chemistry library the appropriate relationships, theories, and principles underlying the major problems which develop within the course of a day.

The scope of a chemical library is rather difficult to expound upon, as there are many departments served by it. Briefly, most of them have available material for use by research, analytical and testing laboratories. This means that in addition to chemistry, which forms the major part of the collection, the library should contain information on engineering methods and materials, market prices, and industrial applications. Organic chemistry alone has so many specialized divisions — dyestuffs, pharmaceuticals, petroleum products, etc. In addition there are textbooks on physical chemistry, colloidal chemistry, electro chemistry, photomicroscopy and even a patent file. The cataloging, abstracting, filing and other routine duties are not called difficult assignments when the librarian has been prepared in the subject. The director of a chemical library should have the degree in chemistry if the library is to operate smoothly. If the said director has spent sometime in chemical work, either as a teacher or a chemist, he is that much better equipped to handle his duties. Of course, he will have had library training through which he became acquainted with the reference works. Now he is capable of seeing this collection not just from the eyes of a librarian, but also as a chemist. At this point, a knowledge of the subject matter is of greatest importance. A knowledge of foreign languages is equally important as he should also be ready to handle translations of abstracts, and other papers in foreign languages: know the subject and the language will be utilitarian. The most indispensable instruments in the life of a chemist are the capable librarian and the library.

Medical Libraries

This specializing spreads to the medical

libraries—the room where an up-to-date collection of books and journals is properly housed. Here in this peace the doctor, the nurse, the medical student, the lay members of the staff and many others should find a haven for further study and research made available by a sympathetic and intelligent staff.

The hospital type library serves a two-fold purpose, that of servicing the professional staff and students as well as the patient population whose stay in the institution can be helped and made pleasant through modern efficient library service. Here, the professional staff will turn daily for advice and guidance in the use of special tools; numerous subject bibliographies are prepared, current periodicals may be indexed for certain staff officials or an article published in Russian might need translating. Perhaps a citizen taxpayer may want some recent material on drinking fountains or some information on experimental cancer or diphtheria immunization or say the nutritive value of kelp.

The hospital librarian, in addition to her professional qualifications, should possess health, poise, dignity, sympathy, tact, a touch of the psychologist, and the spirit of social service. And professionally, she must learn the needs of her staff. Much has been gained by the librarian in particular hospitals where it is said that she has the privilege of occasionally attending the meetings of the internes and resident staff, discussing with them the facilities of the library, new materials available, items of special and current interest—unbeknowningly to her clientele she can with this simple measure inoculate them by placing the books and services in their paths so they will either stumble or have a difficult time passing around. At any rate, she should be certain that the library habit is caught while they are new in the profession. It is essential that our angels of mercy develop a consciousness of the library. Here the

librarian-friend in addition to helping them materially in the complexities of their professional requirements and problems, has also an opportunity to give special assistance in directing leisure time reading habits.

To the profession of Nursing, the library is now an important factor in turning out a nurse well versed in science and culture. A cross-collection including recreational and cultural literature as well as the heavier subject matter must take its place in the curriculum. A few of our Negro institutions are about to grasp this idea and put some action behind their blast. In 1933 the National League of Nursing Education set up standard requirements to be met by all Nursing schools. These requirements specifically indicated that such institutions must have a good library and a trained librarian to maintain accreditation.² Negro institutions have failed to meet these standards for lack of funds and other socio-economic reasons. As of to date we have very few persons in the library field who could meet the requirements of a librarian for a Nursing School. As a result the administrators of such institutions are forced into accepting what they can get or the next best qualified.

Libraries servicing the Medical School and the School of Nursing must strive to provide the atmosphere of a highly technical research laboratory rather than have young scholars accept the outmoded idea that what should be a supplementary work room in reality is a museum collection of books. To make it a laboratory one must know how to use the instruments. Here the medical librarian sets plans whereby compulsory attendance to lectures for beginning students where they are to familiarize themselves with background material—classification schemes, the location and arrangement of books, periodicals, sets, indices and other publications. Medicine, the practical science, is progressive true enough, hence the medical student must

constantly acquaint himself with new methods, new techniques, new drugs. Thereby it stands to reason that doctors will always be students—the interne, practitioner, research technician will depend upon the library to supply the secondary sources which prepare him for original sources of the future. Justly, the instructions received on the use of reference tools as instruments in building his career become a laboratory technique—a skill supervised by a capable tech-librarian who understood the problem and used foresight preparing him to meet and make progress—to live in tempo with the profession by inoculating him with the library habit serum.

