ized. In foreign titles national practice is followed throughout.

The use of Latin terms in footnotes to avoid repetition of titles is confined to "op. cit." and "idem." "Op. cit." may be used if the previous reference is not far away, provided there can be no doubt as to what work is cited. If two works by the same author have been cited previously it is necessary to repeat the reference. "Idem" is used only for a second citation of the same work, immediately following the first, on the same page. "Idem" may represent all of the preceding citation except the page numbers, or it may be used to represent simply the journal just cited, the author and title being different. The forms "id.," "ibid.," "ibidem," and "loc. cit." are not used—not because they are not good Latin but for the sake of simplicity. Even "op. cit." should be used sparingly.

Most features of the Geological Survey scheme are regarded as having obvious advantages; a few represent simply a choice among different styles to insure uniformity. Owing to the vagaries of publishing organizations no scheme can provide for every difficulty that may arise. For troublesome citations that are not covered by the general rules common sense and analogy must serve as guides.

BERNARD H. LANE,
Editor

U. S. GEOLOGICAL SURVEY

REGARDING TWIST IN CONIFERS

I WAS much interested in Mr. Chester K. Wentworth's article in the February 13 issue of SCIENCE concerning the twist in trees, especially at timberline in the Rocky Mountains. It has been my privilege to spend five years in the Colorado Rockies. During the summers of 1927 and 1928 I was stationed at the summer camp of the University of Colorado, which is located near timberline on the eastern slope of the Continental Divide. While here I spent much time studying the flora of the region and noticed particularly the twisted structure of most of the trees at timberline.

The same question asked by Mr. Wentworth was asked by members of different parties we were escorting, so two of the students and myself studied the question in an effort to find out what might be the cause of the twisting. We studied the living trees and those with one side alive, together with the dead ones in the vicinity. Knowing how hard it would be to prove an hereditary tendency toward twisting, we looked for an environmental explanation. From this angle three factors entered into our study, namely: (1) Direction of winter storms; (2) direction of prevailing winds during growing season; (3) natural protection, especially during the younger stages of growth.

It was obvious to the observer that the trees most strongly twisted were entirely devoid of branches on the upper or northwestern side. Upon studying the weather maps of the region we learned that the prevailing heavy storms of winter came from that quarter. These storms, laden with ice and sleet, cut off the small, tender twigs and consequently no branches were formed on the windward side. This left the tree much like a flag with the surviving branches pointing to the south and east. Further study of the weather maps together with our own knowledge of the summer winds told us that the prevailing winds of summer came from the south and west. We could now see that this lopsided tree with its branches on the east would be strongly whipped to the right during the time when its trunk cells would be most active and pliable. It is highly possible that this constant pressure to the right would strain the old fibers and also cause the new tissues to form in a slightly twisted condition. When the storms of winter came from the north and west the tree would tend to become untwisted but being dormant it would yield less in winter than in summer, consequently it would remain twisted. The only effect of the winter winds would be to destroy the tender twigs on the exposed portion of the "flag." The tendency would be to remove any twigs that may have been pushed farther to the right by the twisting during the summer. Thus the twigs would be built up on the left or south side of the "flag" in summer and be beaten off the right or north side in winter. During the lifetime of the tree it might mean the complete rotation of the upper part of the trunk. It is not uncommon to see branches twisted back over the top of the tree like huge arms pointing away from the wind. These may have been forced into this position by the process described above.

Twisting is not common in trees standing in thick timber, but occasional twisted trees are found at the edge of such stands. These trees may have been subjected to tornado twisting when young or may have been subjected to unequal strain when covered with drifted snow. This latter theory may account for left-handed twisting which is so infrequently observed. A few left-twisted trees were observed at timberline and with one exception these were protected in such a way by rocks as to receive the strong winds of summer at an angle which would cause the tree to be twisted to the left. This one exception stood out alone, but there were stumps of other trees near by which must have influenced its early growth. Both this tree and the dead stumps were protected from the northwest storms.

Twisting was not observed on the western slopes mainly because we were not stationed near these regions. It is likely that the same conditions would prevail there since the storms retained their same relative positions as on the eastern slopes.

