pain was experienced. Shortly afterwards he noticed that a part of the retina was permanently affected, the injured portion being in the form of a square, with the center of vision in one corner. The sharp outlines of this field could be easily distinguished, and upon closing the eye, fan-shaped flashes of a violet color spread out from one corner over the injured area at equal intervals of several seconds, their recurrence being entirely involuntary. After being some time in the dark the flashes of color ceased.

There was in general an apparent lack of illumination over this part of the retina, accompanied by a loss of power to properly distinguish colors, more especially green. The outlines of objects were blurred, their dimensions also appearing to be reduced by about one quarter. Printed letters could not be recognized at more than half the distance at which they were easily read by the uninjured eye. Parallel lines seemed to converge over the injured portion. In walking and riding he noticed at a short distance ahead what seemed to be a spot a few inches in diameter and about two inches high, which he often turned his wheel aside to avoid. The injured eye was also very defective in estimating distances. The effect lasted several weeks with almost undiminished intensity, but has since been gradually disappearing.

The second case is that of Mr. R., who in May, 1900, imprudently observed for some time the partial eclipse of the sun with his eyes unprotected in any way. No effect was noticed until late in the day, when in looking over the hillside he saw apparently a flock of eight or ten red birds whose movements were very erratic. Since the birds appeared wherever he looked, he carefully examined the field of vision, and discovered that the sun had formed a crescent image on the center of the retina of the left eye. The color of the image was green with a narrow red border. The injured area seemed to be quite blind, and parallel lines diverged around it, this effect being just the opposite of the previous case. The injury is always noticeable and very annoying, especially in reading. In making observations in the physical laboratory he had to discontinue the use of his left eye, which he had been accustomed to use constantly. The effect is still noticeable after a year, though it causes much less annoyance.

A case exactly similar to this has been described, in which the injury had lasted ten years.

Frank Allen.

Cornell University.

CURRENT NOTES ON METEOROLOGY.

RAINFALL, COMMERCE AND POLITICS.

A suggestive paper by H. H. Clayton in the *Popular Science Monthly* for December, on 'The Influence of Rainfall on Commerce and Politics,' forcibly emphasizes the interest and value of the studies that may be made along the lines of human, or economic, meteorology. In pointing out that 'every severe financial panic (in the United States) has been closely associated with a protracted period of deficient rainfall,' and that 'there has been no period of protracted drought without a severe financial panic except a period, the effects of which were masked by the large disturbances attending our Civil War,' the author has clearly indicated how closely national crises are related to the changing meteorological conditions of successive years. The sequence of deficient rainfall—deficient food supply—financial panics—changes in the dominance of political parties,—is also considered. There is much in this discussion that might well occupy the attention of those who take pleasure, not only in studying the correlations of meteorological conditions and politics in the past, but who also wish to try their luck at forecasting the political changes of the future. Mr. Clayton rightly calls attention to the value of such investigations on the economic side of meteorology, and to the need of more opportunity in our universities for the study of the influences of the atmosphere upon health, upon commerce and upon politics.

This interesting paper suggests a number of other, somewhat similar, examples of the influence of weather upon political movements of greater or less importance. Among the causes of the 'Boxer' outbreak in China, which

involved several nations in war, was the scarcity of rain during the preceding autumn, and the consequent impoverishment and discontent of the people. In this very Chinese war, the allies at Tientsin (July 3, 4) are reported to have been saved from total defeat by a torrential rainfall which obliged the Chinese to retire. A severe winter precipitated the outbreak of the French Revolution. The Russian saying that the Russian Generals January and February are invincible dates from the time of Napoleon's terrible retreat from Moscow, and again suggests the historical importance of a severe winter. Going back much farther, into more ancient history, we find that in the year 54 B. C., Cæsar's legions in Gaul had been scattered about in separate winter quarters, because of the scanty harvest following a drought. Under these circumstances a defeat at the hands of the enemy was natural, and actually took place.

The number of such cases might be extended almost indefinitely, but anyone who reads history with his eyes open to the controls which lie behind the military and political movements of the past will be able to collect an abundance of illustrations for himself.

ECONOMIC EFFECTS OF LAST JULY'S HEAT AND DROUGHT.

ANOTHER recent paper, by the compiler of these Notes, published in the *Bulletin of the American Geographical Society* for October, under the title, 'Some Economic Aspects of the Heat and Drought of July, 1901, in the United States,' brings out certain additional features in connection with the economic side of meteorology. Trade in the United States throughout the greater part of July showed some very marked effects of the high temperatures and of the drought. There was, on the one hand, a stimulation of retail trade in all kinds of light-weight summer clothing, and the continuance of the heat carried this sale beyond the usual time. On the other hand, there was commonly noted a depression of retail trade other than that in summer goods. The heat of the first week of July caused a practical suspension of industrial activity in many cities, thus interfering with the output along the several lines affected by the shutdowns. The drought caused a lack of pasturage in the Southwest, and this led to record-breaking shipments of cattle and hogs to market at Kansas City. Thus the market became overstocked; buyers dictated prices; the situation in hides was much complicated. Prices of cereals and of railroad stocks showed marked fluctuations throughout the hot spell, the damage to corn being the chief control in the case. Reports of rain in the corn belt sent up the prices of corn, and of the stocks of the corn-carrying railroads. Under the influence of the July drought, the number of failures in August was larger than usual. Building was interfered with, and trade in building materials was checked. Meat was in less, and fruit and vegetables were in greater, demand than usual. The demand for ice was so great that there was difficulty in chartering vessels enough in which to ship the ice from Maine.

