

one of the other routes shown to be practicable."

Admiral Ammen of the U.S. navy, in his speech on the Nicaragua route before the American association for the advancement of science at Philadelphia, said that there were 2,000,000 tons of grain produced on the Pacific coast by English-speaking people, which find a market around Cape Horn, mostly in English ports; and that there were vast quantities of timber-lands, extending from Puget Sound to Bering Strait, with the best quality of lumber, which can be shipped through this canal most advantageously. From time to time, a good many estimates of the tonnage that would use the canal have been made, nine of which, obtained by the U.S. commission, range from 3,000,000 to 6,000,000 tons of freight, and give an average of 3,804,000 tons per year. The estimated toll is three dollars per ton, in addition to the port charges and other dues; but the actual expense to the vessel will depend upon the rule adopted for ascertaining the charge, and whether the tonnage is charged upon the actual amount of cargo carried, or on the gross tonnage of the vessel. The latter, which is the method proposed by Mr. de Lesseps, would make the actual cost about six dollars for each ton of merchandise carried.

"The tonnage of the world in 1870 amounted to 17,963,293 tons, and, in 1879, to 20,395,815 tons. These amounts were made up of steam and sail tonnage, as follows:—

Years.	Steam.	Sail.
1870	2,466,498	15,496,795 tons.
1879	4,366,221	16,029,594 "
Gain in 9 years	1,899,723	532,799 tons.

"From this it will be seen, that, while the sailing-tonnage has actually increased, it has not done so at a rate to compare with the increase of the steam-tonnage, which has been facilitated by many causes, prominent among which was the opening of the Suez Canal. Sailing-vessels cannot use this canal to advantage: hence the increased commerce resulting from its construction has called into existence much of the increased steam-tonnage. It is very probable, that, in the event of the opening of a canal by way of Nicaragua, the sailing-tonnage would increase at a remarkably rapid rate, as this route lies in a region which is highly favorable to sailing-vessels."

GARDINER G. HUBBARD.

CERTAIN PRINCIPLES OF PRIMITIVE LAW.

A DEFINITION of the term 'law,' that will hold good under all circumstances, must be divested of the many theories of its origin, the source of its authority, and its ethical characteristics, which are expressed or implied in customary definitions, and laws must be considered as objective facts. The following definition will perhaps do under all circumstances: *A law is a rule of conduct which organized society endeavors to enforce.*

In civilization, law is theoretically founded on justice; but in savagery, principles of justice have little consideration. There are two fundamental principles at the basis of primitive law: viz., first, controversy should be prevented; second, controversy should be terminated. A third is derivative from them; namely, infraction of law should be punished. These principles enter into primitive law in many curious ways.

It was customary among the tribes of North America for individuals to mark their arrows in order that the stricken game might fall to the man by whose arrow it had been despatched.

A war-party of Sioux surprised a squad of sleeping soldiers, who were all killed at the first volley from the Indians. Their arms, blankets, and other property were untouched, because, the attacking party being large, it could not be decided by whose bullets the soldiers were killed.

It has been widely believed that the practice of placing the property of deceased persons in their graves when they are buried has its origin in religion, and testifies to the universal belief that the dead live again, and will need such articles in their new life. But many tribes of North America who have not yet been long in contact with white men avow, that, there being no owner for the property, its disposition might lead to controversy, and hence it is destroyed. Many examples of this fact have been collected. Ownership to the greater part of property in savagery is communal, some classes of property being owned by the clan, others by the tribe; and for such there is no proper inheritance, as the clan and tribe do not die; but purely personal property is inherited by the grave. It seems probable that such is the origin of the custom of burying various articles with the dead. Subsequently it has religious sanctions thrown about it, as have many social customs.

There is a law, among the tribes of North

America, that superior age gives authority. This law is widely spread, and perhaps universal, and exercises a profound influence in tribal society, as the occasions for its application are multifarious. Like many other of the institutions of tribal society, it is woven into the structure of tribal language. Linguists have recorded as a curious fact, that in these languages there is no single term for 'brother,' but two terms, — one signifying 'elder brother;' and the other, 'younger brother.' They have also found similar facts relating to the term 'sister,' and to some other kinship words; but, so far as I know, they have failed to observe that the law applies to all consanguineal kinship names. All of these titles express relative age between the person speaking and the person addressed. Among savage tribes the age of an individual is not kept. No man knows his own age; but every man, woman, and child in the tribe knows his relative age to every other person in the tribe, — who are older and who are younger than himself, — for, in addressing any other person in the tribe, he must necessarily use a term which implies that the person addressed is older or younger. The law that authority inheres in the elder is a simple and ingenious method of preventing controversy.

The above is the explanation of another curious custom observed among savage tribes; namely, that it is illegal to address a person by his proper name. Kinship terms are used in direct address, proper names in speaking of a third person. It is hardly necessary to state that by this device controversy is prevented.

An interesting form of outlawry exists among some tribes. When a man has frequently involved his clan in controversy with other clans by reason of quarrels or other outrageous conduct, his own may decide no longer to defend him, and will formally announce in tribal council that such person is no longer under their protection. If the person thereafter by his conduct maltreats any member of the tribe, the injured party may do as he will with the offender, and not be held accountable by the kindred of the outlaw.

The few illustrations here given are sufficient, perhaps, to make clear what is meant by the statement that a large class of savage laws are designed to prevent controversy. Many other illustrations might be given, for they are found on every hand.

Three especial methods of terminating controversy are widely spread among the tribes of North America.

When controversy arises in relation to owner-

ship, the property is usually destroyed by the clan or tribal authorities. Thus, if two men dispute in bartering their horses, a third steps in and kills both animals. It seems probable that the destruction of property the ownership of which is in dispute is common to all tribes.

A second method of ending controversy is by the arbitrament of personal conflict. For example: if two persons disagree and come to blows (unless conflict end in the maiming or killing of one of the parties), it is considered a final settlement, and they cannot thereafter appeal to their clans for justice. By conflict a controversy is outlawed. This law seems to be universal.

The third method of terminating controversy is by the establishment of some day of festival — sometimes once a month, but usually once a year — beyond which crimes do not pass. The day of jubilee is a day of forgiveness. The working of this principle might be illustrated in many ways.

We have thus briefly set forth certain principles of primitive law, in order that the subject of marriage law in savage society, which will form the subject of a future paper, may be clearly understood. Law begins in savagery through the endeavor to secure peace, and develops in the highest civilization into the endeavor to establish justice.

J. W. POWELL.

SIR WILLIAM THOMSON'S BALTIMORE LECTURES.

THE title 'Molecular dynamics' does not give an accurate idea of the nature of Sir William Thomson's recent course of lectures at the Johns Hopkins university. The object of the lectures was to consider the possibility of placing the wave-theory of light upon a perfectly tangible physical basis which should be sufficient to account for all the phenomena. The lecturer stated at the outset that he would be occupied more with pointing out difficulties than with removing them. He expressed the conviction that what takes place in the propagation of light — at least through gases, if not through solids and liquids — can be represented in its essential features by supposing a mass of vastly denser matter in the ether, bounded by a perfectly rigid shell; this shell surrounded at a small interval by another perfectly rigid spherical shell; and so on. Each shell is connected with the one outside it by a number of spiral springs: the precise number of the shells is not a vital matter in the theory, and the actual number may be infinite, i.e., the system of shells may constitute a continuous atmosphere to the molecule. The problem of the modes of vibration of this system is essentially the same as that of a system of particles connected by