patients who have stood the test of time and tuberculin after long intervals are alone those of value in a clinical estimate of the curative influence of tuberculin in the sense above mentioned (complete cicatrization of foci).

It appears uncertain that tuberculin can do any more for the local process in aiding cicatrization or absorption of tubercles than other leucocyte irritants, such as cinnamic acid²⁵ and nucleins; but if a certain degree of toxin immunity can be produced by the new tuberculin it is more rational to employ a specific irritant. Considering the difficulty and danger of producing even comparative immunity by the use of tuberculin the question is practically resolved to this: Can we safely aid nature to advantage in her attempt to hem in and destroy the tubercle bacillus and its products by medication that increases the hyperemia and absorption from tuberculous nodes? I think it is reasonable to affirm that we can within narrow limits.

The successful treatment of tuberculous joints by combined active and passive hyperemia (Bier's²⁰ method), the complete absorption of tubercles from the peritoneum after simple laparotomy, due to reactive hyperemia (Hildebrandt³⁰), and the same result in lupus from tuberculin, x-ray, and other methods producing inflammation, are certain indications that it is rational so far as they can be applied to pulmonary tuberculosis.³¹ A more attractive subject for consideration is serum therapeutics in tuberculosis, which is in an experimental stage at present. A great variety of relatively immune animals and birds have been utilized in the search for an antituberculous serum without practical success. On the other hand, Maragliano³² and de Schweinitz¹⁴ have attained some prolongation of life in tuberculous guinea-pigs with the serum of horses injected with bacillus toxins. The serums have been and are being used clinically with greater or less claims for success.

Paterson³³ and Behring³⁴ found antitoxic properties in certain bird-serums, and de Schweinitz¹⁴ and Behring³⁴ in tuberculous cows treated with toxins. These were found unsuited for use on human subjects because of irritant properties. Maffucci and Vesten³⁵ obtained prolongation of life in guinea-pigs with serum of toxin-treated sheep, but as it produced fever it was thought to contain tuberculin, and its activity thus accounted for. The antitoxic properties of the serums of Maragliano and Behring were assumed to be demonstrated by the inhibition of a tuberculin reaction in a human subject, and prevention of death from a fatal dose of the toxin in healthy guinea-pigs. None have so far been proved bactericidal or immunizing, and the evidence is yet unsatisfactory (see Trudeau and Baldwin³⁶) as to the much-wished-for antitoxic power, which is at least so weak as to be unappreciated when measured by its immediate influence on the fever of tuberculosis patients. Thus far no tissue has been found to have an especial affinity for the bacillus toxin as in tetanus and diphtheria. This may be the reason that we have such slight evidence of the presence of a strictly antitoxin body.

It might be expected from what has been learned about the mechanism of the tuberculin reaction that a bacteriolytic property might be obtained in serums or tissue extracts of immunized animals. If present, the practical value of such a serum might be limited by its inability to get at the bacillus in the cascating tubercles, unless, like laparotomy in tuberculous peritonitis,

it could cause their complete absorption. The whole subject is being studied earnestly for more light on these problems, and we may not lose hope for results of practical value.

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THE RELATION OF BACTERIOLOGY TO MEDICINE.¹

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By the terms of the subject assigned to me, the parasite of malaria and the question concerning the parasitic origin of malignant new growths are excluded from discussion, since the organisms concerned in those diseases are not classed as bacteria.

Bacteriology has relations with every department of clinical medicine.

With (a) Etiology.

" (b) Diagnosis.

" (c) Symptomatology and the course of disease.

With (d) Prognosis.

" (e) Treatment.

ETIOLOGY.

Through bacteriology we have been enabled to determine practically with certainty the causes of the following diseases:

¹ Read before the Fifth Congress of American Physicians and Surgeons, held at Washington, D. C., May 1, 2 and 3, 1900.

I.

Diphtheria,	Asiatic cholera,
Tuberculosis,	Relapsing fever,
Bubonic plague,	Influenza,
Tetanus,	Gonorrhea,
Anthrax,	Glanders.

Erysipelas and the various diseases due to pathogenic streptococci and staphylococci.

Actinomycosis.

Typhoid.

I have put typhoid last in the list of diseases of whose cause bacteriology has made us certain because it is only since 1897 that the typhoid bacillus has obtained so secure a position through the introduction of Widal's agglutination test. Previous to that discovery the typhoid bacillus was regarded as very probably the cause of typhoid fever, but not as occupying as secure a position as the bacillus of anthrax or of diphtheria.

II.

Next to the above group of diseases, we may arrange those regarding whose connection with a well-identified micro-organism we are but slightly less firmly convinced.