SNOW CRYSTALS.

MR. WILSON A. BENTLEY, of Nashville, Vt., who has spent some twenty years in the critical study of snow crystals by means of micro-photography, contributes a paper under the title, 'The Story of the Snow Crystals,' to *Harper's Monthly Magazine* for December. This article does not differ essentially from one by the same writer in the *Monthly Weather Review* for May last. Since January, 1885, 800 photographs of snow crystals have been taken, and no two of them are alike. The conditions under which the different forms of crystals fall have been carefully studied, and it is stated to be possible to read the character of a storm directly from its crystals. Mr. Bentley's micro-photographs rank with any that have been obtained in Europe. Several of the most beautiful types are reproduced with the article.

WEATHER AND TETANUS.

NUMBERS of cases of tetanus have recently followed vaccination in different sections of the eastern States where there have been outbreaks of smallpox, and the blame has usually been laid upon the impurity of the vaccine matter. In at least one case, however, a study

of the conditions seems to lead to another conclusion. The recent epidemic of tetanus in Camden, N. J., prompted the local Board of Health to send out a circular giving the facts collected by the Board. From this circular it appears that a bacteriological examination of the vaccine matter used in Camden showed it to be free from tetanus germs. The reason for the epidemic is found in the prevailing weather conditions, combined with carelessness on the part of persons recently vaccinated. There had been a long spell of dry weather, accompanied by high winds, which raised the dust, so that there were tetanus germs constantly present in the atmosphere. Infection resulted when the scabs had been removed, and the germs gained access to the wound.

R. DeC. Ward.

WIRELESS TELEGRAPHY.

The readers of Science may be interested in the following editorial taken from the London *Electrician* of December 20. It seems to us also that the Marconi system cannot be expected to replace submarine cables, which form at present a network which appears almost as complicated on a small map of the world as the network of railways on an ordinary map of the State of Illinois. An attempt to substitute the Marconi system for existing cables would lead to a state of affairs closely analogous to the confused din in a stock exchange where each person makes more noise than all the rest. This analogy enables one to appreciate the limitations of wireless telegraphy. In the one case we have electrical waves and in the other case sound waves spreading in all directions from each sending station; and we must remember that Marconi's receiver is far inferior to the human ear in its ability to analyze a complicated system of waves falling upon it, or, in other words, to respond selectively to certain types of waves.

W. S. Franklin.

"The current week opened with the startling announcement throughout the world that Mr. Marconi had succeeded in transmitting wireless signals across the Atlantic. By means of a kite he had contrived, at St. John's, Newfoundland, to intercept waves transmitted from Cornwall, the actual receiver being a telephone and the actual 'message' the Morse letter 'S' at intervals of five minutes, as prearranged. The sounds were very faint, though they are declared by Mr. Marconi himself to have been unmistakable. Thursday, December 12, 1901, may prove, therefore, to be a date to be remembered in the history of wireless telegraphy. Within this apparently feeble result—three very faint clicks repeated at intervals of five minutes—there is to be seen the germ of ocean wireless telegraphy, and, perhaps, telephony. It is a germ that promises to develop into abundantly fruitful maturity. It is not in the interlinking of continents divided by an ocean, but rather in the overspreading of the ocean itself with telegraphic facilities that the power and fruitfulness of this latest achievement of Mr. Marconi is to be perceived. Submarine cables already link ocean-divided continents far better than wireless telegraphy can ever do. Long ago we pointed out that the true field of wireless telegraphy is across comparatively short distances of water—that, in fact, it is really a disadvantage to wireless telegraphy to be able to take in such a wide compass as an entire ocean. Indeed, when such immense areas are covered the probabilities of confusion and clashing of signals is a thousandfold increased.

Lest any section of the public should be disposed to regard Mr. Marconi's latest experiment as foreshadowing the replacement of submarine telegraph cables by wireless apparatus, we hasten to bid them dismiss the idea. No serious competition with submarine telegraphy can ever take place on a commercial basis, at any rate until the Marconi system is evolved into something very different from what it now is. This raises the interesting but thorny question of patent rights. Others besides Mr. Marconi will have something to say on this head. We do not say that Mr. Marconi will not succeed in sending messages between this country and America; but, having regard to the uncommercial conditions under which they must be sent, it is clear that the wireless channel of transmission will be rigorously avoided by business men, to whom a guarantee of secrecy and the certainty of a recorded message are absolutely indispensable. Wireless signals in the ether can never be secret; it must always be possible to intercept them. And messages received in no more permanent form than by sounds in a telephone are too evanescent and uncertain to commend themselves