SCIENCE.

FRIDAY, NOVEMBER 16, 1883.

FROM SUPERSTITION TO HUMBUG.

It is related that especially fortunate English commanders in India have encountered a tendency among the ignorant natives to exalt them as more than human beings. It is not strange that a benighted and superstitious populace, astonished by exhibitions of power to it incomprehensible, should, for a time, turn from its own hazy gods to new and visible wonder-workers.

A somewhat similar revolution appears to accompany the progress of physical science. What its friends have to contend with at present is not so much indifference or hostility, though these are not altogether lacking, as a too implicit and childlike confidence in the efficiency of scientific knowledge on the part of those to whom its ways are in the main unknown.

The real conquests of science have been so vast and unexpected, so much like the workings of magic, that people eagerly pay their homage to a power, which, though mysterious enough to engage their credulity, accomplishes every day feats that witches, ghosts, and magicians performed only upon rare occasions. A genuine scientific man will disdain to abuse this confidence; but there are always camp-followers of the scientific army, who will find in it their opportunity. It is curious to see how those, who, a generation or two ago, would have been the believers in witchcraft and all things 'supernatural,' are now turning to be caught in the toils of scientific charlatanry. The wizard of the present day is an electrician. Electricity and magnetism have become literally words to conjure with.

There is a certain progress in this, though not in itself a valuable progress. It is the advance from sheer ignorance to that little knowledge which is proverbially a dangerous thing. It is the advance from pure superstition, in which men did not reason at all, to humbug, in which they reason from false or insufficient premises to wrong conclusions.

It should be said in justice to the scientific charlatan, that he is frequently not dangerous, and is nearly always amusing. He possesses an audacity, a volubility, that, combined with his habit of blundering, make him a far more cheerful person to contemplate than his gloomy predecessor, the sorcerer. Take, for instance, the modern master of that ancient black art of divination by rods. A newspaper report makes a 'professor' of the science of 'magnetic geology,' as he calls it, speak as follows: —

> "You take the ends of the forks, and grasp them tightly in either hand, allowing that portion where the forks join to point upward. . . . When one walks over a mineral substance in the ground, the electricity ascends through the body into the hands and rod, and draws the central or connecting portion of the rod downward. When this occurs, minerals exist beneath the spot where you stand. If the rod begins to move as the person walks along, take particular notice of the spot where you stand when the movement begins. When the rod turns completely over, measure the distance from where it first began to move to the spot where it indicates minerals. This distance will give you the depth at which the mineral can be found."

'Rabdomancy, or divination by rods, is as old as history,' some one recently remarked. The feature of this science peculiar to our age is the pretence of explaining it. That the method is still resorted to quite widely, there can be no doubt. We read in a Vermont paper, that a few months ago the public authorities of Middlebury resorted to the rod when about to sink an artesian well. They then sank a shaft eighty feet at the spot designated, and there struck, not water, but flint. We have lately heard of a man who ascertains by the divining-rod the proper spot for grounding lightning-rods. We have never seen a statement of his theory in his own words; but it

appears that he holds the doctrine that atmospheric electricity follows, or is controlled by, the course of underground electric currents. He claims, moreover, to be endowed with a peculiar sensitiveness that enables him, by walking over the ground with the forked stick in his hands, to detect the location of these currents. The last touch is given to this theory by the statement that it is necessary for the gifted manipulator of the rod to wear rubber boots during the operation of divining, in order that he may be insulated from the ground.

In regard to the human body and the remedies for its ills, people have always been superstitious; and so, naturally enough, the number of 'electric' and 'magnetic' nostrums offered to afflicted humanity is very great. Their descriptions, however, are nearly always worth reading. Custom cannot stale the infinite variety of their absurdities. Here is a specimen which came to hand a few days since in the advertising columns of a college paper: —

"Labor, study, and research in America, Europe, and Eastern lands, have resulted in the Magnetic Lung Protector, . . . which, . . . with the continuous stream of magnetism permeating through the afflicted organs, must restore them to a healthy action."

There is a class of people who call themselves magnetic physicians, — people who cure, in a modern way, by the laying-on of hands. They are apparently closely allied to the spiritualistic mediums, and evidently intend to use something more than a figure of speech in calling themselves magnetic. There is, for instance, in or near San Francisco, a certain Dr. H——, who gives people what he calls magnetic baths. He claims to magnetize the water for the baths by dipping his hand in it. He is said to have an extensive practice. We have heard that the notorious Slade, whose feats made such an impression upon Professor Zöllner, claimed to possess a literal magnetic power, enabling him to rotate the plane of polarisation of light.

Whatever may be the case with these peculiar people it appears that others, not especially superstitious, do believe themselves particularly endowed or charged with electricity, because, for instance, they succeed in drawing sparks from their hair or clothing during cold weather. Of course, some people do have drier hair, or drier skins, than others, and do, therefore, as frictional electrical machines, surpass the majority of their fellow-mortals. Moreover, physiologists believe that in living bodies there exist slight electric currents capable of being detected by very sensitive apparatus. But apparently it is not with any intelligent reference to these exceedingly minute currents, or to an electric charge acquired by friction, that a man speaks, when he offers to rub a weak or disabled arm because he is 'strong, and full of electricity, you know.' The fact is, we do not know, and we wish the man would explain.

