over a number of years is also necessary to show what precautions must be taken to prevent serious interruption of traffic; the record of snow-storms being most desirable along railroad routes, and of ice periods and low water on the water-ways.

3. MANUFACTURES AND ARTS.—The unremitting labor necessary for the successful operation of manufactories is best obtained in the colder climates. The arts of a nation are, many of them, regulated by the nature of the climate. Water-power, while it is dependent on the slope of the land and other local peculiarities for the head of water, is principally influenced by the amount and regularity of rainfall, conditions which are favorable to alternate floods and draughts being especially unfavorable to use of water-power. Many articles will not stand the removal from one country to another having a different climate, an instance being the cracking of picture-frames brought to our country from the moister European lands; and such instruments as the zither, we are told, cannot be successfully brought to America. The manufacture of some articles requires an excess or deficiency of moisture, as in the case of some textile fabrics. The still unharnessed wind-power will play an important part in our manufactures when its force can be conveniently and economically transposed into electrical energy. Few persons are aware that a wind-wheel twenty feet in diameter, exposed at a moderate elevation above the ground, will furnish on the average one horse-power throughout the year, taking the average of our country east of the Rocky Mountains.

4. INSURANCE.—The increasing application of the principles of science to insurance adjustment must include meteorological data, when this begins to be carefully considered in this connection. Frequent remarks in the late insurance journals show that some meteorological events can no longer be excluded from the computation of risks, and even new fields are being entered upon. The recently established tornado insurance will doubtless be extended to include all storms; but the damages by floods are usually so dependent on local peculiarities, that such insurance can hardly be said to have a scientific basis. Unhealthy climates, and regions of scourges, which usually have marked climatic features, should not be included with healthier countries in any general rate of premium for life insurance. In marine insurance it is possible to take into account the probability of storms, not only for various seas and at different seasons of the year, but also for any sailing course between two ports on any particular sea. In fire insurance the high temperatures, and especially heated terms, and the amounts and frequency of rainfall, must be considered. Nor can we neglect the wind distribution as regards average velocity, and the relative frequency of high winds, and especially the sudden rise of winds which may start smouldering fires which are temporarily unattended.

5. MEDICINE.—Climate as applied to the treatment of disease has generally been studied in a desultory manner, although some general rules have been formulated which are accepted by the medical profession. In most cases, however, there is a wide difference of opinion as to what climatic factors are the most potent as a means of curing or preventing certain diseases; and we find physicians of the highest attainments recommending such extremes as to show that individual opinion in such matters has not yet given way to generally accepted results obtained by the careful study of statistics.

Each one of the climatic elements plays a special *rôle* in the combined effect produced on mankind, and it is these separate effects which must be studied more closely. We know that great daily ranges of temperature, or rapid changes from day to day, are to be avoided in certain diseases, and yet for our own country little data are accessible concerning the latter of these conditions. In recommending long journeys (for instance, from New England to California), how few physicians take into account the hygrometric and barometric conditions to be encountered *en route!* Observations on moisture, relative amounts of sunshine and cloudiness, ozone, and winds, are also necessary for determining the desirability of a place of residence for invalids.

6. MISCELLANEOUS ECONOMIC QUESTIONS.—Under this heading we may put a great many kinds of work in which meteorological data may be very useful. All subjects connected with drainage require a knowledge of amount and frequency of rainfall. Railroad routes, especially where local traffic is to be the main source of income, are not laid out without a careful study of the climates of the countries through which they are to pass. Many engineering undertakings are directly affected by the climatic elements; as, for instance, the effects of winds on bridges. The first question to be answered in connection with the reclamation of our Western arid lands, which interests us so much at present, is, "What is the climate of the country to be reclaimed?" While our politicians are wrangling over the question of protection and free trade, few of them have recognized the bearing of climate on the question. While the use of the winds in aerial navigation is not of practical importance just at present, yet we have but to recall their universal use as power in the flat countries of Europe to show their possible application on our great plains, where a velocity is found almost equal to that on the seacoasts. Climate should be carefully considered in questions of emigration, for the immigrant will usually succeed best in a country having a climate similar to that which he left as an emigrant.

FRANK WALDO.

Cincinnati, O., May 23.

Temperature in Storms and High Areas.

