disc, seemed to be "triple." This continued to be an unsolved riddle for nearly fifty years, until Huygens, by using much improved telescopes, showed that it was caused by a detached flat ring round the planet.

In the meantime, other observers lost no time in taking up the new study of the heavens. Before the end of 1608 Simon Marius, of Anspach, procured a telescope with which he found the satellites of Jupiter one day later than Galileo did. He continued for some years to follow their motions with great perseverance and skill, and produced valuable tables of them in his "Mundus Jovialis," published in 1614. Unfortunately, he roused the jealousy of Galileo, who accused him of plagiarism, an accusation which, up to a few years ago, most historians of science were inclined to consider proved, but which has now been thoroughly disproved by a detailed study of the observations of Marius by Oudemans and Bosscha. Marius was also the first to notice the phases of Mercury and the spurious discs of the fixed stars, which the imperfect telescopes of Galileo had failed to show. Even to the sun was the new instrument directed; Galileo says he saw the sun-spots in the summer of 1610, but he does not seem to have taken any interest in them at first, and did not, as usual, announce the discovery, either openly or through an anagram. Thus Johan Fabricius was the first to publish the discovery of sun-spots early in 1611, though Galileo made up for his hesitation by systematic observations, and by being the first to recognise that the spots are formations at the surface of the sun itself, and not bodies moving round the sun, as Scheiner, the third and most assiduous observer of sun-spots, for a long time maintained.

The Dutch or Galilean telescope did not for long remain the only telescope used by astronomers. Already in 1611 Kepler published his "Dioptrice," in which he clearly showed the effect of combining various lenses and the advantages of the "astronomical telescope," in which a real image of the object is formed by the object-glass at the focus of the latter, which is viewed through a magnifying convex eye-lens. A year or two later Scheiner, and following him Fontana, actually constructed and made use of telescopes of this kind, while the inconvenience of the inverted image produced by them was obviated by the introduction of an additional lens in the "terrestrial telescope" to re-invert the image formed by the object-glass. The importance of the real image, which allows a wire or a wire-cross placed at the focus to be seen through the eye-piece as sharply as, and coinciding with, the image, was recognised about 1640 by William Gascoigne, who applied a telescope to a quadrant for measuring altitudes, an application which had been suggested in 1634 by the French astrologer Morin, who, however, only possessed a Galilean telescope. Outside England Gascoigne's idea probably remained unknown, and it was not until 1667 that Auzout and Picard applied telescopes to measuring instruments, and thereby immensely increased the accuracy attainable in astronomical observations.

The importance of the invention of the telescope for the advancement of astronomy is not to be measured only by the insight it gave into the nature of the heavenly bodies, and the aid it rendered in following their movements more accurately. It also rendered an important service by making the Copernican system appear more natural and reasonable in the eyes of every unprejudiced thinker. Hitherto this system had probably to most people appeared to be nothing but a new way of "saving the phenomena" (to use an expression of the ancients), that is, a new method of calculating the motions of the planets, which anyone might use, whether he believed in the reality of the earth's motion or not. Two circumstances had contributed to give an appearance of unreality to the new system; first, the numerous epicycles which Copernicus had been compelled, like the ancients, to use in his planetary theories (because he did not know the first two of Kepler's laws, and therefore had to confine himself to combinations of circles), and secondly, the spurious preface which, without the knowledge of Copernicus, had been added to his book, in which the system was spoken of as a mere hypothesis which need not be supposed to be true. To assume the earth to be one of the planets was also a difficult thing, so long as absolutely nothing was known about the other planets. As to the moon, the ancients had supposed that it must be a body rather like the earth, and the telescope only confirmed this hypothesis. But adversaries of the Copernican system had always asked how the earth could carry the moon along with it during the annual motion round the sun, or why the moon alone should form an exception to the general rule by moving round a planet instead of round the sun? Now Galileo could point to the undeniable fact that Jupiter, during its orbital motion, carried four satellites or moons along with it. The discovery of the phases of Venus and Mercury deprived opponents of Copernicus of another favourite weapon, for they had been wont to proclaim that if Venus moved round the sun it ought to show phases like the moon. Again, the discovery of sun-spots, objects of a temporary nature, supplied a very striking proof that the Aristotelian doctrine of the immutability of all things celestial would have to be given up. While the analogy between the earth and the planets grew stronger every day, it was also of great importance that the fixed stars in the telescope appeared as mere luminous points, so that the apparent diameters of several minutes attributed to them by all previous observers were proved to have no existence. This put an end to the serious objection raised by Tycho Brahe, the greatest practical astronomer since Hipparchus, that a star having no annual parallax and yet showing a considerable apparent diameter must be incredibly large.

