fact that lightning never strikes twice in the same place. They say that in naval combats the safest place to put your head is through the hole that the cannon-ball has just come through; and if it did strike more than once the rods could be arranged on the principle of the multiple fuse, and a new one plugged in as fast as they dissipated.

Mr. Wolcott: — Mr. Birdsall has been facetious on this point, and I will try to be so, too. I have heard it stated that one reason why lightning does not strike in the same place twice is that the place is generally gone when the lightning has struck once. I certainly have read of several cases where the conductor has conducted several discharges to earth in the same storm. Now, with regard to gold-leaf discharge. That this charge was smaller, of course, may be true. But the fact that the discharge in each of these cases is just about suited to the size of the conductors would seem to show that there was some coincidence about the matter. If a dissipated conductor always stops the damage, or very nearly always, there is something more than coincidence about it. It seems to me that such an instance as that could not be more than a mere coincidence — that a discharge which was capable of doing considerable damage to the building where the conductor was not dissipated, should be all used up by dissipating a very small amount of metal, is not probable.

The President: — I will call the attention of the Institute to the fact that our usual time of adjournment has very long passed.

Mr. Hodges: — Ships have been struck a number of times in the same storm. If you can cite specific cases against me, all right. I have found, so far as I know, that a dissipatable conductor protects. Why, is another question that does not concern us. Why that gold-leaf protected we do not care. It did protect. There is no arguing against its being reasonable, that will set aside the fact. I thought over the matter, and have some theoretical considerations to show why it does protect, but those are not essential.

This is all I want to give at the present time. But I believe there is one other way of furnishing protection against lightning which has been ignored for a number of years. The facts have been staring us in the face. I think about the same time that Harris introduced his system of lightning-rods there was a modification made in the rigging of ships which has tended to mitigate the disastrous effects of lightning. The facts were well known long before Harris came into existence; but they were so thoroughly out of tune with all the science of that day that they were simply ignored; so that, in fact, in the report of the lightning-rod conference, there is only the title of one paper bearing on the subject. To find that paper I hunted through the Astor Library, and put one of their expert searchers to work there; and it was evidently considered of so little importance, that it had not been copied in any periodical. By going back further and further in the "Philosophical Transactions," I found the same facts reported of a most positive character, and I think they have a bearing on this apparent immunity of ships when they are supplied with good conductors. I am inclined to think that it is not the Harris conductor that has been doing good service entirely, but it is something else. But all that I would have said this evening, if it had not been necessary to present a paper of some length, was that a dissipatable conductor protects.

Mr. James Hamblet: — I understand the gentleman to say that a dissipatable conductor protects. I have in mind a very large building situated at the top of a hill, in a very exposed position. That building is constructed with a metal roof, entirely over the building, but having no lightning-rods. It has large iron pipes, six inches in diameter, to conduct water through the building down to the ground. That building has never been injured by lightning at all, but frequently trees around it on the hill have been destroyed by lightning. The lightning conductors of the building, which are these same iron pipes I have mentioned, have not been dissipated.

THE BROOKLYN INSTITUTE BIOLOGICAL LABORATORY.

THE location of this biological laboratory, at the head of Cold Spring harbor, Long Island, is one of the most favorable on the coast. The country around affords excellent hunting ground for every form of animal and vegetable life common to the climate. Just above the laboratory is a series of three fresh-water ponds, each fertile in its own peculiar forms of fresh-water life, and through which flows the water of Cold Spring Creek. Just below the laboratory is the harbor of Cold Spring, divided by a sandy neck into an inner and an outer basin. The inner basin is particularly rich in marine life, and the channel between the inner and outer basins has a varied and vigorous growth of algæ, mollusks, and echinoderms. The outer basin has rocky projections, shallow flats, banks and eel grass, sheltered pools, oyster-beds, and other conditions favorable for collection and study. The outer basin opens into Long Island Sound, whose coast is varied in character for twenty miles in either direction.

The main laboratory occupies the first floor of the New York State Fish Commission building, and is a room thirty-six feet wide and sixty-five feet long, provided with ample light from every side. It is furnished with laboratory tables, aquaria, hatching-troughs, glassware, and all the apparatus and appliances required for general biological work. Into the laboratory is conveyed a bountiful supply of the water of the Cold Springs for use in the aquaria and troughs. This water is as pure as a crystal, has the same low temperature throughout the year, and is the water used so successfully by the New York State Fish Commission in hatching and growing salmon, trout, and other food fishes. The laboratory is also supplied with an abundance of salt water, which is pumped up from the harbor into a brick reservoir, from which it runs to the laboratory.