(a) Epidemic cerebrospinal meningitis (diplococcus intracellularis of Weichselbaum).

(d) Croupous pneumonia (micrococcus lanceolatus).

III.

Among the diseases whose bacterial cause is *probably* identified are:

(a) Malta fever (micrococcus melitensis of Bruce).

(b) Meat poisoning — certain epidemics — (bacillus enteritidis of Gärtner and allied species).

(c) Epidemic tropical dysentery (Shiga's bacillus).

(d) Leprosy (Hansen's bacillus).

IV.

Regarding the bacteria believed by some to be causally connected with the following diseases we are at present *in doubt*.

(a) Whooping-cough.

(b) Yellow fever.

(c) Syphilis (Lustgarten's bacillus).

(d) Cystitis and cholangitis (colon-bacillus infection in certain cases).

(e) Soft chancre (Unna's bacillus).

V.

Finally we may make a list of bacilli probably pathogenic under certain conditions, but not constantly associated with any well-defined group of *clinical* manifestations. Such are the:

(a) Bacillus pyocyaneus.

(c) Bacillus of malignant edema.

(d) Bacillus of Friedländer (ozena, lobular pneumonia, etc.).

DIAGNOSIS.

Bacteriology is in the closest relations with clinical medicine through the help it gives us in clinical diagnosis. Such assistance is given

(A) Through the demonstration of the bacilli themselves in secretions or in the products of disease.

(B) Through the agglutination test.

(C) Through the injection of soluble products of the growth of certain bacilli (tuberculin mallein).

A.

So far only two or possibly three such bacteriological tests can be said to be in general use throughout this country, namely:

(1) The search for the tubercle bacillus in sputa.²

(2) The search for the diphtheria bacillus in the throat, and possibly

(3) The agglutination test of typhoid.

Other such aids to diagnosis which seem likely to come into more general use are the examination of

(a) *The blood* — blood cultures in pyemia, malignant endocarditis, bubonic plague, pneumonia, gonorrheal septicemia).

(b) *The sputa* — for the influenza bacillus, plague bacillus, and micrococcus lanceolatus.

(c) *The urine* — for the bacilli of typhoid and tuberculosis.

(d) *The feces* — for the bacilli of typhoid, tuberculosis and cholera.

(e) *Cerebrospinal fluid* — for the diplococcus intracellularis, tubercle bacillus, and mucococcus lanceolatus.

(f) *The urethral, vaginal and uterine secretions* — for gonococci.

(g) *The nasal, pharyngeal and conjunctival secretions* — for influenza or diphtheria bacilli, bacillus of Friedländer, bacillus of Weeks.

B.

THE AGGLUTINATION TEST.

(a) Next to typhoid, Malta fever seems at present the disease in the diagnosis of which we are most helped by the agglutination test.

(b) In the recognition of the true nature of certain obscure fevers, Durham believes that the serum test with the bacilli most frequently concerned in meat poisoning (Gärtner's bacillus enteritidis) is destined to play an important part.

(c) The diagnosis of relapsing fever between the paroxysms, once difficult or impossible, is now possible by the use of a reaction akin to the agglutination test.

(d) Well-marked agglutination reactions have been constantly observed in leprosy, bubonic plague, Asiatic cholera and tropical dysentery with the bacilli of these diseases. Just how much practical use is as yet made of these tests I am unable to say.

To other diseases the diagnostic assistance of the agglutination reaction has not extended. Individual observers have reported success in the attempt to apply the serum test to the diagnosis of tuberculosis and croupous pneumonia, but confirmation is lacking.

AID GIVEN TO BACTERIOLOGY BY CLINICAL MEDICINE.

To a limited extent we are able to reverse the use of the agglutination test. Instead of using a well-identified bacillus to test the body fluid of a doubtful case, we can use the body fluids of a well-identified case of disease to test a doubtful bacillus. In identifying doubtful cultures, M. W. Richardson uses slips of filter paper soaked in the blood obtained at autopsy from a case of typhoid. Durham has used similar tests in differentiating the flora of the intestine.

² In examining sputa from cases of gangrene of the lung, it should be remembered that the smegma bacillus may occur in such cases, and be mistaken for the tubercle bacillus if decolorization with absolute alcohol is not attempted.

C.

Of the diagnostic use of tuberculin it is only necessary to say that despite the warnings of Virchow it has passed into general use and deserves to be utilized much more widely still. The few who object to its use are for the most part those who have not tried it. The use of mallein is well established.

SYMPTOMATOLOGY AND COURSE.

