# SCIENCE

FRIDAY, MARCH 16, 1888.

THE MOST INTERESTING and the most valuable article in the *Popular Science Monthly* for March is one entitled 'The Antechamber of Consciousness,' by Mr. Francis Speir, jun. It embodies the result of some carefully planned investigations in psychology for the purpose of weighing anew the argument for unconscious cerebration. The mode of presentation is excellent, and shows an acquaintance with scientific method. The facts are presented by themselves without comment, and the discussion of them follows. The facts, and the writer's opinion concerning the facts, are, as they should be, kept quite distinct. The method adopted for the accumulation of data was the well-known one of distributing printed questions, to be answered from personal experience. The question in which the inquiry centred was, 'Does there exist in man the power to exert intellectual activity during unconsciousness?' The answers are grouped and summarized under four heads; (*a*) when the effort is simple, by reproducing past experiences in obedience to a mandate of the will; (*b*) by comparing related facts, and arriving at a settled judgment; (*c*) when the effort is more complex, by continuing old trains of thought begun in consciousness, and proceeding logically, step by step, to a relative settled conclusion; (*d*) when the effort is most complex, by commencing and continuing new trains of thought without having voluntarily undertaken or continued them, and arriving at results of original creation as inventions, literary and musical creations, etc. Of the first, Mr. Speir says, "Almost every individual says concerning these experiences, 'They are of such frequent occurrence that when they happen I pay no special attention to them.'" Of the second it is said that many people, during a state of perfect unconsciousness, can accurately measure time as well as, and often better than, they can in consciousness. In doing this they may perform an intellectual process similar in all respects to the conscious act of calculating a distance between known points. Of the third, "about eighty-five per cent of those answering claim to have arrived at definite results of work begun in consciousness and left unfinished, at results of a finished logical nature, at results that could come only by bridging the gap between the beginning and partial continuation in consciousness, and the perfected conclusion by predicting the existence and operation of unconscious intellectual effort as the necessary cause of the known result." Of the fourth, "only thirty per cent claim to have suddenly discovered the results of creative effort; these creations appeared suddenly, most often while the individuals were engaged in matters foreign to the discovery." All these voluminous answers could not have been collected without patient effort; and psychologists should be very grateful to the writer for laying so much that is new before them. We trust that Mr. Speir will find time and opportunity to push these investigations further, and to complete his chain of evidence by additional data.

## BACTERIOLOGY IN OUR MEDICAL SCHOOLS.

IT was stated in this paper some weeks ago that inquiries were on foot the purpose of which was to obtain information concerning the attitude of our medical schools and training-schools for nurses, toward the germ-theory of disease. For this purpose a circular was sent to each medical school in the country and each training-school for nurses, requesting information on this matter. In most cases the circular was sent to the dean of such institutions, and has asked replies to the questions given below. Answers to this circular have been received from quite a large number of schools, and direct personal inquiry has elicited information from others that have not responded to the circular. In these ways information has been obtained from the following institutions and physicians: —

1. University of Colorado, J. H. Kimball.
2. Medical Department of Yale College, New Haven, Conn., M. C. White.
3. Chicago Medical College, N. S. Davis.
4. College of Physicians and Surgeons, Chicago, Ill., A. Reeves Jackson.
5. Rush Medical College, Chicago, Ill., J. Adams Allen.
6. Medical College of Indiana, J. L. Thompson.
7. Hospital College of Medicine, Louisville, Ky., W. H. Bolling.
8. Medical Department of Tulane University, New Orleans, La., S. E. Chaille.
9. College of Physicians and Surgeons, Baltimore, Md.
10. Harvard College, Cambridge, Mass.
11. University of Michigan, H. Sewell.
12. Minnesota College of Physicians and Surgeons, J. T. Moore.
13. Minnesota Hospital College, F. A. Dunsmoor.
14. C. H. Hunter, Minneapolis, Minn.
15. Kansas City Medical College, Missouri, E. W. Schauffler.
16. North-western Medical College of St. Joseph, Mo., F. A. Simmons.
17. Medical Department of Buffalo University, Buffalo, N.Y., T. F. Rochester.
18. New York Medical College for Women, C. S. Lozier.
19. Medical College of Ohio, J. T. Whittaker.
20. Jefferson Medical College, Philadelphia, Penn., Morris Longstreth.
21. University of Pennsylvania, William Osler.
22. Pulte Medical College, Cincinnati, O., J. D. Buck.
23. Hahnemann Medical College, Philadelphia, A. R. Thomas.
24. Bellevue Hospital Medical College, New York.
25. College of Physicians and Surgeons, New York.
26. Medical Department of City of New York.
27. American Medical College, St. Louis, Mo., E. Younkin.
28. Long Island College Hospital, C. Jewett.

