

Manassas Journal

**Friday,
October 11, 1895
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DEPARTMENT.
FIELD WORK.

— [1. 2^a, 1895.]

so that each new form of life can find that whereon it lives. If every thing that has lived were not destroyed, or, rather, were it not again divided into its elements, there could be no new life. All the material available for the creation of organic matter would soon be used up if organic matter, once made, were indestructible. A man dies, and by the process of fermentation or putrefaction that of which he was made is gradually set free and becomes available for the manufacture of another man. Pasteur did not find this out, but he did discover the nature of the process by which it is accomplished. He proved, too, that there is no such thing as spontaneous generation, but that every form of life, however small, can be attributed to a germ.

Then he studied the sickness of silkworms. The silkworms of France suffered from a mysterious disease, and no one could find any clue to its origin or nature. It was a sort of leprosy that covered their skins with brown spots, deprived them of appetite and caused them to waste away. The health of the silkworm means millions of dollars to France.

Pasteur made the wonderful discovery that the strange, dark spots on the worms were living parasites, and that one silkworm could get the parasite from another, just as a dog may acquire fleas. They got the parasites by contact with contaminated food, by inoculation of the skin and by atmospheric dust. He stamped out the disease by inflicting the death penalty upon all infected insects, by quarantining suspects and by hygienic methods. Just as a smallpox epidemic would be attacked by a Board of Health. That method, now every one knows, is right, seems simple enough, but simple though it was, no one knew much about it till Pasteur told them.

It was while working over sick silkworms that the chemist became first conversant with principles of bacteriology, that he afterwards applied in the treatment of human beings.

In 1850 Davaine and Bayet found in the blood of animals killed by anthrax small ellipsoid corpuscles about twice the size of a blood corpuscle. These, it was supposed, were some product of the disease. Pasteur was the first to find that they were a parasite and the cause of it. He isolated the micro-organisms of anthrax and cultivated it in a medium which could produce anthrax with the same results, and that proved his case. Further studies showed him that anthrax was peculiar to certain localities and that it would break out without apparent reason.

Bearing in mind his own repeated declaration that there was no such thing as spontaneous generation, he dug deeper. He found that if an animal that died of anthrax was buried a yard deep it would still be the centre of infection. He found that earthworms ate the parasites, brought them to the surface and left them there as seeds for other animals to eat. In this way anthrax propagated. The remedy for that sort of distribution is obvious.

It was in 1880 that Pasteur began his work upon rabies. He found that the virus of this disease exists in a pure state only in the nervous system, brain, medulla oblongata, spine or nerves of a dog or rabbit killed by rabies. He found that by inoculating with the virus the uncertainty of incubation is done away with and that treatment is made much

He attenuated the virus—that is, he treated it so that its virulence was lessened. A patient taking the disease from the attenuated virus would have it only in a mild form and subsequently be immune to another attack. That is, he strongly stated, the principle of vaccination. It was found that dogs that had been bitten by dogs known to have rabies when inoculated with the virus usually recovered, or, in other words, they were vaccinated.

After endless experiments with animals, Pasteur in July, 1885, made the inoculation upon a boy named Muister, who had been bitten by a mad dog. The treatment proved successful. After that it was tried again, and in each case it proved to succeed.

One of the points about Pasteur's discovery that tended to make it seem less important to scientific men was the sudden increase in cases of alleged hydrophobia. Physicians had recognized this as a disease, but with the establishment of Pasteur Institutes everywhere stood in fear of developing it. Thousands of persons who in all human probability were never in danger of rabies had themselves injected. Some doctors claim the existence of a false hydrophobia, sort of hysterical affection produced by the fear of the disease and imitating its symptoms, and it has been said that the "Pasteur scare" multiplied this. But of course that is not Pasteur's fault.

The French chemist worked also on inoculation for other diseases, such as hydrophobia. He gave to the scientific world a vast quantity of ideas on bacteriology. Physicians consider that Pasteur opened a door that it will be for others to penetrate further into the myster-

in 1892 Pasteur inoculated animals for cholera and the experiments were successful. A trial was made of the inoculation of a man

but it was not conducted under conditions satisfactory to the medical world, though there was a good deal of faith among many learned men in its efficacy.