I AM strongly of the opinion that Professor Davis has found a veritable "mare's nest" in his presentation of this subject in last week's *Science*. He is certainly nearly three years behind the times; for this whole matter has been thoroughly ventilated, and the palpable errors into which Dr. Hann has fallen have been already pointed out (see the *American Meteorological Journal*, October, 1887; March, 1888; July, 1889: and the *Scientific American Supplement*, June 15, 1889). The ordinary theory is, that in our storms the air, up to about ten thousand feet, is abnormally heated, and this causes an ascending current of moist, warm air, which has its moisture condensed through the cold of expansion; and that the latent heat set free serves to warm up the air, and thus to produce a rarefaction, which serves to accelerate the ascending current. This acceleration in the air-current causes a more rapid condensation, in turn a greater rarefaction, and so on till our most violent tornadoes are evolved. It is difficult to see why the latent heat of condensation does not exactly balance the cooling by expansion, but I leave that point for others to explain. Dr. Hann himself has made a most elaborate computation of this increased heat in a storm, in which he has shown that up to sixteen thousand feet the average temperature in a vertical direction may be about 50°, while in a high area it must be only 30° (see *Austrian Meteorological Journal*, 1874, p. 321). Professor Ferrel of our own country has written hundreds of pages in which the essential point is that there is an ascending current of moist heated air in our storms. In all his theories he has followed most closely the theoretical results deduced by Hann. All this, and I may say the pet theories of a dozen other authorities, are brushed away with a single stroke of the pen: they vanish as an ethereal essence into thin air, out of which we may say they were reasoned on exceedingly unsubstantial grounds.

These would seem most important conclusions, and should not be put forth without incontestable facts to establish them. Let us inquire into the nature of this evidence. 1st, Dr. Hann's observations are all made in the Alps, a region two thousand miles to the south-east of the average track of storms, also a region fifteen hundred miles from the nearly permanent winter high area in Siberia. Surely we are not to consider that it is possible to get an idea of the distribution of temperature in the centres of our storms and high areas under these conditions. The pressure undoubtedly rises and falls in the Alps; but the storms that cross there are in the nature of secondaries, and there is no opportunity to study real storms. No one ought to think that a study of temperature in the border of a storm and five hundred or a thousand miles from its centre, can give the central conditions. 2d, It would be a great mistake to study simply a fall or rise in pressure on a mountain as the passage of a storm or high area. One of the greatest falls in pressure on Pic du Midi, in France, accompanied a high area, and was caused by the intense cold. This

single fact is sufficient to disprove all these finely spun theories of Dr. Hann. 3d, The evidence of our own storms is absolutely conclusive on this point, and I kindly turn Professor Davis's attention to this. Fortunately we have a mountain in this country which lifts its head sixty-three hundred feet directly into the centre of more than half our storms and a great number of our high areas. We cannot ask for better evidence than Mount Washington furnishes us with so lavish a hand. Observations are given us for eighteen years from this most remarkable vantage-ground, and these give no uncertain sound on this question. When a storm approaches within five hundred or six hundred miles of this almost perpendicular and isolated height, the temperature begins to rise, and, when the centre passes, the average temperature of its central core is more than ten degrees higher than that of the air five hundred miles in advance. As the storm passes off, the temperature rapidly falls, and is fifteen degrees lower five hundred miles after it than at the centre. When a high area passes, the temperature begins falling, and the diminution and subsequent rise follow each other in almost exactly the manner and to the degree of the reverse operation in a storm.

The evidence on this point is absolutely conclusive; and, since the seeming contradiction in the Alps can be easily explained, we see that there is no need of changing theories on this account. It will be understood that the ordinary theories of storm-generation are none the less utterly worthless, even though this supposed proof of their worthlessness is itself worthless. It is highly probable that Dr. Hann has been misinterpreted in this presentation of his views, and no one will be more shocked than he at this outcome. Dr. Hann found in a certain October storm the average temperature nearly eight degrees below the thirty years' normal for the height in consideration, and in this storm the air was colder than in a high area nearly two months later. Surely this proves nothing whatsoever. The temperature in a vertical direction in a storm is not fixed, but may be ten degrees, or even more, lower than the average, and yet be many degrees above that of the surrounding region. That the temperature in an October storm was lower than in a November high area is not in any wise remarkable.

