in his studies of the distances of the globular star clusters and the Magellanic clouds of the southern hemisphere.

The investigations of Dr. Hubble were made photographically with the 60 inch and 100 inch reflectors of the Mount Wilson Observaiory, the extreme faintness of the stars under examination making necessary the use of these great telescopes. The resolving power of these instruments breaks up the outer portions of the nebulae into swarms of stars which may be studied individually and compared with those in our own system. From an investigation of the photographs, 36 variable stars of type referred to, known as Cepheid variables, were discovered in the two spirals, Andromeda and No. 33 of Messier's great catalogue of nebulae. The study of the periods of these stars and the application of the relationship between length of period and instrinsic brightness at once provided the means of determining the distances of these objects.

The results are striking in their confirmation of the view that these spiral nebulae are distant stellar systems. They are found to be about 10 times as far away as the Small Magellanic Cloud, or at a distance of the order of 1,000,000 light-years. This means that light travelling at the rate of 186,000 miles a second has required 1,000,000 years to reach us from these nebulae, and that we are observing them by light which left them in the Pliocene age upon the earth. With a knowledge of the distances of these nebulae, we find for their diameters, 45,000 light-years for the Andromeda Nebula, and 15,000 light-years for Messier 33. These quantities, as well as the masses and densities of the systems, are quite comparable with the corresponding values for our local system of stars, the one in which the earth is but a mere speck.

"Although these nebulae are the most distant objects for which we have reliable data, it seems probable that many of the smaller spiral nebulae are still more remote and appear smaller on this account," Dr. Hubble concludes. "From this point if view the portion of the universe within the range of our investigation consists of vast numbers of stellar galaxies comparable to our own, scattered about through nearly empty space and separated from one another by distances of inconceivable magnitude."

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## NEW KIND OF IMMUNITY DISCOVERED BY CHICAGO SCIENTIST

A new method of combating disease germs has been discovered by Dr. H. W. Taliaferro, formerly of the Johns Hopkins University and now of the University of Chicago.

When dangerous bacteria invade the human body, the automatic defensive mechanism of the body usually throws fighting units, called antibodies, into the front line trenches of the blood. These protective substances kill the harmful disease organisms.

The new substance found by Dr. Taliaferro is related to such usual antibodies But instead of wiping out the invading army of germs, it prevents it from perpetuating itself.

Working on a harmless blood parasite of rats, similar to the organism causing tropical sleeping sickness, Dr. Taliaferro found that the parasite, after an initial period of active multiplication apparently lost the power to reproduce its kind. Furthermore, by certain experimental precedure, he found that this peculiar occurrence is due to some substance produced in the rat's blood, and that blod serum

containing this substance could be used to stop reproduction of the parasites in new infections.

This seems to be an entirely new kind of "antibody" action. Generally, seru anti-toxins, and like substances act either by destroying the disease producing crganisns or neutralising their poisons. With this newly discovered substance, however, the case is different; it tolerates the existence of a few organisms, but literally forces race suicide on them by preventing them from multiplying.

It remains now to discover whether in human sleeping sickness a similar action exists or can be induced. This problem Dr. Taliaferro is attacking.

African sleeping sickness is due to a microscopic animal known as a trypanosome and is closely related to the organism found in rats' blood. There are two varieties of tropical sleeping sickness in Africa, the Gambian and the Rhodesian; and one variety in the tropical parts of South America. The Gambian variety of Africa is the more serious one. All of the tropical sleeping sicknesses are carried by insects, just as malaria and yellow fever are carried by mosquitoes.

Besides the tropical sleeping sickness, there is another entirely distinct disease in the temperate zone, called by the same name. This ailment, Encephalitis lethargica, which has been making some trouble in northern countries for some years, has never been traced to its cause, though it is probably due to an ultra-microscopic germ that can pass through the pores of the fine filter.

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## TREES FED AND CURED BY HYPODERMIC INJECTIONS

Hypodermic injections are being used to feed and cure hungry and ailing fruit trees at the University of California.

Dr. C. B. Lipman wields a glorified hypodermic needle-like apparatus with which curative solutions and food are placed directly into the circulation of the growing plant. The natural method of providing the tree with its sustenance through the soil by menas of fertilizers has in a large measure been superseded by direct feeding and medical treatment.

Primarily the new method is being used as a first aid to sick citrus trees. Orange and lemon orchards are sometimes attacked by a disease called chlorosis which causes the leaves to become yellow and the trees to cease bearing fruit. Prof. Lipman and his associates attended some trees that had been in this nearly dormant condition for three years.

They bored holes into their trunks to about three-quarters the diameter. Then glass tubes were inserted and sealed tightly with a special wax. Reservoirs containing a solution of ferrous sulphate were attached and the trees were allowed to drink up the solution.

In three weeks the yellow leaves had been replaced by green ones and the trees had taken a new lease on life. They now give signs of fruiting.

Citrus trees are heavy users of calcium in which some soils are deficient and the University of California scientists have found that injection of calcium nitrate or chloride into their trunks will cure and prevent a harmful mottling of the leaves due to lack of this salt.