

up my mind that there must be a whirl, though in doubt as to its direction. In fact, the best testimony we have, scattering of *débris*, is strongly in favor of the view that there is no whirl. Figs. 2 and 3 will show better than pages of text the nature of this testimony. Let us ask what would be the effect of a whirl, in a direction counter-clockwise, passing through an orchard (see Fig 2). Facing the tornado as it approaches, we would see trees passing our eyes at right angles to the track, or leaning over to the right. After the tornado passes, we would see trees on the south side lying

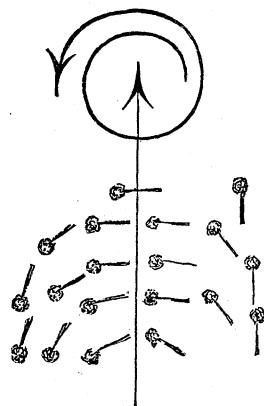


FIG. 2. — ORCHARD BLOWN DOWN BY A WHIRL FROM RIGHT TO LEFT.

parallel to the track, with tops to east, while on the north side their tops would lie to the west. Fig. 3 shows the true conditions which are found. The *débris* and trees in the centre all lie parallel to the track, while on the north and south sides the trees point inward and forward toward the centre. The writer made a most careful investigation of the conditions at the Wallingford (Connecticut) tornado; and these appearances were repeatedly met with, though the

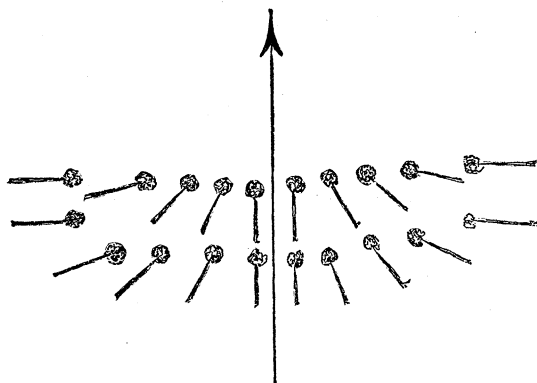


FIG. 3. — ORCHARD AFTER ACTUAL TORNADO HAS PASSED.

true significance of the facts was not fathomed. The strongest argument that has been advanced in favor of a whirl has been the position of tall trees which have crossed each other. Almost invariably the under tree is the one pointing north or north-east, while those above point south-east or south. The proof is very unsatisfactory. If there is a steady whirl in a mass of air, why would it not break down neighboring trees in the same direction?

Further Research.

We are impressed with the imperfection of the evidence regarding the true mechanism of a tornado. Even the ap-

parent drawing-up of water from a pond cannot be regarded as evidence of an uprush. We know, that, even if there were a perfect vacuum, water could not possibly be raised more than thirty-four feet. It is probable that the depression noted as the tornado passes is due to the wind, and the apparent rising of a mass of water is simply fine water-particles or mist borne on the wind. The fact of the existence of a whirl is one of the most important that can be established. While we can never expect that an observer would remain near enough to a very severe tornado to make accurate observations, yet it seems as though this fact might be established by skilled observations in a less severe tornado. If you are on the south side of a tornado, there is little use in looking for a whirl; but attention should be given to the starting of objects into the air. See whether, when a tree starts, it goes suddenly, as if shot from the ground, or is swayed violently at the top first; see whether the *débris* that rises goes up in great confusion, whirling over and over, or whether it is carried lengthwise, as in a stream; etc. If you are on the north side, get as near as you dare, and cling to a large tree, or, better, to a post; note whether a single object near the ground or up in the funnel has any motion whatever toward your right hand as you look at the funnel. The moment the tornado has passed, run with the greatest possible speed to its rear, and, if possible before the dust has enveloped you, see if a single object on the ground or up in the air is moving to your right. If the tornado has moved through an orchard, establish as near as you can the centre line, and then pace off one hundred, two hundred, three hundred feet to north and south, examine trees at the same distance on either side, and see if those on the south are uprooted or broken more than those on the north. If the tornado is moving at the rate of eighty miles per hour, and the whirl a hundred and twenty, on the south side the resultant velocity would be two hundred, while on the north side it would be only forty miles per hour. The greatest care must be taken that we do not blind our eyes with preconceived notions. When some observer who has a barometer has been so fortunate as to take it to a dug-out, and has kept his eye upon it rather than upon the more absorbing tornado, we may hope from his testimony, if the funnel goes over his head, to clear up more doubtful points, and establish more certainties, than can ever be done by any other means. Finally, as the West becomes more thickly populated by skilled observers, we may hope to some time establish many points now very uncertain.

