

Lightning has played a prominent part in almost all ancient religions and has a great deal of mystery and mythology surrounding it to this day, both because it is difficult to study and because it is so wondrous and awe inspiring when it occurs

I. RELIGION

Even the earliest peoples saw lightning as a powerful force. Lightning could not only destroy, but could also protect and warm a person by providing a source for fire before people learned to start and propagate fire at will.

Some primitive peoples characterized lightning as an animal or bird, including the American Indian, the Bantu of South Africa, and the Aborigine of western Australia. Witch doctors and magic men from various cultures were believed to have power to allay storms and to call on the gods to deliver water to their people or destruction to their enemies. They often used charms and potions made of wood, stones, or plants that were connected to lightning in their belief systems to cause harm, bring about favorable outcomes, or cure disease.

Lightning appears prominently in the Buddhist, Druidic, and ancient Egyptian religions. It was used by Jove, Jupiter, and Thor to express their power and often their anger in the ancient Greek, Roman, and Norse religions, respectively. Priests used storms and lightning as omens to interpret the wishes of the gods and control matters of state. Even in Judaic and Christian writings, it was seen as a sign of a superior being's presence, being noted several times in the Old Testament. In the middle ages, church bells were rung to break up thunderstorms and avert lightning. Churches were felt to be protected by God and were sometimes used for munitions storage, with spectacular explosions on more than one occasion. Uman¹ draws attention to the fact that the fifth day of the week must have been particularly important. The Anglo-Saxon Thursday is derived from the Norse Thor's day and has equivalence in the Danish Thorsday, the German Donnerstag (thunder day), and the Italian Giovedì (Jove's Day).

The Second International Conference on Lightning and Static Electricity (Oklahoma, 1988) chose the mystical thunderbird as its emblem. A modern automobile also uses the name of Thunderbird, so one can see that the feeling of power from lightning is still important to our culture.

Such is the penetration of these beliefs that the reports of the strike to York Minster, where the cathedral was struck the day before the enthronement of one of England's most controversial bishops, even today betray a superstitious belief in omens and warnings from the Deity.

II. SCIENCE

Aristotle, Socrates, and Pliny all made observations about lightning. Herodotus and, more recently, da Vinci also described lightning phenomena, but without defining it further. It remained for Benjamin Franklin, the "Father of Electricity", to determine that lightning was a form of electricity and to do many simple but elegant experiments that helped to define some of the basic properties of lightning and electricity. Franklin's "invention" of the lightning rod, which to this day remains almost unmodified, may have been the first practical application derived from the study of electricity.

More recently, it has been postulated that lightning may have had a part in the formation of life as we know it on earth. Urey and Miller suggest that lightning catalyzed the original linking of water, hydrogen, and nitrogen (in the form of ammonia and methane) into amino and nucleic acids, the building blocks of organic life, and carried out experiments that seem to support their hypothesis.

Medical knowledge regarding the pathophysiology of lightning injury was unformed until Critchley's pioneering work in 1932, although Jex-Blake began some early work in 1913. This theme is elaborated elsewhere in the volume.

III. MODERN MYTHOLOGY

Despite all that we know about lightning, there are still many myths that surround it. Probably the most common belief is that injuries from lightning are rare and, when they occur, are invariably fatal. While the incidence of lightning injuries varies by the part of the world and the topography of the land, they are quite common in many areas. Between 150 and 200 deaths from lightning are reported each year in the U.S., with a much larger number of nonfatal injuries occurring.

In their reviews of the medical literature, Cooper² and Andrews et al.³ have shown that lightning injuries are fatal in only 20 to 30% of the cases, depending on how the data are analyzed. Given that usually only the most serious or "special-interest" cases are reported in the literature, extrapolation of these reports suggests that there are probably a minimum of 600 to 1200 injuries per year in the U.S. that often are of only minor degree. In a 2-week period in the summer of 1989, 21 persons in the Chicago area were involved in four different incidents, with only one death occurring. Lightning injuries are much more common in areas where there are large bodies of water (such as the Great Lakes, the Ohio, Mississippi, and Hudson river valleys, along the Atlantic coast, and in the Florida swamplands) than in desert areas or along the Pacific coast, although the western plains of the U.S. can provide wonderful lightning displays as well. Mountainous areas tend to have a greater number of lightning strikes and injured persons than flatlands.

Another myth could be called the "crispy critter" myth: the idea that when lightning strikes a victim they are burned to a crisp, vaporized, or reduced to a tiny pile of dust. Whenever one lectures on lightning, as the audience warms to the question-and-answer period, someone will invariably ask with a slightly embarrassed expression whether lightning is responsible for the stories told about persons walking down the street who burst into flames without apparent cause. Fortunately, the idea of vaporization and spontaneous combustion is the figment of several science fiction writers' and sensationalists' imaginations and has no basis in fact.

