LIGHTNING ALMOST ALWAYS STRIKES TWICE

By Geoffrey Childs

Once is enough to frazzle you. But lightning follows certain rules. Understanding them keeps you ahead of the law of averages.

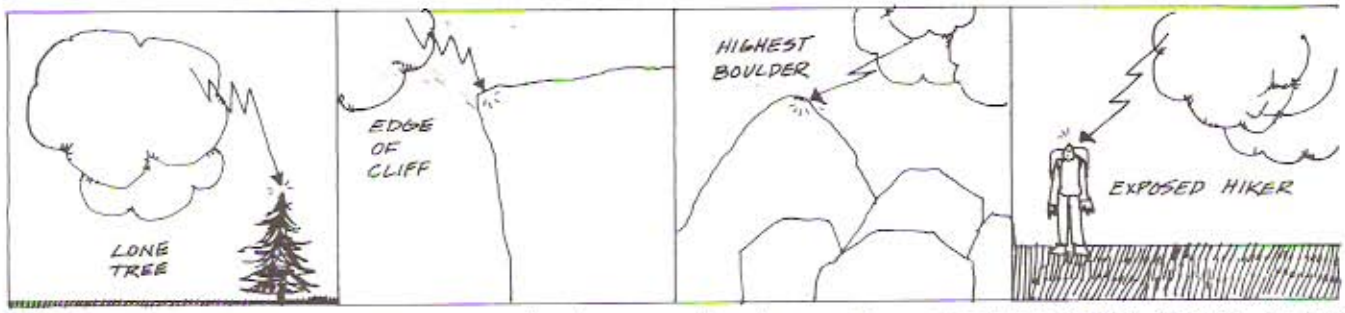
The friend with whom I do most of my hiking is into survival. Given a sheath knife, a match, and a yard of string, he can serve up a three-course supper (with or without a meat dish), throw together a sleeping shelter, and build a fire in about the same amount of time it takes me to do it using all the modern amenities of camping. He claims he could do as well in the desert or stranded on an island in the middle of the ocean, and no doubt he probably could, assuming that the law of averages would protect him from being killed by lightning.

As it stands, the law of averages is *all* that is protecting a lot of people like my friend. They have adopted a kind of fatalism where lightning is concerned, the kind of thing men are apt

to do when trying somehow to confront the unconfrontable. Yet despite its longstanding reputation for unpredictable behavior, lightning is actually one of Nature's most consistent performers. Unfortunately, one of its most consistent statistics happens to be the number of people it kills each year, the vast majority of whom spend enough time outdoors to be fully aware of the potential dangers.

Considering the amount of time that backpackers, mountaineers, survivalists, and rock-climbers spend above treeline and in other areas particularly vulnerable to lightning, their general ignorance about protecting themselves from it is lamentable.

For example, in late August, 1957, two middle-aged couples were approaching the Chasm Lake area on a hike up Colorado's Longs Peak, when they noticed a thunderstorm moving rapidly in their direction. The decision was to head back down immediately. The storm overtook them as they were passing through the open near Mill's Morraine. A sudden bolt of lightning struck and killed one of the women, knocked the other three people off



their feet, and sent the second woman into deep shock. This incident probably best typifies the real danger climbers expose themselves to when caught on open terrain during a thunderstorm. Whereas the city or suburban athlete has only to step indoors to be reasonably safe, the hiker's situation is considerably more complex. Dramatic as it may sound, his initial response is absolutely critical and potentially the difference between life and death.

According to a leading authority, Professor Martin A. Uman, lightning is no more than a "very long spark which discharges regions of excess electrical charge developed in thunderclouds"—much the same as the spark that leaps between your finger and a light switch after you have dragged your feet across a nylon rug. That is: when two dissimilar surfaces rub together, frictional charging is produced. Thus, lightning seeks to ground itself by discharging a spark "of enormous voltage" (once the air resistance between source and ground is overcome). It can be very dangerous if you happen to be the ground it is seeking to connect itself to.

There are three varieties of lightning. The first occurs within a cloud, from cloud to cloud, or from charged air down to a cloud. Although this phenomenon may be of interest to us, it represents no threat. The second and most frequent variety—called *down stroke* because it travels from the cloud down to earth—usually strikes the highest object on a flat surface. Although the *down stroke* may actually hit someone directly, more often than not it causes a voltage-robbing "breakdown" in the air around the body, in which case the individual usually has to sustain only a few thousand volts of what is known as *arc-voltage* for no more than a small fraction of one microsecond. Quite frequently, that can be enough to cause death—but in over 70 percent of the cases, the victim recovers entirely.

