contrast will appear very striking to any one who will compare the maps of January and July isotherms, respectively, for the globe. The two maps will be seen to differ but slightly in the southern hemisphere, immensely in the northern. I know no reason why a contrast between extremes and means in climate, produced by geographical conditions, should have a materially different effect, as regards glaciation, from a like contrast produced by astronomical conditions. It appears, then, that a comparison of the northern and southern hemispheres may show us whether a climate of means or a climate of extremes is favorable to glaciation.

Now, there can be no doubt that at present the southern hemisphere is suffering a greater degree of glaciation than the northern. As the facts are so well known, it is only necessary to allude to them. New Zealand, with a mean temperature about the same as that of Switzerland, has glaciers extending as nearly to the sea-level as those of Norway.[1] Nor is this due to any exceptionally large snow-fall in New Zealand, for the precipitation there is no greater than in Norway, and considerably less than in Switzerland. Tierra del Fuega, with a mean temperature about equal to that of southern Norway, and with a winter temperature no colder than that of Switzerland, has glaciers extending to the sea.[2] The same is true of the island of South Georgia, if, indeed, perpetual snow does not descend to the level of the ocean (as reported by Captain Cook).[3]

It may, I think, fairly be concluded that glaciation depends less upon the coldness of the winter than upon the coolness of the summer. Not a climate of extremes, but a climate of means, tends to produce glaciation. It appears, accordingly, that the two characteristics of the seasons, in an epoch of high eccentricity would tend in precisely opposite directions, as regards glaciation. In one hemisphere, the length of the winter would tend to glaciation, while the intensity of extremes of temperature would oppose glaciation. In the other hemisphere, the shortness of the winter would oppose glaciation, while the approximation to a mean temperature would favor glaciation. The actual tendency to glaciation would be, then, the algebraic sum of two values of opposite signs. In which hemisphere would the tendency to glaciation predominate? And would the absolute value of the algebraic sum of the two tendencies in either hemisphere be sufficient to have any appreciable influence? I simply suggest these questions, making no attempt to answer them.

I may remark incidentally that there is something aparently unsound in the argumentation by which the advocates of the eccentricity theory seek to show that the hot perihelion summer would not melt the snow and ice. They virtually deny that the perihelion summer would be hot, urging that the temperature could not rise above the freezing-point until the ice was all melted.[4] It may well be conceded that the summer temperature could not rise much above the freezing point in the centre of a polar ice-cap, or at the apex of a snow-capped peak. But at the margin of a snow-field, polar or alpine, the climatic conditions would be very different. The ice-fields of a glacial period would not be created instantaneously in their maximum extent, but would be the results of a slow accumulation for many centuries. As each hemisphere in turn gradually approached the condition in which the climax of its winter would fall in aphelion, the snow-fields would be at first of very small extent. Outside the boundaries of those snow-fields, the land would be heated to a temperature increasingly hot, as year by year the climax of the summer approached the perihelion; and that high temperature of the surrounding areas would produce rapid melting at the margins of the snow-fields. Moreover, even at the extreme of glaciation, the area covered by ice would form but a small part of the surface of a hemisphere. Cold aphelion winters must be accompanied by perihelion summers not only potentially but actually hot.

WILLIAM NORTH RICE.
Wesleyan University, Middletown, Conn., Aug. 16.

[1] *Science*, iv. 426, 1884.

[2] Darwin, 'Journ. of researches during voyage of H. M. S. Beagle,' p. 224. N. Y., 1875.

[3] Lyell, 'Principles of geology,' vol. i. p. 242. N. Y., 1872.

[4] Croll, 'Climate and time,' pp. 58–67. New York, 1875.

The causation of pneumonia.

In *Science* for Aug. 13, 1886, p. 133, I notice a paragraph relative to results of observations by Dr. Seibert of seven hundred and sixty-eight cases of pneumonia, wherein it appears that pneumonia prevails to its greatest extent "whenever there exists a low or falling temperature, with excessive and increasing humidity, and high winds." This reminds me that readers of *Science* may be interested to know that facts respecting a very much larger number of cases, and respecting pneumonia in different parts of the United States, in England, and in India, — that is to say, in several climates and under different conditions, — confirm to some extent the conclusions reached by Dr. Seibert, as mentioned by *Science*. Such statistics, presented by abstract at the last meeting of the American climatological association, demonstrate, I think, that the sickness from pneumonia is absolutely controlled by the temperature of the atmosphere. The higher the temperature, the less the sickness from pneumonia; and the lower the temperature, the more the sickness from pneumonia. This is equivalent to saying that that part of the conclusion of Dr. Seibert which relates to humidity is an error; because the absolute humidity of the atmosphere is, speaking roughly, inversely as its temperature, and there is most sickness from pneumonia when, or soon after, the air is driest absolutely; and there is least sickness from pneumonia when, or soon after, the air contains the most vapor of water, that is, when the temperature is highest. The error of many who have written on this subject, and probably the error of Dr. Seibert, consists partly in calling the 'per cent of saturation of the air' (technically known as 'the relative humidity,' the humidity of the atmosphere. But the curve for 'relative humidity' is not, when inverted, the same as the curve for pneumonia, as you may see by comparing such curves, on the diagrams I published, based upon over twenty-seven thousand weekly reports of sickness in Michigan, by observers in different parts of the state, and upon over one hundred and twenty thousand observations of the psychrometer during the same time, namely, the seven years, 1878–84. Relative humidity seems to have an opposite relation in the warm months to what it has in the cold months. The fact, which I think I have completely demonstrated, is, that pneumonia is quantitatively proportional to the coldness and dryness of the atmosphere;

and, as this is true for every month of the year, it follows that, if there is any pneumonia which is infectious, it is absolutely dependent upon those meteorological conditions for its action upon the human organism.