The schools in this list will hereafter be referred to by the numbers affixed against them.

This list includes about one-fourth of the medical schools of the country; but inasmuch as it includes all of the largest schools, the proportion of students thus represented is much larger. Nearly one-half of the medical students of the country are in attendance upon the schools represented in the above list.

The answers received to some of the questions show in many cases so much similarity, that it is not necessary to give them all here in detail. The following summary will indicate the questions, and the substance of the replies: —

*Question* 1. Is the theory that most, if not all, infectious diseases are caused by the growth of microscopic organisms, accepted by the members of your faculty and the physicians in your vicinity?

To this question the responses have been in the affirmative in almost every instance.

Nos. 3 and 22 change the question so that it reads, "caused or accompanied by," and then answer in the affirmative. This, of course, changes completely the significance of the answer; for, if the causal connection between the microbe and the disease is denied, there is nothing left of the germ-theory.

No. 5 says, "No."

No. 7 says, "Some absolutely, some *cum grano salis*."

No. 12. "Opinions still divided, a majority of the more modern thinkers falling in with that view."

No. 27. "Not wholly."

No. 28. "No, we are not wedded to this theory. It may be true, but it may not."

*Question* 2. Do you regard the theory as of as much importance as is claimed for it by the various doctors and scientists who advocate it?

With the exceptions noted below, all of the replies recognize that the subject is one of great importance, this conclusion being in general based on the fact that the germ-theory emphasizes and makes possible a scientific study of preventive medicine.

The exceptions are as follows: —

No. 3. "I do not. The adoption of the mere theory as a general proposition does not add any thing to our resources for either curing or preventing disease. Every new fact that becomes clearly and definitely established concerning the existence of a microbe, a ptomaine, or any other material condition accompanying the development and progress of any disease, is of importance, because each new fact is likely to suggest such investigations as will bring to light other facts until results of importance are obtained. The popular adoption of a general theory of disease has in all ages led to an effort to make all facts conform to the theory, and thereby led to many practical errors."

No. 5. "Briefly, no."

No. 7. "No, I do not believe that the bacillus has been proved to be the occasion of disease. May it not be a product? Am open to conviction."

No. 22 says, "Further investigations very desirable. The facts are not all in yet."

*Question* 3. Do you think the practical value of the subject is destined to be sufficient to demand a wider and more thorough treatment in our medical schools and training-schools for nurses?

To this question a simple or an emphatic affirmative answer was given in all cases where a reply was received, except in the following instances: —

No. 3. "I think the subject receives a full share of attention in all the more important medical colleges, hospitals, and training-schools for nurses in the country. Such is certainly the case in the schools in this city, and in the medical societies also."

No. 5. "No."

No. 6. "I do not, by any means."

No. 7. "The whole subject needs to be further investigated and better understood."

No. 22. "As fast as solid ground is reached. The human mind naturally jumps at conclusions."

No. 27. "There is nothing as yet very practical about the subject: it is mainly theoretical."

*Question* 4. Is it practical to introduce it into a medical course as a branch of pathology?

No direct reply to this question has been received from Nos. 2, 10, 12, 19, 20, 21, 24, 25, 26. In all of these institutions, however, very special attention is paid to the study of bacteriology, as will be seen in the answers to the next question.

No. 1 says, "Yes, but the ideas advanced should be demonstrable."

No. 3. "Certainly not; and for the reason that microscopic organisms, so far as they act as causes of disease, belong to the department of etiology instead of pathology, and, if any of them are simply developed as products of disease, they belong to the department of morbid anatomy."