That the French Republic is not altogether ungrateful is shown by the fact that it gave Pasteur a life annuity of 12,000 francs (\$2,500) for his discoveries; chiefly for those bearing on fermentation.

He was given a State funeral and thousands visited his bier. The whole civilized world has expressed regret and gratitude for what the great man added to the sum of human knowledge.—*The World.*

An Interesting Lesson in Space.

An interesting discussion took place recently in Paris at a meeting of scientists as to the distance of the nearest fixed star. A number of astronomers had been asked to make observations of a certain star, and then to report the result of these observations to the meeting.

It was discovered that no two calculations agreed, but the astronomers departed with feelings of great satisfaction, for in no case was the difference between any two results greater than 20,000,000,000 miles.

There are eight planets moving about the sun, of which the earth is one, and astronomers have calculated, with very little chance of error, the distance of these bodies from each other and from the sun. The various results can be conveniently recorded in miles.

But when we come to the fixed stars, which are themselves suns, many of them far larger and brighter and hotter than our own sun, and around every one of which it is not improbable that a family of planets is moving, the task of computing distance is far more difficult. The abyss of space that separates us from our nearest stellar neighbor is so enormous that the human mind cannot even form the slightest conception of it. Even astronomers, who are suspected by some of possessing minds of more than human capabilities, confess that this distance cannot be adequately represented in terms of miles.

Nor is the ordinary astronomical unit, or distance of the sun from the earth, sufficiently large to be convenient in expressing the distance of the stars—that is, if we attempt to denote the distance of the nearest star, it is “so many times the distance of the earth from the sun,” it is found that this unit is entirely too small to be used with convenience, though it measures 93,000,000 miles.

Experience has shown that it is pre-satisfactory to take as a unit the distance that light travels in a year, which is about 63,000 times the distance of the earth from the sun. Thus, if we say a particular star is at a distance of ten light-years we mean that it is so far away that it will take ten years for its light to reach us, supposing it to have just sprung into existence.

It is curious to think that such comparatively insignificant creatures as human beings, inhabiting a third rate planet, revolving around a third rate sun, should be able to compute with any degree of accuracy the enormous distance of any one of these stars. The magnitudes are so great that the ordinary mind cannot comprehend them only when they are represented by some illustrative comparison. This may be done as follows:-

If we select any flat surface, such as a level field, and place on it a globe 2 feet in diameter we may consider this the sun. Mercury, which is the nearest planet to the sun as well as the smallest of all the planets, will be represented by a grain of mustard seed at a distance of 82 feet. Venus will be indicated by a small pea at a distance of 142 feet from the aforesaid globe. The earth will be a slightly larger pea 5 feet from the globe. Mars will become a rather large pinhead at a distance of 327 feet from the central body. Jupiter, the largest of the planets—in fact, larger than the others put together—will assume the respectable dimensions of a moderate sized orange nearly a quarter of a mile from the globe. Saturn, the beautiful ringed planet, will be represented by a small orange one-fifth of a mile from the mock sun. Uranus will be a full sized cherry or a small plum three-fourths of a mile from the same object. Neptune, the most remote of all the planets, so far as known, will be indicated by a good sized plum at a distance of 1½ miles.

If, however, we attempt on the scale to indicate the distance to the nearest fixed star, we impose a heavy task on our power of imagination. For such a star would be represented by another globe, about 100 in diameter, at a distance of 100 miles—in other words, at the equator, at the other side of the globe, on the end of a line drawn through the earth's center from the point representing the sun.

In 1838 Bessel succeeded in demonstrating and measuring the parallax of the star known as 61 Cygni, then, by a protracted series of calculations, in determining the distance of this star as 60,000,000,000 miles. This announcement created great sensation in the scientific world, and the fortunate Bessel was hailed with congratulations and laurels of honor. Then Struve published the results of his observations of the same star, in which he stated it at not less than 100,000,000 miles. Curiously enough