In the paper to which I have referred, I have advanced a theory of the causation of pneumonia consistent with the facts demonstrated; and, briefly outlined, it is as follows: Air expired from the human lungs is nearly saturated with vapor of water at a temperature of about 98° F., and this contains about 18.69 grains of vapor in each cubic foot. The quantity of vapor exhaled is at all times greater than the quantity inhaled; but when the air is very cold and dry, the quantity exhaled is excessive, as may be seen when we reflect that air at 32° F. can contain in each cubic foot only about two grains of vapor. The fluid which passes out from the blood into the air-cells of the lungs, and which normally keeps them moist, contains some of the salts of the blood; and the chloride of sodium, not being volatile, is mostly left in the air-cells when the vapor passes out with the expired air. When the air inhaled is excessively dry (as it always is when excessively cold), this salt collects in the air-cells of the lungs in considerable proportion. This is proved by my statistics, which show the increase of pneumonia at such times, taken in connection with the fact that chloride of sodium in the lungs is in excess in pneumonia, which was proved in 1851 by Lionel S. Beale, M.D., of London, England. Dr. Beale also verified the observations by Redtenbacher, made in 1850, that during the onward progress of pneumonia the chlorides disappear from the urine, and reappear when convalescence has been established. In the air-cells, the chlorides are irritating when they become concentrated; but the exudation of fibrine, which is the most prominent condition in pneumonia, is probably favored by a fact in osmosis which is not generally well understood, —namely, that albumen, which it is usually considered will not pass by osmosis, will pass through an animal membrane to a solution of chloride of sodium.

Thus the causation of pneumonia by the inhalation of cold dry air seems to be completely worked out. As a cause of deaths, pneumonia is one of the most important diseases. It is hoped that its prevention may now begin.

HENRY B. BAKER.

Lansing, Mich., Aug. 17.

The sweating sickness.

In Hume's 'History of England,' volume ii., p. 384, appears the following passage: "There raged at that time, in London and other parts of the kingdom, a species of malady unknown to any other age or nation, the 'sweating sickness,' which occasioned the sudden death of great multitudes, though it seemed not to be propagated by any contagious infection, but arose from the general disposition of the air and of the human body. In less than twenty-four hours the patient commonly died, or recovered; but when the pestilence had exerted its fury for a few weeks, it was observed, either from alterations in the air or from a more proper regimen which had been discovered, to be considerably abated."

The time of this endemic must have been about the summer of 1485, just a short time previous to the coronation of Henry VII. The historian makes no further mention as regards the nature of this malady; in fact is distressingly concise in his account of so interesting a disorder.

Now, the object of my letter is apparent: I wish a little more definite information concerning this so-called 'sweating sickness.' But if perchance, in my ignorance, I am inquiring about a disease the name of which is synonymous with one at present in existence, then the modern name will be all-sufficient.

E. W. EVANS.

Easton, Penn., Aug. 16.

[The 'sweating sickness' to which our correspondent refers prevailed in England during portions of both the fifteenth and sixteenth centuries; appearing for the first time in 1485, again in 1506, for the third time in 1517, and twice subsequently, in 1528 and 1551. During this last visit, it appeared in London July 7, and during the twenty-three days that it remained caused nearly a thousand deaths. The disease was in the nature of a fever, followed by sweating; commencing with pains throughout the body, flushes of heat, oppression at the stomach, and delirium, after which, a profuse perspiration of an offensive odor. Relapses were apt to occur, sometimes as many as twelve in number. Some regarded the disease as a rheumatic fever, others as a form of ague, and others still as an influenza. The first appearance of the disease, in 1485, was traced to the army that fought at Bosworth; the second, of 1517, occurred when London was crowded with foreign artisans; and that of 1528 was coincident with the great military operations of Francis I. in Italy. At the time the sweating sickness prevailed in England, that country was ravaged by diseases and pestilences of almost every name. Spotted fever, brain fever, epidemic flux, scurvy, diphtheria, small-pox, measles, scarlet fever, and erysipelas, — all figured largely as mortality factors during these two centuries.

That England was not blotted out of existence by pestilential disease during this epoch is a marvel. Houses were constructed without any regard to ventilation; the floors were made of loam covered with rushes, which were not removed, but were covered with others from time to time, until the deposit of twenty years and more had accumulated, — containing bones, broken victuals, and all manner of filth, and saturated with the discharges of man and beast. The streets were in the same condition, the filth being thrown into them from the houses. Of this condition of things Erasmus wrote, "If, even twenty years ago, I had entered into a chamber which had been uninhabited for some months, I was immediately seized with a fever." Add to this the gluttony and intemperance of the English people of this time, and some faint idea may be obtained of the influences at work to undermine the constitutions of our ancestors and prepare them for epidemic disease whenever it should appear. If our correspondent desires to study this disease in detail, he will find a full account in the following works: 'Historia regni Henrici, septimi regis Angliae, vol. ix. of the works of Francis Bacon; 'The epidemics of the middle ages,' J. F. C. Hecker, M. D., published by the Sydenham society; 'A boke or counseill against the disease commonly called the sweat or sweating sicknesse, made by Jhon Caius, doctour in physicke, 1552' (appendix to Hecker's 'epidemics of the middle ages'). A very admirable résumé of this epidemic disease, and of others, will be found in 'Public health,' by Wm. A. Grey, M. B., published by Henry Renshaw, London. — ED.]