“Bibliotherapy . . . that which is accomplished through the presence and service of skilled librarians who are capable of assisting patients in choosing books suitable for their interests and their condition and in directing their reading along therapeutic lines. A good hospital librarian must be somewhat of a diagnostician when her skills are applied in this direction. It has been most aptly said that to permit patients to read anything and everything, regardless of their condition, without the supervision and direction of an expert, is like allowing a diabetic to choose his own diet and eat indiscriminately.”³ The librarian at this point resorts to her study of medical psychology where she has been introduced to the social, physical, and constitutional determinants of personality-disorganization, and other types of abnormal behavior. She relates the mental need with the physical handicap in order to prescribe the right book for the right patient at the right time, just as medicine and food are also prescribed. Here, a better attitude about the hospital and its public relations is spread throughout the community through the special messenger ex-patient, the ambassador of good will. A book accompanied with a smile reassures the uncertain. Books make unbearable situations tolerable,

they help to soothe the soul, bring peace to a terrorized mind and eventually rest and sleep for the weary.

To give advice in the use of technical literature, some of which is in a foreign language, requires more than library training. One must have a good basic background in the history of sciences and medicine and/or an academic foundation in the biological sciences: physiology, embryology, parasitology, histology, genetics, bacteriology. To interpret, decipher and whittle down a chapter on "Insulin treatment of diabetes mellitus" one must know what the inquirer has in mind based on the simple interview. Insight is required throughout the career. A number of students do not have the right approach as to the nature of what they want; some have a vague idea as to what they want; and it is a rare occasion to discover one who is specific. To be able to help the student put his finger on the right phase requires a strong infusion of a well packed subject imagination in order to reap the appreciation that accompanies a fruitful search.

The crux of the problem in this too overwhelmingly generalized field is the need for subject specialization. The dividends cannot be accomplished unless the collection is organized and operated by one who knows the subject and is an authority in library science.

L. R. Wilson points out the following major objectives of the professional training part of the librarian which could well be applied to the medical librarian: (1) To give the student a broad overview of librarianship; (2) to acquaint him with the library's role in an educational institution; (3) to set forth for him in their appropriate relationships the theories and principles underlying the major subjects within the field; (4) to acquaint him with the body of literature pertinent to these subjects, and (5) to give through course assignments and observation, the command of library procedures which will be fundamental for future profes-

sional performance.⁴ A further objective is to gain a technical knowledge of special problems and procedures used in tackling bio-medicinal literature. This is one of the major reasons for setting a standard of qualifications so specialized and so exacting. How to diagnose a case of scarlet fever is no concern of the medical librarian. That's the doctor's business. But the business of finding out and determining the location of information on methods and current literature on therapeutic trends through the use of standard works on the subject such as the **Index-Catalogue of the Surgeon-General's Office** has a different significance. Now, that's the medical librarian's business.

There is a dire need for more young people to come into library work prepared in subject material—medicine and allied fields. Here is a future that will go far with our new librarians.

Engineering Libraries

Our standard dictionaries and encyclopedias will define engineering as that art and science by which mechanical properties of matter are made useful to man in structures and machines. An engineer thereby, steers our natural forces so that they might be beneficial toward our goal of better living for mankind. Further, the engineer is a scientist since mathematics, physics and chemistry are prerequisites to most of his training and the basic knowledge for which he applies to his research and testing, to the design, construction and operation of works and machines. The basis of his work lies in his ability to apply what he has learned. As a chemist he might have discovered that starch can be changed into glucose. As an engineer he may through application design and operate a concern where our supply of table sirups are made from corn and other starch bases.

Civil and mechanical engineering represent our basic divisions of engineering. Mining, electrical, chemical, sanitary, marine, aeronautical, railway, loco-

motive, etc. are specialized branches of the main stems, however, each will in some measure apply the fundamental engineering principles. Very few people have bothered to go into or even understand engineering and the vast group of materials represented by it.

Our engineering libraries will suffer most in locating people who have had the training to organize and service justly such a highly specialized collection. Here we find a consolidated collection of subject material: electricity, mining, higher mathematics, physics. Here also are textbooks, trade and technical journals, proceedings and transactions of engineering societies. Too, these collections are strong in foreign literature, but as was stated before—know the subject and the language will be utilitarian.