Much the opposite is true with the third variety—*upward stroke* lightning—which is almost always lethal. It is called *upward stroke* because the lightning actually begins on the ground and shoots upward to the cloud. As this kind of stroke is limited to the tops of mountains, it was very probably the cause of the woman's death in the previously mentioned incident.

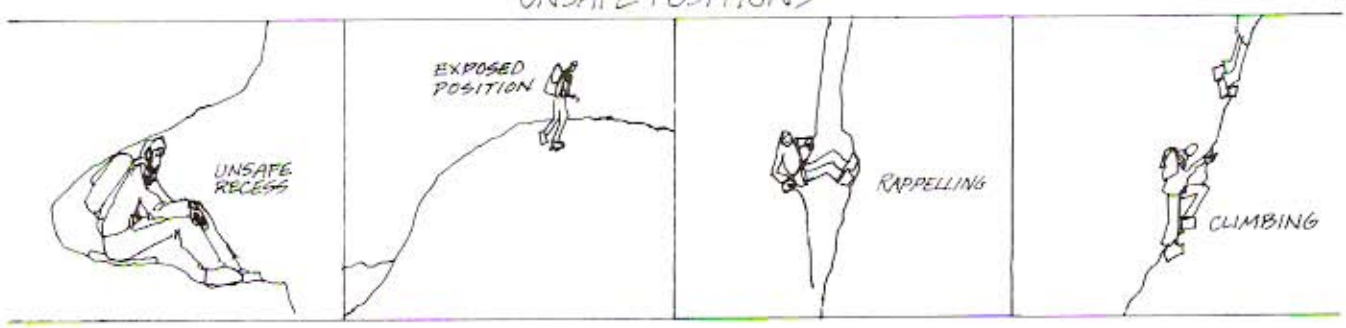
A person struck by upward stroke lightning may draw as many as 100 to 300 amperes for several hundredths of a second, at a temperature of up to 50,000°F. This internal heating, combined with the electrical shock to the cardiac system, almost always results in death. Typically, burns are found on the body and clothing; metallic items, such as zippers, bobby pins, and buttons may be welded together.

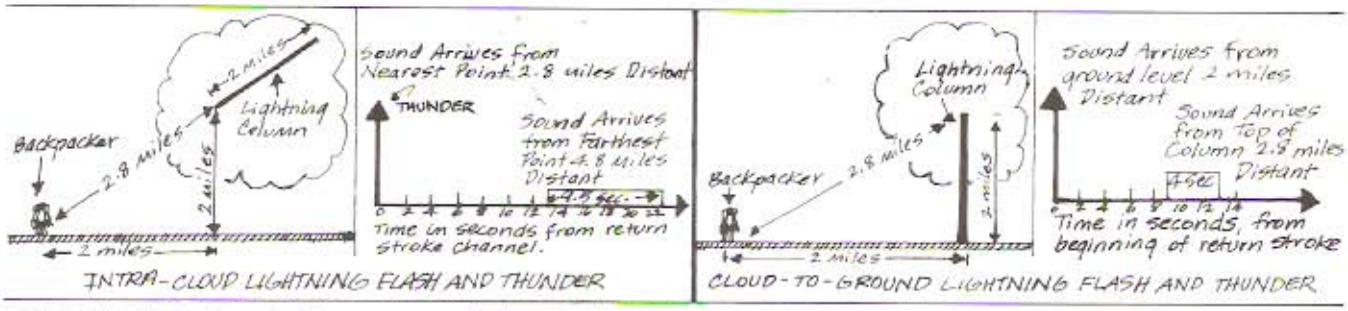
Most lightning-caused casualties, however, do not result from direct hits. More often, they are the result of a radial diffusion of the lightning's voltage through the ground, in what is called *step voltage*. In other words, when lightning strikes, it sends out its charge in an expanding and slowly dissipating circle around the point of impact. The shock you receive depends on how close you are to the strike, and how good a conductor the ground you are standing on happens to be. A few years ago, two teenage boys were camping on the summit of Mt. Lafayette, New Hampshire, when a lightning bolt struck and shattered a boulder 35 feet away. Because the rock on which they had pitched their tent was such a good conductor, both were charged severely, one suffering burns and lacerations, the other falling into shock.