(1) Bacteriology is rapidly bringing about a regrouping and rearrangement of those clusters of signs and symptoms by means of which we have been accustomed to recognize the entities called "diseases." Previous to the development of bacteriology we thought of acute pneumonia as a single well-defined disease. Now we know that there are many kinds of pneumonia. The pneumonia due to the micrococcus lanceolatus differs in many respects from pneumonia due to the streptococcus pyogenes, to the plague bacillus, or to Friedländer's bacillus. Such differences are clear on the post-mortem table and we are beginning to recognize clinical types corresponding to them.

I cannot help hoping that such differentiations will help us to clarify the turgid sentences in which perforce our symptomatology is now expressed. When I read symptomatology, and still more when I attempt to write it, I am at times inexpressibly depressed by the wearisome occurrence of such phrases as "sometimes," "not infrequently," "in certain cases," etc. "Sometimes pneumonia ends by crisis—sometimes not." "Peritonitis sometimes caused distention of the abdomen, sometimes retraction." "Why?" asks the intelligent student and there is no answer.

Now if we could say (as I hope before long we can): "Pneumonia when due to the micrococcus lanceolatus ends by crisis, when due to the streptococcus by lysis"—what a godsend it would be! How much more scientific, how much less by the weather predictions of the Yankee fishermen our text-books of medicine would sound!

(2) Again by showing that one species of bacteria may set up disease in the brain, the lung, the endocardium and the peritoneum, bacteriology has suggested that what we now separate as various diseases—meningitis, endocarditis, peritonitis should properly be brought together under the heading of "pneumococcus infections." Influenza, tuberculosis, gonorrhea and typhoid already occupy such a position. Influenza is still influenza whether it attacks the upper air passages, the gastro-intestinal tracts, or runs its febrile course without any recognizable local manifestation. The recent report of the Bombay Plague Commission manifests an advanced form of the same tendency when it specifies no less than ten forms of infection by the plague bacillus at least, as different from each other as are the different manifestations of the micrococcus lanceolatus in various organs.

(3) The interesting subject of combined bacterial infections is too extensive to be treated in this paper. But it is evident that our conceptions of the symptomatology of pulmonary tuberculosis have been greatly clarified since we began to distinguish the symptoms due to mixed infection with pyogenic cocci or with influenza bacilli from those due to the activity of the tubercle bacillus alone.

PROGNOSIS.

Statements regarding prognosis are apt to present an unrivalled material for the study of the art of hedging.

Bacteriology is helping us to make our prognoses less meaningless. The following examples are in point:

(a) When pneumococci can be demonstrated in the blood of a case of pneumonia, a fatal termination is almost certain.

(b) When the spirochetes of a case of relapsing fever are rendered motionless within one hour by the blood of another patient who has passed through one paroxysm and is expecting another, no second paroxysm will occur, while if the spirochetes are not quieted within two hours another paroxysm is sure to follow.

(c) Empyema due to the pneumococcus is likely to heal after relatively rapid tapping, often without permanent drainage.

TREATMENT.

(a) *Antitoxic or protective sera.*

The subject is so familiar and well worn that I will simply classify the various antitoxic sera according to the best current opinion of the efficiency.

I.

Markedly curative.

Antidiphtheritic serum.

Antispirillum serum (relapsing fever).

II.

Efficient as protective.

Anticholera serum.

Anti plague serum.

III.

Limited utility in selected cases.

Antitetanus serum.

Koch's tuberculin.

IV.

Doubtful but hopeful.

Antityphoid serum.

Antidysenteric serum.

V.

Probably inert.

Antistreptococcus.

Antipneumococcus.

Anti-amarillic (yellow fever).

(b) Under a slightly different heading comes the treatment of inoperable cases of malignant disease by the injection of the toxin of erysipelas, which appears to have a distinct though very limited field of usefulness.

RELATION OF THE CLINICIAN TO THE BACTERIOLOGIST.

The Municipal Laboratory of the City of Boston now offers to examine for physicians material suspected of coming from any of the following diseases: Typhoid, tetanus, tuberculosis, diphtheria, malaria, glanders, gonorrhea, influenza.

Now, as a citizen of Boston, I take great satisfaction in knowing that we have such a municipal laboratory, and that our physicians can and do avail themselves of it. Yet I am sometimes appalled when I see

how innocently, how literally, how trustfully, physicians accept the verdict of the laboratory as decisive. I have been amazed to see how my own laboratory reports at the time when I was doing such work were accepted as final, and used as foundations on which to build an extensive superstructure of diagnosis, prognosis and treatment. No one who has ever done much laboratory work ever accepts the report of another in such a spirit, for he knows from experience

(a) The chance for error in the laboratory (from confusion of specimens, deterioration of cultures, or culture media, etc.).