Thus far in our Negro institutions we have neither the library nor the librarian who could meet the approval of the Engineers Council for Professional Development. Yet our men of this generation are becoming aware of the opportunities offered to persons properly trained in engineering. Dean Lewis K. Downing of the School of Engineering at Howard University says "Preparation for the profession of civil engineering calls for a thorough background in college mathematics, physics, chemistry, biology and the humanities along with discipline in the professional courses allied to and in the field of civil engineering."⁵ Negro institutions offering degrees in engineering include Hampton Institute, Howard University, Tuskegee Institute, The Agricultural and Technical College at Greensboro, North Carolina and a number of our land grant colleges. These institutions are providing us with what they have but the time has come when they must give more. More and more attention and emphasis must be placed on the importance of a properly housed, properly selected collection, and most of all a properly trained librarian who knows and understands the subject. In

this way, the librarian can then be expected to anticipate the needs arising through reconversion and integration of technical developments. Our students, our young scholars demand of us these provisions, if they are to be expected to accomplish more and do better work than that to which we point with pride in this day. Their products of tomorrow must reap and reflect the benefits of this turning point in librarianship.

There is a need for standards or again some common denominator to act and be the basis for selecting people properly trained to service these collections, but here again they must be studied carefully before formulating if we are to get the best results. The student who has a major in mathematics and physics or chemistry is best prepared to undertake the job. It should be a prerequisite for her to take a course similar to that offered by the University of Michigan, School of Engineering, called "Engineering English." Business and economics will play a great role on this stage. Money, banking and finance have a close relation in the economics of our labor market, and in the operation of a highly industrialized concern where research, production and construction have practically the same meaning and cost is always emphasized. Now we come to the library training—to service any collection of books properly requires a knowledge of the techniques taught in library schools on cataloging and classification, book selection, administration, reference and the like. Without these tools we lose sight of our goal. We must bring qualified persons to service people who will eventually be qualified engineers. It is obvious that the struggle to accomplish these objectives will be a long and difficult task but we must remember that it is a sure thing, a profitable and lasting one.

Conclusion

In the fields of chemistry, medicine and engineering discoveries are being made,

former methods of preparation are being perfected, elements already known are opening an unlimited area of research. This knowledge appears in the literature written by men and women who were our "firsts." Our record must be preserved and to prevent useless repetition of work we must provide special libraries serviced by subject-librarians who are capable of acting as subject consultants and who can also assemble the best books on the subject for our young atomic influenced scholars of today and leaders of the future. Long ago Louis Pasteur reminded us that "Chance favors the mind that is prepared"—pioneering as a subject librarian is the point at issue.

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Chapter News

Beta West Virginia State College Institute, W. Va.

On Friday, May 2, 1947, six students at West Virginia State College were inducted into Beta chapter at the regular Friday morning chapel exercises. The initiates were presented with keys, symbolic of the society, certificates and membership cards. Dean Harrison H. Ferrell, called attention to the importance of science and the desirability of pursuing high scholarship in this field. President Benjamin Goods, Training Officer in the Veterans Administration, outlined the requirements for membership in the society and traced its history.

In the September meeting of Beta chapter Miss Oda K. Carmichael was elected president, Mr. Melvin Stockton was elected vice president and Prof. William J. L. Wallace was re-elected secretary-treasurer and faculty advisor. Mr. George Williams, assistant professor of

biology, was made chairman of the Program Committee.

On Sunday evening, October 5, 1947, Beta chapter conducted its annual Sunday evening services for the benefit of the student body and staff of West Virginia State College. The Chapter presented Dr. Kelso Morris, associate professor of chemistry at Howard University and regional vice president of the Society as the main speaker. Professor Morris held the attention of his college audience with his sincere and scholarly presentation. In his address, he emphasized the purposes, objectives, and benefits of education. He pointed out that the educative process is a never-ending one, that the truly educated person is one who continues to grow and to show evidences of that growth. To such a person success comes easily and naturally and can be worn gracefully.

At the November meeting the following questions with reference to membership were asked:

1. Shall a person who has made a grade of "F" in any course but who has otherwise satisfied requirements for membership be invited to join the Society?
2. Shall courses taken in other institutions be counted toward satisfying the admission requirements?

It was decided to give further consideration to these questions. Beta chapter solicits the views of members of other chapters on these questions.