No. 5. "No."

No. 6. "No. It could be disposed of in a few sentences; but to make the fuss over it that some lunatics do is an abomination in the eyes of the Lord and man."

No. 7. "Not at present."

No. 8. "This is a question chiefly of finance and of public appreciation of preventive medicine."

No. 11. "I think it not only practical, but necessary to an understanding of pathology."

No. 16. "Yes, and it ought to be done, or intimately associated with it, as we have already done in our school."

No. 27. "Not as a branch of pathology settled, but it is well to treat of the subject so far as science has unfolded."

All others answer with a simple affirmative.

*Question* 5. To what extent does the subject receive attention in the medical course of the school with which you are connected?

The answers to this question are of so much interest, that they are given here in detail.

No. 1. "Not to any great extent, no pathological laboratory work."

No. 2. "A fully equipped laboratory for bacteriological investigation. A special lecturer is employed to give instruction. In the pathological laboratory attention is given to demonstrations of the presence of bacteria in disease. The subject of ptomaines is taught in the chemical department."

No. 3. "The subject of micro-organisms receives a full share of attention in the practical laboratories of chemistry, histology, pathology, and a well-equipped bacteriological laboratory, as well as in the teaching of every practical department, both didactic and clinical."

No. 4. "All the teachers whose branches bear upon it teach it more or less, though not systematically. We have a professorship which includes general pathology, hygiene, and bacteriology."

No. 5. "More than deserved."

No. 6. "In speaking of the causation of disease, it receives due attention."

No. 7. "Two professors of pathology."

No. 8. "All of the seven chairs enforce the germ-theory of communicable disease."

No. 9. "Special lecturer employed to give instruction on this subject."

No. 10. "Bacteriological laboratory, and a special instructor in this branch."

No. 11. "A special chair of pathology and bacteriology has recently been established, and a well-known scientific worker elected to fill it."

No. 12. "The pathology which I give in connection with theory and practice, when dealing with infectious diseases, includes bacteriology; and I am in the habit of urging the students to investigate the field for themselves, as the branch is not thoroughly developed."

No. 13. "One lecture each in surgery, medicine, obstetrics, and poisons, with four in chair of pathology, and practical microscopical work."

No. 14. "Interwoven in all the teaching. Lectures on micro-organisms, their life-histories, nature of proof that they cause diseases, etc., are given. Different specimens of bacteria are demonstrated."

No. 15. "Is lectured on and demonstrated by one lecturer on histology, who has one hour a week."

No. 16. "The subject is largely taught by the professors in surgery, theory and practice, materia medica, chemistry, gynecology, pathology, and hygiene."

No. 17. "A culture laboratory, and the professor devotes considerable time to bacteriology."

No. 18. "Professor of hygiene teaches in his lectures something of the theory of germ-cells and microbes in disease, and the importance of care and cleanliness; also the danger of eating uncooked or rarely cooked animal food. The professor of anatomy and histology also has given some very instructive discussions in his lectures on the subject."

No. 19. "A fully equipped bacteriological laboratory. The laboratory was furnished directly from Koch's laboratory in Berlin."

No. 20. "In the early lectures of the yearly course on pathology a full exhibition of the pathogenic forms is made by means of the lantern; also lectures on the relation of the micro-organisms to each disease. In the laboratory the class examine with the microscope the organisms in stained preparations of cultures and sections of tissue, etc. The method of culture-preparation, etc., are shown."

No. 21. "In the second and third years a good deal of time is spent by the students in the pathological laboratory. Bacteriology forms part of the regular course of instruction. In the department of clinical medicines the bacteriological questions in relation to diagnosis and etiology are fully discussed, and the clinical laboratory is provided with full means of research in this line."

No. 22. "Incidentally only."

No. 23. "Only in an incidental way in connection with infectious

disease. I have in contemplation introducing a department for study and original experiment in bacteriology in our school."

No. 24. "A competent instructor in bacteriology, trained in Germany."

No. 25. "A well-equipped bacteriological laboratory, with a special instructor."

No. 26. "A special instructor, a pupil of Koch, gives bacteriological instruction."