Twisting of trees other than those at timberline has been observed and noted but not studied to any great extent. Apple trees are usually twisted in the prairie regions, but no definite set to the twist was noticed. It often occurred that both left and right twisting could be found in the same tree. In cutting up an old orchard that had died we found many trees of this type.

W. C. YEAGER

HOBSON SCHOOL,
SIOUX CITY, IOWA

THE GROWTH OF STALACTITES

AN occurrence, similar to that discussed by Professor Ellis in SCIENCE for January 16, 1931, "Concerning the Rate of Formation of Stalactites," came to my notice during an inspection of Fort Delaware in the summer of 1929.

Fort Delaware is situated on Pea Patch Island, in the middle of the Delaware River, 12 miles below Wilmington and is of the pre-Civil War type with walls of gray granite and interior finish of high grade brickwork. Though started in 1848, it was not completed until after the Civil War.[1] Thus the setting is similar to that at Fort Pickens.

Abundant growths of stalactites were found in process of development from the brick arches on many of the lower casements, the material for their growth being supplied mainly from the lime-natural cement-sand mortar but perhaps to a slight extent from the bricks, which showed some spalling due to water action. These stalactites varied as to type, many being of the slender, fragile variety described by Professor Ellis, with the larger ones reaching over a foot in length, while others were much stouter, with a length of four to five inches and a diameter of over one half inch, and were therefore strong enough to be readily collected. They consisted of a pure white carbonate of lime. Lime deposits also covered the floors of these casements to a considerable extent and in a few cases the development of stalagmites was beginning to be noticeable. Deposition was still in active progress.

As Fort Delaware had already become practically obsolete by the time it was completed, deposition may have been going on undisturbed for as long a period as 60 years. On the other hand, as there was some activity at the fort during the Spanish-American War, 30 years may be set as the lower limit available for the growth of the longer stalactites.

GRAGG RICHARDS,
Captain, 363rd Engineers, U. S. R.
DETROIT, MICHIGAN

[1] Charles H. Roe, "The Building of Fort Delaware," *The Military Engineer*, Vol. 21, pp. 350–354, July–August, 1929.

A CASE OF A BOY POSSESSING AN AUTOMATIC DIRECTIONAL ORIENTATION

IN a note in the *Psychological Bulletin*[1] twenty-two years ago H. C. Warren described the case of a boy who had an extraordinarily good sense of direction. A few months ago I wrote to this individual and asked him several questions about his sense of orientation. The answers received were all in the negative —that is, the individual disclaimed that he possessed any different sense of orientation than the ordinary person has who uses familiar objects or the sun as a guide. Whatever ability at orientation this individual had as a boy he has obviously lost as a man.

Recently a married couple who attended one of my classes reported that their son possessed an unusual sense of orientation to the points of the compass. He never seemed to get lost, they said, and when in a strange city could be relied upon to tell them in which direction they were going. While driving in an automobile through unfamiliar country he was able to tell the direction at any time.

With the cooperation of the parents I tested the boy in our psychological laboratory. I took him into a dark room, blindfolded him and confused him by revolving him (without, however, making him dizzy) in a noiseless rotating chair. After a few correct judgments he began to make large errors, and soon lost all absolute orientation. He oriented himself immediately as soon as he was permitted to see.

I convinced myself that he possessed no genuine "magnetic" sense of direction. This finding was corroborated by a story of his parents to the effect that if he went to sleep while riding in an automobile at night he was temporarily lost as to directions when he awoke. Regardless, however, of his lack of a sense of absolute orientation, it is exceedingly interesting that once he gains a true orientation during his waking hours he seems to remain oriented at all times. I might add that he is twelve years of age, above the average in intelligence and curious about everything that goes on around him.

His mother furnished an interesting bit of information on the origin of the development of this sense of orientation. As she is left-handed and frequently confuses "to the right" with "to the left," she used to give orders of the following sort to the youngster:

[1] H. C. Warren, "Magnetic Sense of Direction," *Psychol. Bull.*, 5: 376–377, 1908.