However, many quite reasonable and intelligent people believe that anyone hit by lightning will be severely burned, perhaps beyond recognition and repair, because of lightning's tremendous energy and violence. Fortunately, lightning seldom causes deep burns, but usually results in very superficial damage to the skin and soft tissues, although it may play havoc with the cardiac and neurological systems as it interferes severely with the body's natural electrical circuits. While burns from lightning can occasionally mimic the burns seen with high-voltage electrical injuries, this is quite rare, probably because of the brief time course involved in a strike.

Mystery and fantasy still surround lightning. One of the sensationalist rumor sheets sold at the checkout line in many grocery and drug stores in the U.S. recently reported the story "Lightning Turns Man into Woman". One might understand how lightning could result in emasculation and a necessary switch to the female sex if a part of the "crispy critter" myth were operational, but it is difficult to understand how lightning could turn a woman anatomically, physiologically, or genetically into a man.

Many persons who might otherwise have survived their lightning injuries have died because bystanders believed that the victim was "electrified" by the strike and could electrocute the rescuers if they attempted to aid the victim. While lightning energy can spread through the surface of the ground and backflash through pipes, wires, and other metal objects, this happens in a few hundredths of a second and the lightning energy does quickly dissipate and will not harm anyone who would touch the victim.

However, a victim who has been hit by lightning may be in an area that continues to be dangerous during a thunderstorm, since lightning can and often does strike the same place twice (despite the popular belief to the contrary). It is only logical that if conditions favor a lightning strike occurring once, lightning may strike again under the same conditions. For instance, tall buildings are struck many times each year, and sometimes in a single thunderstorm, which is one

reason that properly designed lightning protection systems are so important. Thus, it is prudent not to subject a rescuer to excess risk in this manner, and removal of a victim from a risk area in accord with the usual practice of first aid is wise, but not for the reason of residual electrification!

A notion that continues to occur in the medical literature is that lightning causes a state of "suspended animation", so that a lightning victim can recover from a prolonged cardiac or respiratory arrest without any brain damage. The initial report on which this belief is based cited a pediatric case that did not have a documented prolonged arrest. In addition, the original report claimed that the child recovered from the arrest (the management of which included open chest cardiac massage) with an IQ higher than that tested prior to the injury, which is difficult to accept. There have been other anecdotal reports similar to this, but there exists no experimental evidence for believing that a lightning victim who receives prolonged cardiopulmonary resuscitation will be protected from hypoxic brain damage or will have their mental abilities improved by the lightning stroke. The preponderance of evidence is quite contrary to this and in agreement with the current literature on cardiac arrest.

Some people believe that the victim will be spared cardiac damage if the lightning travels over the right side of the body (thus "avoiding" the heart, which is thought to be on the "left" side of the body). Lightning energy may "flash over" the exterior of the victim's body, markedly decreasing the cardiac insult. Alternatively, lightning energy may penetrate the body. Electrical energy treats the soft tissues of the body like a continuous medium, although it does have a tendency to travel through the areas of the body that offer the least resistance, especially the blood vessels. These pathways lead readily to the heart. Even if the energy did flow over only one side of the body, a cursory study of human anatomy shows the heart to be situated in the center of the chest, extending into both sides with only a slight preponderance into the left chest, so that it would be affected regardless of the "side" struck.

Other myths concern the degree of protection a person has if they are inside a building. Unfortunately, there are multiple reports of persons being injured by flow of current through plumbing, telephones, electrical appliances, or other conduits, although they are within a building. Small open-sided sheds, tents, and soft-top automobiles all offer substantial risk to the person caught in a violent thunderstorm.

Many people believe that rubber, in the form of tires or shoe soles, is a good insulator against lightning. Since lightning can traverse a mile or more of air, which is a much better insulator than rubber, an inch or less of rubber (or more likely a petroleum by-product) cannot be counted on to protect a person. The recommendation that persons take off the raincoat they are wearing and place it on the ground to insulate themselves in a storm is even more ludicrous.

Lightning, as a spectacular natural phenomenon, has had a large mythology generated about it. Many "modern myths" have hampered not only effective resuscitation of lightning victims, but also research in this area.

REFERENCES

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3. Andrews, C. J., Darveniza, M., and Mackerras, D., Lightning injury — a review of clinical aspects, pathophysiology, and treatment, *Adv. Trauma*, 4, 241, 1989.