No. 27. "The facts and investigations are clearly set forth, leaving the subject open to further investigation. We believe that blood-poisoning may not be due to germs. Much depends on ptomaines. Decomposition does not depend on germs. Suppuration has a cause within the body independent of germs. Germs may be the result of decomposition or animal chemical changes. At all events, we are not satisfied on these points."

No. 28. "I can speak of obstetrics only. The student is taught a rigid aseptic practice, and is daily drilled in the methods of sterilizing hand and instruments, etc."

*Question* 6. Do you think the general principles of the nature of infectious diseases, and the methods and meaning of infection, should be taught the general public through the public school?

The responses to this question have been quite varied, and are of course in all cases personal opinions rather than official replies. These replies are interesting as indicating various opinions on public-school teaching, and a number of them are given below; but since in some cases the request was made that the reply should not be quoted, the replies are given without reference to the source from which they are obtained.

Ten replied with a simple affirmative: others replied as follows:—

"I think that this subject, in connection with general sanitary science, might and should be introduced into the studies of the common school."

"Not yet, except in the way of and in regard to necessary disinfection, cleanliness, and general hygiene."

"Am free to say that the attempt to teach bacteriology generally would be a most misdirected effort."

"It would unquestionably be avantageous could suitable teachers be obtained; but I shudder to think of the statements which would pass current if the subject were made obligatory in even the high schools."

"Not at present, but after the subject is more fully understood."

"No, they would make a botch of it, and teach more falsehood than truth. It needs more acquaintance with the subject than can be expected of non-medical or non-expert teachers."

"Yes. If physiology and healthy function are taught, of much more importance would it be to sow the seed of understanding how to keep those functions healthy in all ways. An elementary work on preventive medicine, including bacteriology, should be taught the young. It should be so prepared that the mind could grasp it without being prepared by a medical education."

"To some extent it should; but so very much is crowded into the children's heads, that they become dazed, and are mere parrots when they get through."

"No, certainly not: first, because not one per cent of the scholars in the public schools have reached the stage of maturity and mental discipline necessary to enable them to comprehend or profit by the teaching of such subjects; second, because the public schools are already over-crowded with so many branches of higher and more abstruse character, that not twenty-five per cent of the scholars are allowed time enough to gain an adequate knowledge of the most rudimentary and practical branches of knowledge. Consequently it is much easier to find boys and girls who can repeat Latin, French, or German, finger a piano, recite verbatim answers from a manual of physiology, etc., than to find those who can write a letter containing one or two hundred words without violating some of the most important rules of orthography, syntax, and penmanship."

"I do not think any one connected with this school would advise the introduction of bacteriology in our public schools."

"First teach the profession, and through them the public. No objection, of course, to extending knowledge in every possible way, but don't think it yet time to expect much through public schools. We must first show more facts."

"No harm, little good."

From the circulars sent to the training-schools for nurses, no responses have been received. This is the more to be regretted, since, if preventive medicine is of value to any one, it is to nurses.

A few words in final summary and review may not be amiss. The question naturally arises, whether the responses from the schools above given can fairly be taken as an average, and whether we can judge of the whole body of medical schools by the replies received from those in the above list. I think it cannot be assumed that this is possible. The above list includes nearly all of the larger schools, and those in which most advanced methods would be expected. It seems quite natural, also, that those institutions which have given any considerable attention to this subject would be more likely to respond to the circular sent by *Science* than those which had not yet regarded the subject as of sufficient importance for careful study. It is almost certain, therefore, that, if responses should be received from the remainder of the medical schools, there would be found a much larger proportion in which the subject is considered only incidentally or not at all, a much larger proportion in which the germ-disease theory is regarded as of little or no importance.

The fact that no responses have been received from the training-schools for nurses can hardly be interpreted as having other significance than that the subject of bacteriology has not received enough attention in these schools to warrant any opinion on the matter.

From the replies above summarized, even though they are less general than could be wished, I think we can fairly draw the following conclusions:—

1. The germ-theory has in the past few years been rapidly acquiring acceptance, is almost everywhere regarded as a subject worthy of most careful consideration, and is nowhere looked upon as an absurd speculation, as was the case a few years ago. The causal connection between specific microbes and definite diseases is not yet, however, everywhere acknowledged by physicians.