Miss Dorothy Paxton, formally of Gamma chapter, Howard University, was welcomed to Beta Chapter. She holds a temporary instructorship in chemistry at West Virginia State College. Professor Paul J. Moore served as chairman of a sub-committee to prepare test items for the Organic Chemistry Test Committee, sponsored by the Committee on Examinations and Tests of the Division of Chemical Education of the American Chemical Society. Professors J. J. Mark and William J. L. Wallace attended the meeting of the Conference of Negro Land Grant College Presidents in Washington, D. C., in October 1947. The latter also attended the fall meeting of the American Chemical Society held in New York City in September where he participated in the formation of a new objective test for general chemistry in the college testing program conducted by the Committee on Examinations and Tests of the Division of Chemical Education of the American Chemical Society.

William J. L. Wallace,
Secretary.

Eta

Morgan State College Baltimore, Md.

Eta chapter has initiated six new members and six associate members. The induction services were held during the regular assembly hour at which time Dr. James D. Carr delivered the main address, "Ideas and Gadgets."

At the October meeting, Miss Ednae

Lomas spoke on "Atomic Energy and Nuclear Fission." Miss Roberta Lavarr will be the speaker for the next regular meeting. A special meeting was held December 10th at which time Mr. J. A. Herculson, of the department of chemistry, demonstrated and discussed, "Techniques and Methods of Detecting Stimulation in Race Horses."

The newly elected officers of Eta chapter are: Franklin Furr, president, Ednae Lomas, secretary, and Roberta Lavarr, treasurer.

Ednae Lomas,
Secretary.

Xi

Tennessee A. & I. College Nashville, Tenn.

The following program is sponsored by Xi chapter during 1947-48:
October 10: Business Meeting.

November 4: Panel on Cancer. Mr. Robert Jordan, chairman, Dr. L. D. Scott, Meharry Medical College, Dr. H. B. Crouch, Dr. H. D. West, Meharry Medical College, Miss Mildred Burgess and Mr. Gilbert Mason, students.

December 9: Radioactive Isotopes as Tracers. Dr. Carl M. Hill, Mr. Roscoe Koontz and Miss Catherine Maryland.

January 8: Sexual Dimorphism Among Plants. Dr. Edward Ferguson, Jr.

February 2: Magic Program in cooperation with Chemistry Club. Mr. Gilbert Mason, chairman.

March 11: Topic to be selected. Dr. H. B. Crouch.

April 8: Election of New Members and Social. Miss Prigmore, sponsor.

May 13: The Effect of Various Chemicals Upon Plant Growth. Dr. Marian Richards, and Dr. Major Spaulding.

In addition to the above program Xi chapter plans to assist the science section of the Tennessee Negro Education Association to provide science exhibits to

bacilli are the etiological agents, and can always be a source of danger to the host. BCG on the contrary is a non-virulent strain of the tubercle bacillus, and does not produce progressive tuberculosis, and it has not been found to be a source of danger. BCG can not, however, be expected to accomplish more than any other type of vaccination where protection is provided against casual contacts and where isolation is strictly observed. Any child would be greatly endangered if left in contact with virulent typhoid or diphtheria bacteria, even though vaccinated against it at the beginning of exposure. The accidental type of infection may conceivably serve as a measure of protection, but since it cannot be accurately controlled from the point of view of dosage, virulence, etc., the danger of such risk is apparent. However, when negative and positive reactors are exposed to a common potentially infective environment, a higher percentage of originally negative reactors develop progressive pulmonary tuberculosis.

BCG vaccination produces a positive tuberculin reaction in the subject, the test becoming positive in practically 100% of the cases in from 1 to 4 weeks after administration of BCG—50% positive the first week, and 90% positive by the end of the second week. A positive tuberculin will persist after 1 year in 100% of cases, dropping to around 85% after 2 years.

Dr. K. Irvine of London made a personal 2-year study of major BCG clinics in Europe and the United States in 1934. At that time he concluded, "When we consider that 1,343,000 infants have been vaccinated against tuberculosis without one sure case of death from BCG infection, we would indeed be cautious if we still doubted the safety of the vaccine for the normal infant."⁶

The 1930 tragedy in Lubeck, Germany, has been frequently cited by those opposed to BCG vaccination as a warning against its use. In this disaster 270 infants were vaccinated with BCG, and 77

died of tuberculosis. Careful and exhaustive investigation revealed that laboratory workers had carelessly kept BCG culture and virulent vacilli in the same incubator, and that the BCG vaccine used to the children had become contaminated with the virulent cultures. The persons in charge were subsequently convicted of criminal negligence and given prison sentences.