Professor Davis makes this remarkable statement: "The cyclonic air does not rise because it is warm, but, according to Dr. Hann, it is lifted in spite of becoming cool." I doubt if there is a sadder example of bowing down to authority than this. Where is the jack-screw by which this air is lifted? If the air becomes cooler than the surrounding air, does not its specific gravity at once cause it to descend? Is the law of gravity so easily overcome, and swept away by a single stroke? If there is some mighty force pressing down the air in our cold waves, and causing it to warm up the lower it gets, why does it not warm up clear down through? Where is this plane of demarcation, and change from a warm region to one just the opposite and bringing us the coldest period of the winter? There are millions who will thank Professor Davis if he will prove to them that they will not need to buy coal next winter, because, by a newly discovered law, our cold waves hereafter are going to be really warm waves, to use an Irishism.

Professor Davis says, further, "In this country, Hazen has drawn attention to the absence of indication of the 'neutral plane,' called for deductively; and for this and other reasons he has discarded pretty much all parts of the cyclonic theory, following Faye more closely than any other." It seems to me this is an exceedingly unfortunate allusion, if the intention is to support Dr. Hann in his views. The only reason why this so-called "neutral plane" was discarded was because in the centre of a storm it was found that the temperature continually rose, the higher up one went. It is easy to see that this condition is absolutely contrary to that presented by Dr. Hann. Faye has not been followed in this country, but his view that there was a downrush in a general storm has been denied. I am sure that no one will be as much pleased at this corroboration of his views by Professor Davis, and this proof of a downrush in a storm carrying in the cooler air of the upper regions, than M. Faye himself. If readers of *Science* are led to the belief that, after all, we know next to nothing of the real cause of a storm, and that the great and crying necessity that is pressing upon the meteorologic world at present is reliable observation in the storm region, it will be a great advance.

H. A. HAZEN.

Washington, D.C., June 2.

The Winnebago County (Iowa) Meteorites.

A FRAGMENT of the 104-pound "meteorite" found in the northern part of Kossuth County has been examined by us, and we are perfectly well satisfied that it is not of meteoric origin at all. In outward appearance it is suspicious at first sight. The color is darker than that of the other pieces. There is no distinct crust, and no metal present. The gravity taken on a piece weighing about half a gram was 2.83, which is nearly a unit lower than that of the well-established specimens. Under the microscope the crushed mineral shows by reflected light a mass of colorless, transparent particles mingled with dark green particles resembling pyroxene. The analyses given below, together with the appearance of the chip furnished us, strongly suggest diorite or some closely allied rock.

Silica	71.63
Oxides of iron and aluminum	14.39
Lime	6.80
Magnesia	—
Soda	5.55
Water	1.63
Total	100.00

Some circumstances connected with the finding of this piece have made us slightly suspicious from the first, and such examination as we have given thus far seems to be conclusive.

JOSEPH TORREY, JR.
ERWIN H. BARBOUR.

Iowa College, Grinnell, Io., May 24.

BOOK-REVIEWS.

The Village Community, with Special Reference to the Origin and Form of its Survivals in Britain. By GEORGE LAURENCE GOMME. New York, Scribner & Welford. 12°. $1.25.

THE special object of this work, which is the latest volume of the Contemporary Science Series, is to present the author's theory as to the origin of British village communities. He rejects the view most commonly held, that they are exclusively Aryan institutions, and particularly repudiates the theory of their Roman origin, and endeavors to show that they date back to prehistoric times, when the British Isles were peopled by Iberians. He admits, of course, that there is no direct evidence to support this view, but attempts to prove it by reference to India, where village communities are known to have existed before the advent of the Aryan conquerors. He adduces a number of facts relating to the British communities in historic times, and shows that they have parallels more or less close in those of India; and from these facts he draws the conclusion that the origin of the two systems must have been similar. "Over and over again," he says, "the certain evidence of these race distinctions which is forthcoming from the unamalgamated elements in Indian villages finds a parallel among the existing archæological and traditional facts of English villages; and my contention is that the parallel must be true all along the line —must therefore tell us of the old race origins of the English village life" (p. 115). The evidence he adduces in support of this view is by no means sufficient to make it an established theory, though it does show that such an origin of the British communities is possible. The subject, as every one who has even a slight knowledge of it knows, is a difficult one, and it will probably be some time before a general agreement is reached in regard to it. But meanwhile it is necessary to consider the question in all its aspects, and for this reason students of the subject will take a good deal of interest in reading Mr. Gomme's work. He marshals a great array of facts in support of his theory, though he acknowledges that some of them admit of other interpretations than those he gives; and both the facts and his reasonings on them will be useful to other investigators.