2. Quite a number of special bacteriological laboratories have been established in connection with our larger medical schools. They are under the charge of competent directors, and are places where original research is being carried on, and where students have an opportunity to familiarize themselves with the subject in a practical manner. American medical schools are thus doing their share in this research in this matter, and in the endeavor to advance our knowledge of bacteria and their relations to disease.

3. A large number of our schools, probably a large majority of them, do pay considerable attention to bringing to the notice of their students this subject in its theoretical and practical bearings. In some cases it is only done incidentally, in others by a few odd lectures, and in others by regular courses of lectures and laboratory instruction. As much is being done in this line as can be expected, when we remember that not a few of the medical courses are, of necessity, little more than periods of cramming to give the students just enough knowledge to enable them to make ordinary practitioners. The course is frequently so short as to make it hardly a possibility to treat scientifically any subject not directly bearing upon the treatment of disease. It will be noticed that the amount of attention given to the subject is not regulated by the amount of importance placed upon it by those who have answered the circulars. In some cases where the theory is rejected it is still taught in the school; and in others, where it is fully accepted and regarded as of great importance, the amount of teaching is yet very slight. This indicates that it is usually difficulties of finance or otherwise which in many cases have delayed the adequate consideration of the matter.

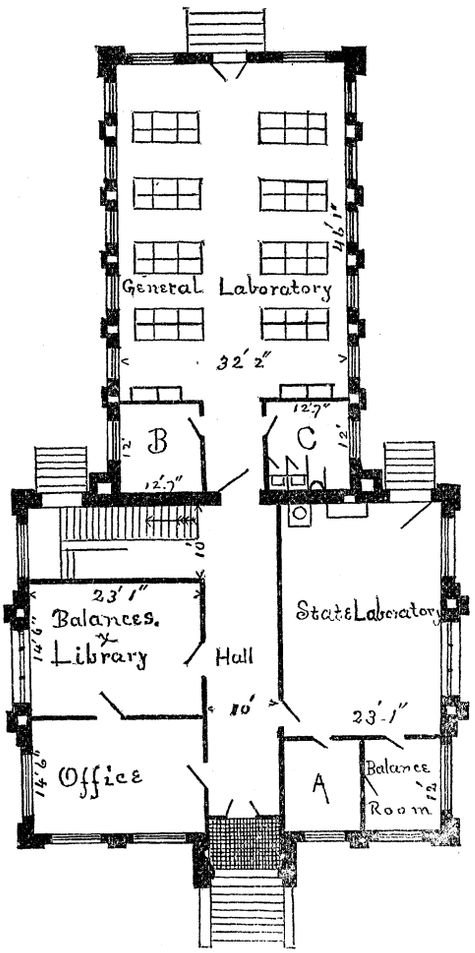
4. It would be the opinion of probably a majority of physicians and teachers, both of those who believe in the importance of the subject and of those who do not regard it as of much import, that the time has not yet come when bacteriology can be taught to advantage in the public schools: at least, this cannot be done until some thoroughly competent person shall have carefully summarized the facts in the form of a short, clear account, which could be used as a text-book. It must be borne in mind, however, that many physicians are, for reasons similar to those given above, opposed to the teaching of physiology in the public schools. This is, however,

generally recognized as advantageous, and in some States required by law. It certainly seems, that, if physiology is to be taught, there would be just as few evils, and much more of value, accruing from the study of the principles of infection and subjects connected therewith, than results from the study of many subjects now taught under the head of physiology. The value of the study of bacteriology in the colleges and universities is more evident, and has been well shown in the letter of Mr. Theobald Smith, published in a recent number of this paper.

In conclusion, then, it may be said that our medical schools and profession generally have been and are advancing along this line of bacteriology as fast as can be expected. All of the larger schools have taken up the subject in a thorough manner, and many of the smaller ones are doing the same. The indications are, that a few years will see bacteriology established as a subject to be taught, either as a branch of pathology or otherwise, in all of the medical schools whose financial condition will warrant it. H. W. CONN.