Spectacular results from BCG such as those obtained in vaccination against smallpox, rabies, typhoid, tetanus, etc., have not so far been observed, but under certain conditions, and among certain groups of persons, significant results have most definitely been achieved. For example, in their study among North American Indians, Aronson and Palmer⁷ unquestionably proved that BCG vaccination is associated with marked protection against the development of tuberculosis as measured by morbidity and mortality experience of their experimental and control groups. During the 7-year period of their study, 60 deaths occurred from all causes among the 1,457 persons in the control group, compared with 34 among the 1,550 who were vaccinated. Mortality rates in terms of deaths per 1,000 person-years were 7.2 per 1,000 in the control group, and approximately only half as great, 3.8 per 1,000, in the vaccinated group. There were 28 deaths from tuberculosis among the unvaccinated and only 4 deaths among the vaccinated subjects. These investigators are inclined to believe that protection increases with time, being greater in the later years than in the earlier years after vaccination. An editorial in the issue of the Public Health Reports in which the Aronson and Palmer study is presented⁸ suggests that "vaccination (with BCG) might be useful among . . . infected groups, especially where there is little chance of isolation."

Petroff and his associates have been able to dissociate BCG into "R" and "S" forms. Petroff claims that the "S" form

produces progressive disease when introduced into animals, but is firmly convinced that our present BCG is a pure "R" form, incapable of producing progressive tuberculosis. Several other authors feel that BCG could revert to its former virulence by the use of other forms of cultivation. Sasano and Medlar⁹, Dreyer and Villum¹⁰, Reed and Rice¹¹, working independently, all concur in that opinion on the basis of their investigations and the results they obtained.

Nelda Holmgren of the Tice Laboratory has recently injected as much as 65 mg. of BCG organisms intravenously, intraperitoneally, and subcutaneously into rabbits over a period of a few months without producing progressive disease. This dose, 65 mg., is approximately 300,000 times the human dose calculated by weight.

Levine and Sackett have described the results of an experiment with 2,084 children up to January 1, 1944, from tuberculous homes in New York City¹². Of the total, 1,011 children were vaccinated with BCG, and the remaining 1,072 were used as controls. Prior to alternation of cases, the mortality among the non-vaccinated group was about 5 times that of the vaccinated group, namely 3.38% as against 0.58% in the vaccinated group. In the second period following alternation, figures for the 2 groups were essentially the same, the mortality for the vaccinated cases being 1.41%, and the control 1.51%.

BCG is also being used to protect medical students and student nurses from succumbing to the certain exposure to tuberculosis in the course of their routine activities in hospitals. At the Cook County Hospital in Chicago all nursing students are tuberculin tested, x-rayed, and negative reactors vaccinated immediately on entering school, at least 2 months before they would normally come in contact with tubercular patients. Thereafter they are tested and x-rayed

every 6 months. Medical students at the University of Illinois are tuberculin tested and x-rayed when they enter school, and again at the beginning of their 4th semester in school, at which latter time they are also vaccinated with BCG. Since they enter the wards in their 3rd year, and since BCG is supposed to retain its efficacy for 3 years, it is hoped that vaccination in the last semester of their 2nd year will carry them safely through internship¹³.

Another type of tuberculosis vaccine is that made with heat killed tubercle bacilli. In using this vaccine, workers recognize the added advantage that living tubercle bacilli are not being introduced into the body. Opie, Wells, Freund, Flashiff, Smith^{14, 15} and others have done considerable work in the preparation and demonstration of this vaccine from heat killed tubercle bacilli. Opie, Flashiff and Smith have reported their findings of a study conducted in the Mental Hospital of Kingston, Jamaica, British West Indies, demonstrating the fact that contrary to prevailing view, heat killed bacilli are almost as affective as attenuated BCG. The vaccine which they used was prepared by Dr. Freund, Dr. J. Casals and one of the authors of the study in the Pathology Laboratory at Cornell University Medical College. Their subjects were the approximately 2,000 patients of the mental hospital, about equally divided as to sex, the majority of them being adults, only 3% of them under 20 years of age. The number of persons admitted and discharged every year was about 500. Recorded deaths in the hospital from 1927 to 1932 were as follows:

Year	Total No. Deaths	No. Pulm. Tbc. Deaths
1927	132	34
1928	137	38
1929	110	28
1930	142	44
1931	261	54
1932	185	55