With an estimated 2,000 thunderstorms going on at any given moment, with about 100 bolts of lightning striking the earth each second, the same law of averages most of us depend on to save us from lightning also dictates that if you spend much time outdoors, you are probably going to encounter it one way or the other.

Contrary to popular myth, lightning almost always strikes twice. It is drawn to the tallest object of the topography and will consistently strike it time and time again, year after year. From this it follows that you should neither allow yourself to become the tallest object, nor try to shelter beneath the tallest object. That sounds like common sense, yet 15 percent of the people killed by lightning are found lying under trees. Though there are no statistics available on it, probably at least as many are killed standing out in the middle of a meadow. Experts like Professor Uman suggest the wiser course is to wait out the storm in a stand of smaller trees or conceal yourself in a depression twice as deep.

UNSAFE POSITIONS





INTRA-CLOUD LIGHTNING FLASH AND THUNDER

CLOUD-TO-GROUND LIGHTNING FLASH AND THUNDER

as the tallest nearby object.

It is also wise to avoid grouping with either animals or other people, ten meters of separation being the advisable minimum. Though step voltage goes out in all directions, it obviously will follow the line of least resistance, dispersing along natural leads like splits or cracks in mountains, small streams, vegetation or debris at the base of a cliff. Consequently, it is wise to avoid these, particularly a depression with a small stream flowing through it.

Because thunderstorms usually travel at a speed of well over 25 mph, trying to outrun one seems futile. It is more advisable to use your time trying to find a safe and dry place to wait it out. You can judge pretty accurately how much time you have by counting the seconds between a flash of lightning and its thunder. For every five-second interval, it is one mile away. Using this system you can pretty well predict whether the storm is coming or going and how fast it is moving—though once you've decided it is coming towards you, your time can probably be better spent looking for a place to hide.

If you're caught out in the open, the ideal position is away from all steel objects, crouching low on the knees or haunches with the feet close together. If possible, you should try to put at least ten centimeters of insulation between you and the ground. Coiled rope or sleeping pads function better than most things in this capacity. Lying down, as the two boys were doing in the preceding example, is obviously a very bad position to be caught in. If you are in a tent during a storm and it does not seem to offer itself as a particularly good target, you may as well stay inside—crouching on your sleeping pad, not lying down.

The predicament of a rock-climber is both the most critical and the most complex. Obviously, if there is enough time, he should try and get down off the face, but frequently there is not enough time, and rappelling during a storm is only asking to be struck. Shallow caves or recesses are equally unsafe because a bolt of lightning "can arch across the entrance and bring disaster," as the Sierra Club's *Basic Mountaineering Manual* puts it. "A safe position may be regarded as 50-80 feet from the face of a cliff or between and below the top of two flat boulders."

Jettisoning all steel technical climbing aids is also of great importance. If you are too slow in doing so, you may notice a buzzing of pitons and carabiners or other metal objects in contact with each other, and the head of an ice-ax may begin to glow. This effect is known as *St. Elmo's Fire*, and demands separating yourself from the objects immediately. Occasionally, it is possible to notice the same effects climbing into a cloud, with the addition that you may notice a tingling sensation through your legs. When electrical potentials differ at various ends of the same cloud, static energy is created and poses the threat of discharging itself within the cloud as lightning. In any case, the sensible course is to retreat immediately.

Still, no matter how conscious one is of the danger and the steps to take to avoid it, lightning is erratic and always capable of creating an emergency situation. However, it should be emphasized that as many as 70 percent of all lightning victims make full recoveries; thus, artificial respiration in the form of heart massage and mouth-to-mouth breathing should always be attempted. Often a person's heart and breathing will cease immediately upon being struck; the heart will usually begin again on its own, but breathing will not. Not breathing for a prolonged period will cause brain damage, though cases have been reported where victims went for as long as thirteen to 22 minutes without respiring and still made full recoveries.

Injuries from diffusion are considerably more varied, ranging from burns, lacerations, and contusions to amnesia, paralysis, and internal injuries. Broken bones and head injuries often result from falls taken after being struck.

In the final analysis, the best way to avoid running the danger of being struck by lightning is to listen to the weather forecasts and stay out of the mountains or other areas where you are likely to encounter lightning. If that's impossible, then remember that Nature is not without a heart. Lightning provides you with an early warning system: thunder. There is no lightning without thunder; the sound should be warning enough to set about finding some kind of shelter or, if there is time, to retreat until the storm blows over. Even if it were true that lightning never strikes twice, once would be sufficient.

RECOMMENDED POSITIONS