

Some years ago Dr. Harlow Shapley of Harvard worked out a useful relationship between star brilliance and the period of these Cepheid variables, so named because they are most prevalent in the constellation of Cepheus. He found that if the period of variation was known the absolute brightness, dependent only upon the temperature of the star and not upon its distance from the earth, could be determined. A simple comparison of absolute brightness of the star with the brightness shown through the telescope tells the distance of the star from earth.

When Dr. Hubble applied this law to the variable stars he discovered in the Andromeda nebula, he found that they were all about 930,000 light years away in another island universe.

While Dr. Hubble is the first man to prove the distant existence of such vast conglomerations of matter outside our own locality of space, their character has been suspected for about a century. Sir William Herschel, English astronomer of 100 to 125 years ago, when he saw the spiral nebulae poetically called them "island universes". The name stuck and now Dr. Hubble has given it justification.

Undoubtedly more distant spiral nebulae, now known to be stellar galaxies, lie even farther out in space. There are more than 100,000 of these spirals known to astronomers and most of them instead of being great patches of light like the one in Andromeda, appear merely as points of light in telescopes and on photographs.

Imagination totters when it attempts to conceive of the distances that must intervene between these galaxies or "universes" and our own.

Space, or the super-universe, with the aid of Hubble, Einstein, and other scientists, has been swollen enormously in the past few years.

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#### PROTOZOA KILLING PROMISES TO AID MAN'S HEALTH

Killing of the thousands of minute animals that inhabit termites or "white ants" and digest their woody food for them may seem an unimportant accomplishment. Yet this is what won Dr. L.R. Cleveland, National Research Council fellow working at the Johns Hopkins University, Baltimore, half of the annual American Association for the Advancement of Science prize.

The microscopic protozoa that live in the digestive tracts and blood systems of man, animals and insects are mostly harmless or helpful, yet there are some that cause serious diseases, like malaria, sleeping sickness and dysentery. The importance of Dr. Cleveland's success in killing the protozoa of termites without hurting their involuntary hosts lies not in the practical application of this one accomplishment, although the method may be used in destroying troublesome "white ants", but in the promise of new biological and medical methods that it contains. His new technic has possibilities of application in widely different fields ranging from the cure of disease to the protection of property.

Dr. Cleveland's studies began about five years ago, on the protozoa that inhabit the digestive systems of termites, or "white ants", wood-eating insects very destructive to all timber structures in the southern states and in all warm countries. He found that they played a very important role in the lives of most species of these insects. In some termites half the body weight is made up of swarms of protozoa. Dr. Cleveland, wondering whether these internal guests might not be necessary to the termites, sought for methods to kill them without killing the hosts. He found that this could be accomplished in any of three ways: 1. By keeping his termites at a temperature of about 95 degrees Fahrenheit for 24 hours; 2. By starving them for a time; 3. By exposing them to air or pure oxygen under pressure. Under any one of these treatments the protozoa perished and the termites survived.

But they did not survive long. Deprived of their "inhabitants", they starved

to death in three or four weeks, even though they had plenty of wood to eat. Apparently they cannot digest their customary diet without the assistance of their colonies of protozoa. Dr. Cleveland suggests a method for taking advantage of this discovery torrid a house of termites. "Close it up thoroughly," he says, "Cut off the termites' retreat through the basement to the ground. Fire the furnace to the limit, until you get a temperature of 95 degrees or higher. Keep it that way until you are sure the walls have been heated through for twenty-four hours. Or if you can get a temperature of 110 degrees or more, a much shorter period should suffice. With their protozoa dead, the termites should die of starvation in the midst of plenty."

More important, however, in Dr. Cleveland's opinion are the possible uses of his discovery in promoting health, through adaptations of his methods of killing protozoa with oxygen. He found that if pure oxygen were substituted for air at ordinary atmospheric pressure, or, what amounts to the same thing, if air with its twenty per cent. content of oxygen, were supplied at five times the usual pressure, the protozoa in the bodies of termites and cockroaches could be killed in an hour or less, while the insects could stand the treatment for much longer periods - in some cases indefinitely. When pure oxygen was applied under pressure, the protozoa died even more quickly, and there was less risk to the host animals. Cold-blooded vertebrates, like frogs, also survived this treatment, but success has not yet been attained with warm-blooded animals. Dr. Cleveland is now contemplating further experiments on rats, in an endeavor to find and eliminate the causes of failure.

For more immediate results, however, Dr. Cleveland, in a second series of experiments on the warm-blooded animals, is searching for a chemical that will release oxygen to kill the internal protozoa without injuring the body tissues. He has had partial success with those he has already tried, and is now awaiting the arrival from Germany of a new compound which is claimed to be particularly efficient.

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#### THE SUN AND OUR WEATHER

By Dr. Charles Greely Abbot,

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(Dr. Abbot keeps the closest watch on the sun of any man on earth. In this article, written for Science Service, he points out the immense practical possibilities that lie in knowing the exact effect of variations in the energy poured forth by the sun.)

There seems to be evidence to show that very moderate changes in the sun's heat, without much affecting the average temperature of the world as a whole, may yet make the difference between prosperity and failure in some localities here on earth.

The studies of H. H. Clayton, an American meteorologist, show plainly that major changes of the barometer and temperature in the United States come from solar variations. About 10 years ago, Mr. Clayton, then chief forecaster for the Argentine Government, began a long thorough investigation of just exactly what happens to barometers, thermometers, and rain gauges all over the world when the sun's heat changes. By 1920, he was actually employing solar measurements of the Smithsonian Institution to make public official forecasts a week in advance for the