The station is provided with three small row-boats and a naphtha launch, together with nets, trawls, and dredges, for use in collecting and dredging. Near the main laboratory is a photographic room, with a dark room and work room adjoining. Each student is provided with dissecting instruments, chemicals, and glassware, to be used in the dissection, preparation, and study of tissues. Microscopes will be provided for those students who cannot provide themselves with instruments.

The following general course is open to each student, and is under the direction of Professor Conn. It will consist primarily of laboratory study of specimens illustrating the types of animal life. The practical work will be accompanied by lectures giving an outline of systematic zoölogy, for the purpose of showing the relations of the forms studied to other animals. The lectures will also touch upon various matters of general biological interest. The types studied in course will be as follows: *Protozoa*, — study of microscopic forms, including directions in the use of the microscope; 1. *Cœlenterata*, — hydroids, including the study of jelly fishes and the development of hydroids; 2. *Echinodermata*, — the star-fish; 3. *Bryozoa*,— study of an adult Bryozoan; 4. *Mollusca*,— the clam, the snail, development of the oyster or some other type; 5. *Crustacea*,— the crab, with a study of its development; 6. *Insecta*, — the grasshopper; 7. *Vertebrata*, — dissection of the fish, dissection of the frog.

Accompanying this course of laboratory work and lectures will be given instruction in methods of mounting objects and in the preparation of microscopic sections. Opportunity will also be given for collecting and surface skimming.

A special feature of the laboratory this season will be an extended course in the methods of bacteriological research. The course will consist of laboratory work on the culture and propagation of bacteria, identification of species, and of lectures and demonstrations by the director. Only those who are well prepared by previous study and experience in biological or medical work will be admitted to the course.

Students who pursue the general course of instruction during the summer, and who have time for extra work, are given the instruction and facilities necessary to enable them to carry on special investigations; while those students who have already gained the knowledge and experience which is provided by the general course, will be permitted to give their entire time to special work.

The laboratory will open for the season on Tuesday, July 7. The regular session for students will continue from that date until Friday, Aug. 28. The number of students for the season of 1891 is limited to twenty-five.

A good reference library will be placed at the service of students, and a collection of *algœ* will serve to guide students in marine botany. In addition to the regular lectures given in connection with the laboratory work, evening lectures will occur two or three times a week, illustrated by the aid of a magic lantern. The lantern is provided with a vertical attachment and with large and small cells, in which forms of life may be placed and their structure exhibited on the screen. A microscopic attachment to the lantern will enable lecturers to demonstrate points in minute anatomy, and a large collection of lantern slides of biological subjects will furnish the means for comparison of many allied forms and structures. The evening lectures will be open to the public, and persons interested may secure admission to the entire course.

For further particulars inquire of Professor Franklin W. Hooper, Secretary, Brooklyn Institute, Brooklyn, N.Y., or of Professor Herbert W. Conn, Ph.D., Wesleyan University, Middletown, Conn. Applications for admission as students should be sent to the secretary of the institute.

THE ETIOLOGY OF TETANUS.

IN a late number of the *Annales de l'Institut Pasteur* there appears (from the Bacteriological Laboratory of Val-de-Grâce) a most interesting paper on tetanus by Drs. Vaillard and Vincent, an abstract of which is printed in a recent issue of the *Lancet*. This paper appears to throw very considerable light on the subject of tetanus, and to clear up a number of points and observations that have hitherto been enshrouded in obscurity. After describing the organism, and identifying it with that already made familiar through the papers of recent writers, the authors give it as their firm opinion that in cases of artificial inoculation of pure cultures it is always the poison introduced along with the bacillus, and not the organism itself, that acts upon the animal. This indeed seems to be probable, as they are able to prove that almost inconceivably minute doses of this poison, which they compare with snake poison, are quite sufficient to produce all the symptoms of most acute tetanus; in fact, it was almost impossible, from some of the cultures that they obtained, to administer a dose that was not lethal.