The very high ratio of deaths from pulmonary tuberculosis among this group of mental patients is another reason why our case-finding programs in such groups are usually productive and justified. All the patients in this study were x-rayed within a week after admission, and this roentgenographic examination was repeated every 3 or 4 months. The authors found that protection was greatest among this group in the first 18 months after vaccination. In this particular study the conditions under which observations were made were unfavorable to the demonstration of protection, because on the one hand the vaccinated persons had been exposed to severe infection during the time when they were acquiring immunity, and on the other hand, it was obvious that after 18 months of observation the controls who had escaped manifest tuberculosis had in large part acquired infection, and were presumably protected by such infection. The actual efficacy therefore of the vaccine was thus rendered difficult to measure, because whatever protection the vaccination afforded had progressively decreasing significance as time after admission increased, a large number of unvaccinated persons being protected by spontaneous infection. After 2½ to 3 years, the number of reactors to the tuberculin test was about equal in controls and experimental group, both groups having been made up from a homogeneous originally negative reacting population.

Experimentation has also been done with the Vole bacillus, an acid-fast bacillus which closely resembles the tubercle bacillus. A vaccine has been prepared from it which Wells injected in pigs intracutaneously prior to infection of the pigs with human strain bacilli of a virulent nature. The Vole acid-fast bacillus grows dysgonically on the usual nonglycerinated egg media as pearly-white conical or granular colonies which become visible to the naked eye after

one month. The bacillus grows well on potato, but not at all on 5% glycerine agar or egg media. It was in 1937 that Wells observed at the Bureau of Animal Population in London and at Oxford University, an epizootic disease among wild voles (*Microtus agrestis*) which were brought to the laboratories from 7 different stations in the British Isles. The disease closely resembled tuberculosis, the caseous lesions in wild voles containing masses of acid-fast bacilli which on further study proved to represent a new type of tubercle bacillus. Its bacteriology was particularly interesting to Wells and Birkhaug^{16, 17}. On tryptinized broth the organism developed slight tiny colonies, but not on the surface of the plain broth. No growth occurs at 22°C. The bacillus stains positive with Gram and Zeihl-Neelsen methods, are slender and much longer than ordinary human tubercle bacilli. The most striking forms of the vole bacillus resemble a shepherd's crook, a sickle, a spiral or the letter "S", but no branched forms are seen. Some of the organisms exhibit fine granulation and vacuolation along their entire length. Relatively large doses of Vole bacilli injected intravenously in rabbits caused death from acute miliary tuberculosis. The war interrupted his investigations, but Wells found that his Vole bacillus gave a high degree of protection which is apparently equal to, but not greater than that produced by vaccination with BCG. This work, however, needs to be confirmed by other observers.

BCG is safe, constantly being assayed, and the dosage, method and time of administration can be regulated accurately. All evidence points to the fact that there is definite protection in its use. From a purely public health point of view, the efficacy of BCG must of necessity be gauged by its ability to reduce the tuberculosis mortality of children vaccinated in their homes in the midst of tuberculosis environment. The removal of tubercular persons from the home will

remain the more advantageous procedure for the protection of children and other contacts in the home. Vaccination against tuberculosis is applicable only to those children and adults reacting negatively to tuberculin. Up to date we know of no vaccine which will give some measure of protection to the positive reactors. Benefit of BCG vaccination, however, should be given to all children living in highly tuberculous areas, whether there is open tuberculosis present in their home or not. Not only is BCG vaccine safe and free from any post-vaccinal reaction, but its efficacy has been unquestionably demonstrated in innumerable experiments and studies. Its use is particularly indicated among the lower economic groups and in certain racial groups which exhibit very high mortality rates, such as Negroes, Mexicans, Porto Ricans, Indians, Filipinos, Orientals, etc., and other groups in which there is little chance of isolation.

The Tice Laboratory has been devoted to the cultivation, preparation and administration of BCG vaccine since 1934. The vaccine is put up in capillary tubes as for vaccina. The multiple puncture technique is used in administering the vaccine, but oral administration in the case of infants has been employed extensively and found entirely satisfactory. About 3 weeks after a multiple puncture administration, pin-head sized papules develop which may reach a diameter of 2 to 3 mm, remaining stationary for from 4 to 8 weeks, and then recede without leaving any definite scar. However, enlargement of the regional lymph nodes is not uncommon.

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