Botany and Religion

Botany

DR. A. F. WOOD, of the U. S. Department of Agriculture, in an address before the Mt. Pleasant Congregational Church, Washington:

Religion viewed from the standpoint of science is a generic term that applies to a psychological state of an individual or group of individuals in relation to supernatural power. It may in its narrower sense be understood as a body of belief in reference to such power or it may emphasize procedures connected with the relation of the individual or group to such power, or it may include all these aspects. All are involved in the development and evolution of the religious sense in man and must be studied by the psychologist and anthropologist if a clear understanding of man in his totality is to be secured.

When primitive man began to ask questions and to find or invent answers to them he began his relations to higher power and intelligence. Perhaps the developing child is as good an illustration as any of the gradual race development step by step in this respect. It is in a measure a recapitulation of psychological race history. The love of legend, and of mystery, fairies, gnomes, elves, giants, fair ladies, and princes is a part of this development in every normal child of all races. It dates back to the days of race intellectual childhood, when all unknown manifestations of power were attributed to some living personality, unseen, connected with the object. These were good or bad according to the relation of the manifestation to the welfare of the individual or the tribe.

The origin of many curious beliefs and customs can be traced to what are now well-known phenomena. The lower organisms causing disease are the evil spirits that caused it in the olden times. That these might be passed on from one afflicted to others is now the well-known contagion and infection.

Whatever the evil spirit may be it is associated with bacteria or protozoa, and these are legion, just as dangerous as our forefathers thought they were, *and they are living things.*

Ancient tree worship, as the belief in druids in England, and the spirits in the grain, a common belief among many primitive tribes, was a recognition of *something living* in plants, sometimes helpful, sometimes destructive. The proper recognition and treatment of these spirits, good and bad, was a matter of life and death and appealed very strongly to the primitive mind.

Our knowledge of plant life today places these phenomena in their right relation. The causes of bountiful harvest or famine are well known and can be in a measure controlled. While there is still that mysterious *life* we can study the laws of its action and its relation to environment. We can see it struggling upward in the scale of being and we are acquiring increasing awareness of wonderful powers in the universe that we do not understand. We are impressed more and more with the reign of law. Action and reaction, cause and effect, progress and degeneration, life and death—all a series of adjustments, transformations, leading on to higher or lower levels, as the case may be. Life manifestation passes from its simplest state, where it is almost if not completely controlled by environment, to the other end of the ladder, where it almost if not quite controls its environment.

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Dr. Millikan's Own Statement—*Continued*

discovery of a banded structure in the cosmic rays shows that they are not produced as are X-rays by the impact upon the atoms of matter of electrons which have acquired large velocities by falling through powerful electrical fields—the fields needed to produce frequencies of the order of the cosmic rays would be at least 150,000,000 volts (3000 times as great as the field existing in X-ray tubes)—but that they are rather produced by definite and continually recurring atomic transformations involving very much greater energy-changes than any occurring in radioactive processes.

Third. If the Einstein special theory of relativity may be taken as a sound basis of reasoning—and no results predicted by it have ever thus far been shown to be incorrect, while it has many striking successes to its credit—then it follows that radiant energy can never escape from an atomic system without the disappearance of an equivalent amount of mass from that system. These relations being contained in the well-known equation of Einstein $MC^2=E$, where M=mass in grams, C is the velocity of light in centimeters and E=energy ergs. Now, through recent very exact work of Aston's, we know the mass of every one of the atoms with a great deal of certainty, and we can, therefore, compute the amount of ether-wave energy that can be generated by any sort of atomic transformation that can take place, and, knowing this energy, we can compute with the aid of quite reliable formulae the frequency and the penetrating power of any rays resulting from all possible atomic transformations. Such studies reveal the fact that there are no possible transformations capable of yielding rays of the enormous penetrating power observed by Millikan and Cameron except those corresponding to the *building up,* or creation of the abundant elements like helium, oxygen, silicon and iron out of hydrogen, or in the case of the last two elements out of helium. The entire annihilation of hydrogen by the falling completely together of its positive and negative electrons might be an additional possibility, but it can be eliminated in this case for two excellent reasons. The qualitative evidence is, therefore, scarcely escapable that the powerful cosmic rays here studied are produced by this very act of the creation of the common elements out of the primordial elements.

Fourth. The evidence herewith obtained is, however, fairly accurately quantitative, not merely qualitative. For Millikan and Cameron analyzed their cosmic ray curve empirically before they had called on any theoretical considerations whatever, and reported in scientific papers that their observed curve demanded three cosmic ray bands of absorption coefficients .35, .08 and .04 per meter of water, respectively. They afterward computed from the foregoing considerations what the theoretical absorption coefficients would be if their observed cosmic rays were produced by (1) the formation of helium out of hydrogen (2) the formation of oxygen out of hydrogen and (3) the formation of silicon out of hydrogen. The results came .32, .075, and .043, well within the limits of uncertainty of their analysis of their curve.

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