An exceedingly interesting feature brought out in the course of their work is that in no case was the poison developed as soon as the organism began to grow; in fact, gelatine cultures of the tetanus bacillus were never capable of producing toxic symptoms until liquefaction of the gelatine had commenced, when spores were demonstrated to have been formed, and when the peculiarly disagreeable odor so characteristic of tetanus cultures had become perceptible. They associate both the odor and the peptonizing power with the formation of the poison in the cultures. That it was not due merely to the presence of the spores that the material was poisonous they demonstrated by heating their cultures to a temperature of 62° C., for a short time (a temperature which is quite incapable of interfering with the vitality of the spores), when it was found that cultures so heated and introduced by inoculation into a rabbit or a guinea-pig failed to produce any tetanus, thus proving that, although the spores are not killed, the poison has been destroyed by the heat. The spores were proved to be living by making fresh cultures from them in artificial media; after a time they grew luxuriantly, and if left to grow eight or ten days produced another crop of the poison. By simply washing away the poison from the spores with distilled water they also obtained similar results, for, although the spores could still develop and form the specific poison in artificial media, they were, when inoculated, incapable of giving rise to any symptoms of tetanus. From the re-action to heat of a substance they were able to separate, and from its resemblance to the diastases in other respects, they conclude that they have obtained from tetanus cultures the true tetanus poison, a poison, however, that cannot be formed by the tetanus bacillus in healthy tissues. The micro-organisms are here so rapidly attacked by the leucocytes that they are rendered *hors de combat* before they have time to form their poison.

It has long been well known that the tetanus bacillus could not develop in the tissues except, apparently, in the presence of other organisms, and the suggestion is offered that these other organisms act in one of two ways; they either paralyze the activity of the leucocytes, or they draw off, as it were, their attention and activity from the tetanus bacillus, thus allowing it sufficient time to develop its characteristic products.

It is interesting to note that Drs. Vaillard and Vincent consider that in many respects the tetanus bacillus is extremely like the diphtheria bacillus, the method of action on and in the organism being essentially the same in the two cases, the above factors in all probability playing a part in diphtheria much as in the case of tetanus; and it is evident that in studying the one poison much light may be thrown on the other. Behring and Kitasato appreciated this fact, and combined their forces to work out the question of immunity in these two diseases. It is obvious, however, from a consideration of some of the points that are indicated in this paper, that there are many sources of fallacy that will have to be eliminated before the ultimate explanation of the condition of immunity in protected animals can be given.

The facts that this poison is active in such extraordinary minute quantities, and that the micro-organisms are able to grow with such difficulty in the human tissues, allow us to hope that extremely minute changes in the blood may be quite sufficient to secure the alteration or breaking-down of the virulent poison, even when it has become diffused throughout the system. So long as the organism is localized to the wound, there is, of course, more chance of coping successfully with the disease, although here, as in other diseases, there always appears to be a possibility of the poison exerting such a paralyzing influence on the cells that usually take up foreign substances, that secondary septic conditions may be liable to occur even when the action of the tetanic poison can be antagonized so far as its primary effects on the cells are concerned.

One question appears to be set at rest, and that is, as regards tetanus and diphtheria, the ptomaines have had their day, whatever may become of the products of other organisms. It may be accepted that here, at any rate, we have some subtle poison which, although it has not yet been actually separated, has become so far isolated that it may be taken as proved that it is not an alkaloid or basic poison.

A most remarkable feature is that, in peptonizing gelatine with the filtrate from a meat-broth culture of the tetanus bacillus, the poisonous properties are lost to a certain degree in direct proportion to the amount of gelatine that is peptonized; this, taken in conjunction with the fact that the properties are not developed until the gelatine begins to liquefy, has led Drs. Vaillard and Vincent to suppose that the same agent that peptonizes the gelatine is the active agent in bringing about the development of the toxic symptoms of tetanus.

ONE of the many important uses to which electric welding machines are put is welding railroad rails. Owing to the difficulty of maintaining rails in crowded and paved city streets, it is an advantage to have the rails as long as possible, thereby reducing the number of joints to be cared for, and during the past year a company in Johnstown, N. Y., has been successfully experimenting in electrically welding rails up to 110 pounds per yard. This company is now having constructed one of the largest machines ever built for the purpose. As a result of careful tests, it is claimed that a saving of at least thirty-four per cent is effected by the electric welding process as compared with the older method.