H. A. HAZEN.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

To Discuss Meteorological Topics.

A PRELIMINARY survey is being made to discover if available material enough exists in and near this city to form a society to study and discuss meteorological topics. Such an organization should include physicians, civil engineers, and other professionals, and amateurs who have studied the weather in a scientific way, or the relations of any of its phases to important human interests, like health, construction of dams, bridges, and buildings, navigation for commerce and pleasure, horse and steam car local traffic,

crops, preservation of forests, and writing insurance. Nothing, perhaps, touches people's mundane welfare at so many points as the weather; and yet, as a science, meteorology is really in its infancy. In many civilized countries there are, aside from the official weather bureaus, independent associations made up of persons who are interested in their own or other people's investigations of the weather, in some of its bearings upon the happiness of man. Such are the New England, Royal, and Scottish Meteorological Societies. Some of the members are professional and hard working meteorologists, of national or world-wide fame, like Dr. Buchan and the Hon. Ralph Abercrombie; and some are wealthy but intelligent enthusiasts, like Mr. G. Lawrence Rotch of Boston, who has built and equipped one of the finest private observatories in the world, and in a quiet way contributes much to the advancement of science. There can be no question as to the value of such an organization. A few minutes' reflection should satisfy any well-informed resident of this city and vicinity that men enough, admirably qualified to conduct such an enterprise, are to be found hereabouts; and the advantages of affiliation for this purpose ought to be too apparent to need pointing out. The discussion of appropriate papers from members or outside experts, the education which even the most accomplished scholars would derive from others' labors, the stimulus and direction given to individual investigation, the procuring of a common library for use in meteorological research, the shaping of popular ideas about weather, and the depreciation of "cranks" of the Wiggins type, would be among these benefits. Whether those persons best fitted to carry on this work have the time and inclination to carry the proposed society through a short infancy into an assured permanence and a usefulness worthy of the American metropolis and its environs, is really the only question to be solved. I should be glad to be the humble means of bringing together for organization those who will favor the movement in private letters to the editor of *Science*. JAMES P. HALL.

Brooklyn, N.Y., May 20.

BOOK-REVIEWS.

Midnight Talks at the Club. Reported by AMOS K. FISKE. New York, Fords, Howard, & Hulbert. 16°. \$1.

MOST of the chapters of this book were originally published as a series of articles in the Sunday edition of the *New York Times*, and purport to be accounts of certain talks and discussions at the Asphodel Club, at which the author was present as a listener. The principal talker is known as "the Judge," who is obviously intended as the author's mouthpiece. The talks are almost entirely on religious themes, "the Judge's" views being those of the most advanced liberal Christians of the present day. He is represented as regarding "the restraint and elevating influence of Christianity over society as necessary to the uplifting of mankind from their low condition, the salvation of free institutions, and the system of popular government" (p. 108). But he holds that "the Church, in order to maintain its great influence and power for good, and do the work which most needs to be done, absolutely must range itself in line with modern progress in knowledge and thought" (p. 221). But the Church, he says, has not kept up with the intellectual progress of recent times, and for this reason is losing its hold upon the world. The remedy that "the Judge" proposes is to "discard the requirement of a belief in the miraculous" as a condition of admission to Christian fellowship. Such a loosening of the bonds of dogma would, he thinks, bring into the Church all the best minds of the age, and make it the saving and elevating power that it ought to be. It will be seen, therefore, that the views expressed in the book are those now commonly held by scientific men and historical critics, but they have not until recently been expressed in this country with such freedom and emphasis. Unfortunately, however, "the Judge's" views, like those of most liberal Christians, are mainly negative and critical; and he has little to say as to the positive side of religion, except that he believes in the being of God and the immortality of the soul. Hence, although the work is written in an excellent spirit, and contains many good points, the reader lays it down with the consciousness of something lacking.