(b) The difficulty of interpreting the results of bacteriological investigation, or of understanding just how decisively the bacteriologist intends to speak on the point in question.

(a) The bacteriologist knows that some of his verdicts are relatively final — other less so, and more subject to modification, according to various other circumstances. He knows when his technic has been above suspicion, and when (either from the condition of the material furnished him, or the nature of test attempted) his results are to be taken less seriously. All this the bacteriologist knows — but the clinician frequently does not. Hence arise errors and misunderstandings, which not infrequently drive the clinician to an utterly unreasonable distrust of *all* laboratory results.

(b) Few clinicians realize how difficult it is to interpret the results of bacteriologic examinations. For example, to draw the *properly limited inference* from the announcement of a positive Widal reaction; to be enough, and not too much, alarmed by a positive reaction to tuberculin, or by the finding of Klebs-Löffler bacilli in a patient's throat.

Especially is this true where relatively indefinite quantitative expressions enter into the bacteriologist's report. Only he who makes the test can really appreciate what is meant in a given case by such phrases as "Very numerous tubercle bacilli, very virulent streptococci, very motile organisms, very numerous malarial organisms, etc."

In view of these facts I believe that we get the greatest help from bacteriology only when the bacteriological tests are made by the clinician himself or by some one (for example, his private assistant or interne) who is familiar with the clinical aspects of the case in question. Otherwise, the wisdom of the laboratory and the wisdom of the bedside often fail to connect with and to re-enforce one another.

Bacteriological evidence on clinical cases cannot be passed from hand to hand without damage; the truth as the bacteriologist sees it is not the same truth which the clinician receives through the medium of a written report. The journey from mind to mind has modified it — sometimes transformed it into something very like error.

THE SOCIOLOGICAL STATUS OF THE PHYSICIAN.¹

BY CLARENCE JOHN BLAKE, M.D., BOSTON.

IN the very beginning of his studies the medical student is brought into investigatory relationship with that which he has heretofore thought of as an entity, a being, a mystery, and which, now put into his hands

¹ Abstract of Address delivered before the Fifth Congress of American Physicians and Surgeons, held at Washington, D. C., May 1, 2 and 3, 1900.

for demolition, he finds to be a most wonderful and delicately constructed machine, in the study of which he may be said to pass through much the same process of mental evolution as that attributed by Professor Giddings to primitive man.²

He is lost in marvel at the compact arrangement of muscular tissues, regards as might the explorer of a buried city the system of canals which carry quickening fluid to the outermost circumvallation and of drains into which are cast waste matters to be discharged without the walls; while the glistening white lines of nerves sending their branches in a network between muscles and under and over canals and drains reveal to him the suggestion of a system for the communication of intelligence and the issuance of governing mandates to which the combined telegraphic and telephonic services of the greatest city built by human hands have no comparison in relative extent or in perfection.

There is probably no point in his career of so much initial portent as that in which the student in the dissecting-room for the first time lifts the wet sheet from a face that he has never known, but behind which there dwelt and through which there have been expressed all that emotion and desire can crowd into the compass of a human life; it is a period in which he either consecrates himself or turns back; if he be honest he does one or the other; if he be a pretender he may, it is true, continue and complete his medical school course and go out into the broader school of work, but without the consecration he will inevitably fail of his highest possibilities as a physician. The impress which is made by the study of anatomy upon the truly thoughtful man cannot but be emphasized in the physiologic laboratory where the student learns the values and uses of the different parts of the human machine and finds the answers to questions which the previous study of the structure of the silent body have evoked. Here and in the associated laboratories, he learns the chemical processes of the body in health and disease, the supplementary relationship of the different organs, the provision for their maintenance and repair, and comes to recognize and to know the functions of the microscopic organisms with which the body teems. Carrying with him the lessons born of research, he next passes into the wider school of clinical teaching and learns at the bedside that he has to study something more than the disease and that to render the fullest meed of service as a physician he must come to know, patiently, tenderly and, in the broadest sense, sympathetically his brother man. Here, too, he learns that his own feelings and emotions must be subordinated to the one purpose of his greatest help — efficiency; that here, as in all scientific work, his personal equation must be reduced to a minimum and that he must lose himself in the effort to think wisely and judge well for others.

In former times, not very many years ago, the bedside teaching was provided under a system corresponding to that of apprenticeship in trade and the student gained his clinical experience through association with some active general practitioner; but to-day, with the aggregation of population in cities and the consequent establishment of hospitals, these institutions are made to furnish the clinical material necessary for instruction, thus fulfilling one of their important obligations to the community which supports them; for, while

² F. H. Giddings: *The Principles of Sociology, Anthropogenic Association*, p. 246.