As it were in a twinkling of an eye, the whole aspect of the universe had been changed by the invention of the telescope. That this was felt in some way, even by determined enemies of the idea of the earth's motion, may be seen from the statement made by Clavius, the chronologist, in 1611, that astronomers would have to look out for a system which would agree with the new discoveries, as the old one would not serve them any longer. The question could no longer be, "Do you believe in the earth's motion?" it could now only be whether the arguments in favour of this motion were becoming so irresistible that the safest thing to do for its opponents would be to proclaim the doctrine to be heretical. This was accordingly done little more than seven years after the invention of the telescope. J. L. E. DREYER.

THE YUCHI INDIANS.[1]

ANTHROPOLOGISTS have exaggerated the evolutionary gulf between civilised and uncivilised peoples. The more we learn of the latter the narrower does the gulf appear. A remarkable case in point is that of the Yuchis of Oklahoma, recently studied by Mr. F. G. Speck.

Here we have a people engaged in agriculture and cattle-raising, like their white neighbours, wearing the same European dress, and hardly distinguishable from them except in language and colour. It is actually the fact "that many negroes and some poor whites as well are eager enough to work for the

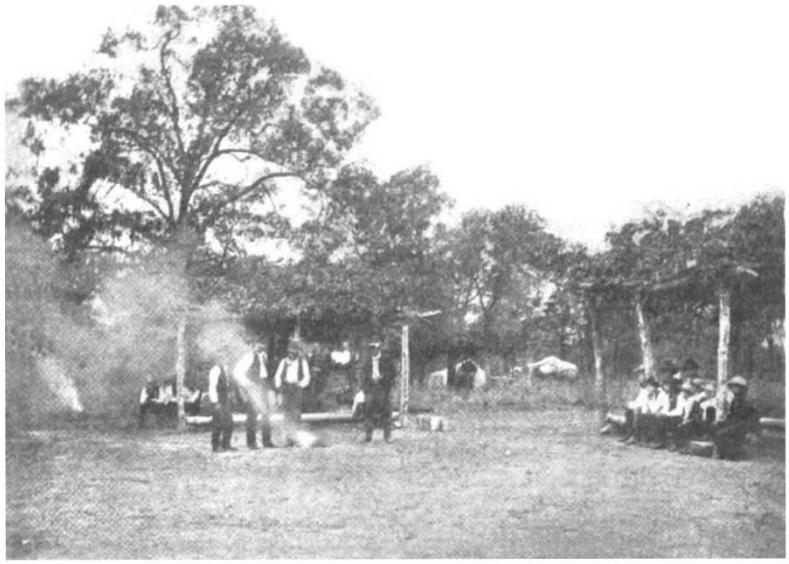
[1] University of Pennsylvania. Anthropological Publications of the University Museum. Vol i., No. 1, "Ethnology of the Yuchi Indians." By Frank G. Speck. (Philadelphia: University Museum, 1909.)

Indians on their plantations." Yet this people possesses a perfect set of the primitive ideas and practices illustrated in "The Golden Bough." Totemism, tabu, initiation, exogamy, reincarnation, the couvade, new fire, and the medical practice and food regulations found among the rude Australians—these and other primitive ways flourish here. They are not "survivals," but living realities, forming the warp of the social fabric.