It would appear that such terms as 'animal magnetism,' and 'personal magnetism,' originating, no doubt, in metaphor, are sometimes taken almost literally. We have met one or two very intelligent people who seemed to have a vague idea that psychological problems might be attacked by means of the laws of electricity and magnetism.

This list of frauds and delusions might be greatly extended. Enough has been said, however, to illustrate some of the kinds of error into which people are led by their ignorance of the results and methods of scientific research. The need of a wider and more intimate knowledge of physics in the education of all classes would, no doubt, be generally acknowledged. It should be observed, however, that the kind of half-knowledge of this subject which is frequently obtained from newspapers, and even from public lectures and popular scientific books, is the very pabulum of such errors and humbugs as we have described. A woman hears a lecture on sympathetic vibrations, fundamental tones, etc., notes the trembling of a church under the music of the organ, and writes to her religious paper an enthusiastic letter explaining the fall of Jericho in a scientific manner, — and all in the interests of revealed religion.

A man reads, or sees in a public hall, that two electrified pith-balls attract or repel each other. He learns that the human body may be charged with electricity. Straightway he begins, upon this basis, to explain the table-tipping feats of spiritualistic mediums, — a gross error, hardly more respectable than the pure superstitition of the veriest believer in ghosts.

To make such errors impossible would require that definite, familiar knowledge of things, in their quantitative relations, which is hardly to be obtained without actual contact. It would require a laboratory training; and it is perhaps impossible to make provision for a very extended training of this sort in any scheme of general education.

The tendency of the times, however, is toward the objective and experimental in teaching; and it is probable that the next few years will see considerable changes in the methods of general instruction in physics.

WHIRLWINDS, CYCLONES, AND TORNADOES.[1] — III.

WE may now pass on from the small daytime whirls of dry air to the larger, long-enduring storms that are accompanied by rain; and here will be met two new elements, — the effect of condensing vapor, and the effect of the earth's rotation, — both of great importance. As a sample under this second heading, we may take one of the cyclones of the Bay of Bengal; for the storms there are very characteristic of their class, and have of late years received much careful attention. There is good reason for thinking that these cyclones generally spring up in calms, much as the desert-whirls begin. The seasons and regions of their occurrence both point to that conclusion; for tropical cyclones seem never to begin in well-established wind-currents, but rather in a place of quiet, weak, or variable winds. By India, for example, the cyclones are almost unknown during the prevalence of the steady blowing monsoons, but are not uncommon at those seasons when the monsoons change; that is, at times when the air has no well-established motion, but stands about idly, waiting for a decisive command to move on. During these idle times of stagnation, the lower air may become very warm and moist, and so prepare for a stormy overturning. The calm that precedes a cyclone often makes part of the description of a storm at sea: the air is close and oppressively warm; the water settles down to a glassy surface; and now we may see, what is not always clearly expressed, that this calmness of the water, and oppressive heat of the air, are not antecedent effects of the coming storm, but are actually the conditions that allow and determine the beginning of a storm. The warmer the air and the quieter the water, the longer must have been the preparatory stage; the greater the quantity of solar force collected in the lower atmosphere, the more violent will be the storm when it begins. This warm calm is really the embryo of the cyclone; and, if it lie long enough in a proper latitude, it will grow to well-developed maturity.

It is often stated that tropical oceanic cyclones begin at the meeting of two opposite currents of air rather than at a time of calm. This may be true for some cases, and undoubtedly has a very general application in temperate latitudes; but it seems more probable that in the Bengal cyclones, and most other tropical hurricanes, this stage is a little later than the earliest beginning, and is really the first development of the inblowing winds. A general calm would doubtless be found to precede such opposed currents if observation could trace the antecedent conditions a little farther back than is usually possible. The principal contrasts between the desert-whirls and the Bengal cyclones, at the time of their beginning, may be thus summarized: —

First, The area and uniformity of the surface on which the disturbance is developed is much greater on the ocean than on the desert.

Second, There is a lower temperature, but a much greater amount of heat, surface for surface, in the cyclone's embryo, than in the whirlwind's. The temperature of the air over the ocean seldom exceeds 95°: over the desert sands it may often rise to 140° or 150° close to the ground. But on the desert the stratum of air that is so excessively warmed is very thin; it often fails to reach the height of a man's eye, and so gives the appearance of a mirage: while over the sea, although the lower stratum is not so warm, its thickness is greater, and there is more of it warmed. What it lacks in temperature it more than makes up in quantity.

Third, The presence of water-vapor over the ocean makes a most important contrast between the two cases; and it is on this account that the warm sea-air is cooler than the hot desert-

[1] Continued from No. 40.