## CHEMICAL LABORATORY OF THE ALABAMA POLYTECHNIC INSTITUTE.

WE present in this number of *Science* a cut of the new chemical laboratory of the Agricultural and Mechanical College of Alabama, located at Auburn. The substantial growth of this institution has been such that the trustees, at their annual meeting in June of last year, authorized the construction of a new laboratory in connection with the Agricultural Experiment Station and the State Department of Agriculture, of which the professor of chemistry is the official chemist, and for original research. At a subsequent meeting in July, it was determined to erect a larger building than at first contemplated, and transfer to it the chemical department of the college.

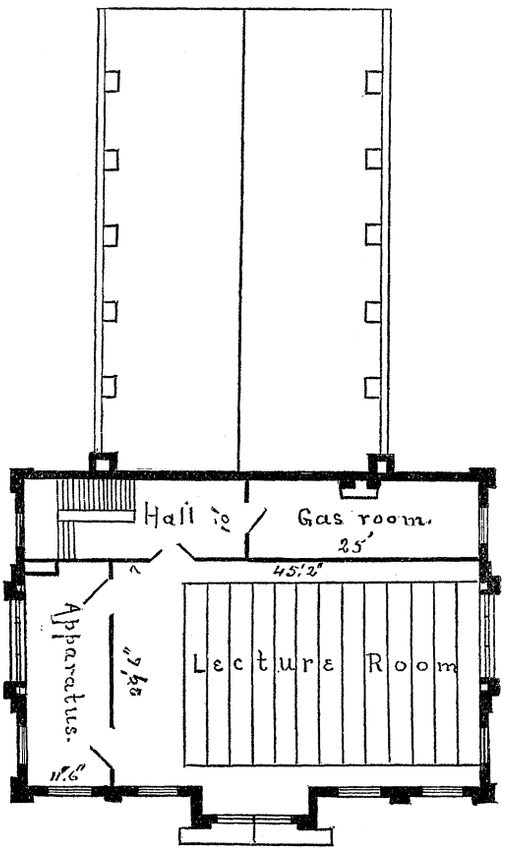



FIRST FLOOR.

*A*, Spectroscope and polariscope room; *B*, Assistant's private working-room; *C*, Combustion-furnace room.

The building is a handsome two-story structure, 40 by 60 feet, with a stately tower, and a rear projection 35 by 60 feet of one story, and basement. The exterior is of the best quality of pressed brick, laid in red mortar, with cut stone trimmings and terra-cotta ornamentation.

The main floor contains a central hall ten feet wide, with side hall for stairway of the same width, but extending only halfway across the building. On entering through the large archway under the tower, the first room to the left is the office of the professor of chemistry, to the rear of which is the library and balance-room. On the right, extending the whole length of the floor, is the State laboratory and laboratory for research. Two small rooms are cut off from this, one to be used as a balance-room, and the other for the spectroscope and polariscope. Leading from the rear of the main hall is the door which enters the large laboratory for general work. Two rooms are cut off from this, — one for combustion furnaces; and the other, a private working-room for the assistant.




SECOND FLOOR.

In the basement are ample accommodations for assaying and storage. The main laboratory will accommodate sixty students, and, when the fitting-up is completed, will contain the latest improved working-tables, with water, gas, and every necessary appliance for chemical work. Niches in the walls opposite each working-table, with hoods where necessary, connect with flues, and furnish the best possible means of escape for deleterious vapors, while ventilators in the ceiling furnish additional means for getting rid of noxious gases. The pitch is sixteen feet in the clear, with panelled ceiling of oiled Southern pine. The rooms are wainscoted throughout, and finished in natural wood. The second story contains a large lecture-room and room for gas-analysis. Around this lecture-room, suitably arranged, will be cases for containing crude and manufactured products, illustrating the subjects of agricultural and industrial chemistry, which are prominent subjects taught in this institution. Since the war, the South has awakened to an appreciation of her vast industrial resources, and every effort is made to educate her young men in a way that will prepare them to utilize her vast deposits of coal and iron and marble, and other valuable minerals, as well as to maintain, and if possible to increase, the productive capacity of her soil.