

VI. *An account of the heat of July, 1825 ; together with some remarks upon sensible cold.* By W. HEBERDEN, M. D. F. R. S.

Read January 12, 1826.

As I think it may not improbably be deemed an object of some curiosity to the Royal Society to collect from different parts, an account of the very unusual heat of last July, I presume to offer the enclosed report of observations which I made at that time, at Datchet, in Buckinghamshire, with every precaution that suggested itself to me, to ascertain the real temperature of the atmosphere, uninfluenced by adventitious circumstances. The observations were made with a small sensible thermometer, which had been carefully graduated.

On Friday July 15, the wind blowing from the south-west, the thermometer was suspended in the shade of a large laburnum on my lawn, at a height of about five feet and a half from the ground. This tree was chosen, as admitting the air in some degree to pass through it, at a time when the wind and the sun were both in the same quarter. On the subsequent days, the wind being in the east and north-east, the thermometer was hung, at about the same height, from an external branch of a very thick Portugal laurel, standing likewise upon the lawn, at a distance from any building ; where it was exposed to the full influence of the wind, and at the same time effectually sheltered either from the actual

rays of the sun, or from any object heated by it. I have been the more particular in giving this account, because it is often difficult, especially in great, or rapid changes of temperature, to get observations made with sufficient attention to avoid the neighbourhood of buildings, or other objects, which may considerably affect the thermometer, and give an appearance of heat sometimes greater, sometimes less than the truth.

In order to ascertain the greatest heat, the thermometer was repeatedly examined at short intervals during the hottest period of the day. The highest degrees indicated, under the circumstances I have detailed, were as follows :

July 15.	-	-	92°	wind S. W.
17.	-	-	90°	} wind E.
18.	-	-	96°	
19.	-	-	95°	

The 16th is not set down, because, though it was a hot day, yet being several degrees cooler than the day preceding, it was not thought worth while to examine the thermometer with the same attention.

There is some reason to believe that an unusual degree of heat was felt about the same time, not only in most parts of Europe, but also in America.

The only instance of heat, that I am aware of having been noticed in England equal to this, was in July 1808 ; on the 13th of which month the thermometer is stated, in the Meteorological Journal of the Royal Society, to have risen to $93\frac{1}{2}^{\circ}$. On the 12th it had stood at 90° , and on the 14th it was 91° ; the wind at the same time varying from east to

south and south-west. On the hottest of these days Mr. CAVENDISH's thermometer at Clapham rose to 96° .

It is true that other accounts have been recorded, some in the Transactions of this Society, of hot days, or hot seasons, which may have equalled, or possibly surpassed this: but till within the last sixty years, the use of the thermometer had hardly been understood sufficiently to enable one to rely upon the vague statements of earlier times.

To persons who may wish to compare this with the heat of tropical countries, it will not be thought superfluous to add, that the late Dr. HUNTER, whose accuracy is well-known to many members of the Royal Society, has stated in his valuable account of diseases in the West Indies, that the range of the thermometer at the hottest part of the day, and in the hottest season of the year, at Kingston, in Jamaica, is from 85° to 90° . In the coldest season it is about 5° lower.

It is not the least singular circumstance attending the heat of last July, that it should have subsided without rain, without lightning, without any change of wind, or any obvious cause; the succeeding days continuing dry and fair, as those before.

I am tempted to add to the above some other observations, which, if they are not immediately connected, are not entirely unconnected with this subject; for it cannot have escaped the attention of any person moderately conversant with natural philosophy, that the index of a thermometer is a very imperfect measure of what I may call the *sensible cold*, that is, of the degree of cold perceptible to the human body in its ordinary exposure to the atmosphere. For while the thermometer truly marks the temperature of the medium in

which it is placed, the sensations of the body depend altogether upon the rapidity with which its own heat is carried off. And this is by no means confined to the actual temperature of the air ; but whatever alteration of quality increases its power of conducting heat ; and, above all, whatever currents increase the succession of its particles in contact with the body, the same will increase the sensation of cold. Hence it is, that in very hot weather, the same stream of air which would heat a chamber, will nevertheless be cool to the feeling ; on the other hand, when the thermometer was more than 80° below the freezing point, Captain PARRY observed, that while the air was still, the cold was borne without inconvenience.

It therefore occurred to me, that the proper way to estimate the *sensible cold*, would be, first to raise a thermometer to a height something exceeding the natural heat of the human body, and then to observe at what rate the quicksilver contracted upon exposure to the air. For this purpose I used a thermometer with a very small bulb, which might show the alteration of heat in a short time. This I held to the fire till it rose to about 120° , and then carried it in a warm glove into the open air. I had with me an assistant with a watch in his hand ; and as soon as the mercury had descended to 100° , he began to count the seconds, while I continued to observe the thermometer, marking the degree of heat at the end of every ten seconds during half a minute. The result rather exceeded my own expectations ; and (being, as far as I know, the only experiments of the kind,) I have thought the Society might not dislike to be made acquainted with them.

The circumstances that particularly engaged my attention were wind, and moisture. With these views the following experiments were made, and verified by repeated trials.

Experiment 1.

1821, January 3. A strong east wind.
The temperature of the air 31° .

The thermometer in this, and all the experiments, being previously raised to 100° , in the manner before-mentioned, the descent of the mercury from that point was observed as follows :

After 10'' it was 78° . Decrement 22°
 20'' — 60° ————— 18°
 30'' — 52° ————— 8°

By the decrements, it is to be understood the descent in each successive ten seconds. This is added, because I consider it as the proper measure of the *sensible cold*, so long as the thermometer retains a heat approaching to that of the human body.

Experiment 2.

1821, Jan. 4. No perceptible wind.
The temperature of the air 30° , the atmosphere hazy.

After 10'' therm. 89° Decrement 11°
 20'' — 80° ————— 9°
 30'' — 71° ————— 9°

Experiment 3.

1821, Feb. 10. A strong east wind.
Temperature of air 47° . The atmosphere clear, with sunshine.

After 10'' therm. 82° Decrement 18°
 20'' — 73° ————— 9°
 30'' — 64° ————— 9°

Experiment 4.

1824, Jan. 9. A cold fog. No wind.
Temperature of the air 37° .

After 10'' therm. 92° Decrement 8°
 20'' — 85° ————— 7°
 30'' — 79° ————— 6°

The most superficial view of these experiments shows the prodigious effect of wind to increase the *rate of cooling*, which, I apprehend, constitutes *sensible cold*; so that in experiment 3, though the thermometer suspended in the open air was 17° higher than in experiment 2, yet the *sensible cold* was very considerably greater; but when there was no wind, even a wet fog did not much, if at all, increase it. This, which at first sight may appear contradictory to experience is not, I believe, really so; for though the power of such air to carry off the heat of the body be indeed increased, yet so long as we remain at rest, we are in great measure unaffected by it;

so much the effect of wind exceeds that of mere moisture. It is by walking, or riding, in such a state of the atmosphere, that we produce on our bodies a current of moist air, which is then felt in proportion to the rapidity with which we pass through it. If it were thought worth while to bring this to the test of the thermometer, the instrument should be made to pass through the air at the same rate as the person would move.