Epitomes of Three Sciences: Comparative Philology, Psychology, and Old Testament History. Chicago, Open Court Publ. Co. 12°. 75 cents.

THIS volume contains three essays designed to give an account of recent investigations in certain departments of science, with their most important results. The ablest and most interesting is the first, on "The Study of Sanskrit," written by Professor H. Oldenberg of Kiel. It is not, as the title of the book would lead us to think, an exposition of comparative philology, which is only incidentally alluded to, but is an historical account of the discovery and elucidation of the ancient Sanscrit literature. Beginning with Sir William Jones, the author traces the progress of Sanscrit studies through various vicissitudes and difficulties to the present day, and shows how much has been done toward the recovery of this important literature, and by what means the work has been accomplished.

The second paper, entitled "Aspects of Modern Psychology," by Professor Joseph Jastrow, is really devoted to the new science of psycho-physics. It is not a summary of the science, but a brief history of its origin and development. The contributions of the different nations are recorded, those of Germany naturally occupying the most prominent place; and there are also a few pages on recent investigations in comparative psychology and in animal psychology.

The third essay, "Rise of the People of Israel," by Professor C. H. Cornill of Königsberg, is an attempt to state the grains of historical truth in the early traditions and legends of the Israelites. The author holds that every such historical legend has a basis of truth; but by what criterion he discriminates between the truth and its attendant falsehoods he does not tell us. However, he sets before us what he believes to be the real outline of Israelitish history from Abraham to David, which has at least the merit of being based on conscientious and painstaking study. On the whole, this little volume is well worthy of perusal.

Pure Logic and other Minor Works. By W. STANLEY JEVONS. New York, Macmillan. 8°. \$2.50.

THIS volume is made up of several of the author's shorter works, with a preface by Professor Robert Adamson. It contains the work on "Pure Logic" first published in 1864; "The Substitution of Similar," which appeared in 1869; and some minor logical essays, closing with the four papers entitled "John Stuart Mill's Philosophy Tested," originally published in the *Contemporary Review*. As all of them have long been before the world, and most students of logic and philosophy have already formed their opinion of them, we shall not discuss them here; but we cannot help recording our opinion that neither these nor the author's other works have such high merit as his admirers claim for them. Jevons was always trying to be original, and to revolutionize the branches of knowledge with which he dealt; yet his only valuable contributions to them relate to minor points. The criticisms of Mill might better, we should think, have been left to slumber in the pages of the magazine in which they originally appeared, as they are no benefit to their author's reputation. He does, indeed, point out some defects in Mill's philosophy; but many of his criticisms are worthless and misleading, while their tone and temper are about as bad as is possible. They are, in fact, models of all that controversial writings ought not to be.

How to Remember History. By VIRGINIA CONSER SHAFFER. Philadelphia, Lippincott. 8°. \$1.

THE main object of this work is to assist the student of history in remembering dates. It presents a summary of the leading events of the sixteenth, seventeenth, eighteenth, and nineteenth centuries, some thirty or forty in each one, with charts designed to make the dates and character of these events apparent to the eye. The occurrences of each century are first stated in brief chronological form, it being intended that these statements shall be committed to memory; and then follows a succinct historical account of the events themselves. But the charts are the peculiar feature of the work, and are believed, not only by the authoress but by others who have used them, to be valuable aids to the memory. The plan of the charts was originally borrowed from