This meeting of old and new may be partially realised by the illustration, here reproduced, of the "new fire" ceremony, which forms part of the New Year festival.

The Yuchis constitute an independent linguistic stock. A hundred years after their incorporation with the Creek Confederacy they left Georgia for the west of the Mississippi, in 1836. They now number about 500, in three "towns," and are "a remarkably strong and healthy set of people."

The clan-system is in use, based on maternal descent and totemism. The members are relatives and descendants of certain pre-existing animals, the *oiaron* of other American tribes. The Bear clan worships and protects the bear, getting bear's meat from the



New Fire Rite. Second Day, Annual Ceremony.

Deer clan, and so on. Above the clan-system is the Society or Class. The entire male population is divided into the Chief Society and the Warrior Society. Above this is the Town or Tribe.

Mr. Speck's careful inquiry brings out several interesting points. Students of ballistics will be glad to know that the principle of "rifling" was used in barbarous ages. It is applied to the feathers of arrows. They are twisted so as to make the arrow revolve in its flight.

An important phase of animistic theory is connected with birth. Until the fourth day the child has not "severed all the bonds which link it with the supernatural." On that day it is fed for the first time, and receives a name. "It is then *no longer a half-spirit, but a real human being,* and belongs to earth." (My italics.)

The origin of the tribe is traced to the Sun, and at the New Year festival the town-square is represented as a rainbow. This festival is a good example of primitive ritual, comprising fasting, various tabus, scarification, the rite of the emetic, totemistic drama, inoculation against evil during the coming year, the kindling of sacred fire, and the ceremonial eating of the new corn.

Mr. Speck's interests are chiefly linguistic, but he has made a valuable contribution to general ethnology. The Pennsylvania University Museum is to be congratulated on its first anthropological publication.

MALARIA AND ITS INFLUENCE ON NATIONAL HISTORY.

WIDESPREAD disease, in the form of plagues and pestilences, has profoundly influenced the course of events, local or national, in various countries. The Biblical narrative contains instances of this, and the black death left its mark on European history; in fact, Dr. Gasquet regards the black death as the most important event of the Middle Ages, and a prime factor in the making of modern England. The presence of disease in a locality may in many ways disturb life and enterprise there. Thus the failure of the early attempts to cut the Panama Canal may in part be attributed to the terrible mortality among the labourers, principally from malignant malarial fevers, and the existence of tsetse-fly disease (which attacks horses, &c.) in wide tracts of country in Africa has rendered the problem of transport and the opening up of such districts a difficult one. Prescott, in his "History of the Conquest of Mexico," though writing without the knowledge we now possess, remarks that we find no mention in the records of any uncommon mortality among the conquerors, Cortes and his companions. Had yellow fever and malaria prevailed in the country as they have done in more recent times, in all probability the Spanish conquest of Mexico would never have been accomplished.

Similarly, the introduction of diseases into districts previously free from them may so disturb the balance that the subsequent history of such districts may be entirely altered. A modern instance of this is the introduction of malaria into Mauritius. Until fifty years ago or thereabouts this disease was unknown in these islands; it was then introduced, probably from India, and has since caused serious loss through sickness, in life and by depreciation in the value of property.

It is but a step from a consideration of specific local instances such as these to the suggestion that the introduction of diseases which have the capacity of spreading widely may modify the characteristics and subsequent history of whole nations. This theme in the case of Greece and Rome has been elaborated by Mr. W. H. S. Jones, who sees in the introduction of malaria into these empires at least one of the important factors which helped their decline and fall.

In his "Malaria and Greek History,"[1] Mr. Jones corrects and develops the theory put forward in a previous work (see NATURE, March 19, 1908, vol. lxxvii., p. 457), that man, in the struggle for existence, has to compete, among other enemies, with disease-producing parasites, that even if he is not exterminated by

[1] "Malaria and Greek History." By W. H. S. Jones. To which is added "The History of Greek Therapeutics and the Malaria Theory." By E. T. Withington. Pp. x+175. (Manchester: University Press, 1909.) Price 5s. net.