

LXIV. *An Account of artificial Cold produced at Petersburg: By Dr. Himfel. In a Letter to Dr. De Castro, F. R. S. Translated from the French by James Parsons, M. D. F. R. S.*

Read May 1.  
1760.

ON the 14th of December [1759] we had, at Peterburg, the most excessive cold weather that ever was known, even to 205 degrees of De Lisle's thermometer. At that time Professor Braun repeated Fahrenheit's experiments, in order to produce excessive cold by means of spirit of nitre combined with snow. He saw, with surprise, the quicksilver fall considerably in the thermometer, and descend even to 470 degrees at last: there the quicksilver remained fixed in the open air for the space of a quarter of an hour, and did not begin to rise till it was carried into a warm room. He repeated the same experiment, first with the same, and then with another thermometer, with the same success. The immobility of the quicksilver made him conjecture, that it might be frozen, or become a solid body. But as Mr. Braun had not broken the glasses, he could only at that time form a conjecture. On the 17th he produced, again, cold equal to that of the 14th; but on that day there was no experiment made; and Mr. Braun communicated his discovery at a meeting of the academy. On the 25th of December in the morning, between nine and ten, De Lisle's thermometer was at the 199th degree of cold; and Mr. Braun, as well as Professor Æpinus,

Æpinus, then repeated this experiment. As soon as the former had observed the quicksilver immovable in the thermometer, he broke the glass; and he found, to his amazement, the quicksilver frozen, but not entirely; for in the middle of the glass ball there was a small portion yet remaining fluid. Mr. Æpinus's thermometer fell, with extreme rapidity, almost to the 500th degree, and in breaking the glass from below, he found the quicksilver contained in it absolutely frozen. Both the gentlemen found, that the quicksilver, thus rendered solid, bore hammering and extension, like other metals; but being afterwards exposed to the open air, it recovered its former fluidity in a little time.

Mr. Æpinus went somewhat farther, in order to examine the quicksilver, when it was made solid. He poured quicksilver into a glass tube as thick as one's finger, closed at bottom, but open at top. The quicksilver in this cylinder, which was about one inch and half long, froze in three quarters of a minute; and he observed, that it became solid, perfectly resembling other metals, except iron: it continually contracted, and its surface, which was at first pretty high, soon sunk very low. This cylinder of frozen quicksilver sunk to the bottom of fluid quicksilver, in the same manner, as is observed of other metals, except iron. We know the contrary happens with regard to water frozen and other fluids, which extend as they become solid, and their ice swims in the fluid matter, of which they were produced.

On the 26th of December in the morning, between nine and ten, the cold became extremely sharp at 211 degrees, and such as exceeded the greatest

degree of artificial cold fixed by Fahrenheit; for 40 degrees below *zero*, in Fahrenheit's thermometer, is equal to 210 degrees of that of De Lisle.

Mr. Braun repeated this experiment again, exactly with the same success with that of the day before. The counsellor and professor Lomonoffow made the same experiment on the same day; and by means of aqua fortis the cold came to 495 degrees. He then poured in spirit of common or sea salt, and the quicksilver fell down in the thermometer to 554 degrees; and in taking the thermometer from the mixture, the quicksilver continued to fall in the open air to the 552d degree. He threw yet into the glass a little more snow, pouring on it some oil of vitriol, and suddenly the quicksilver fell to 1260 degrees. Then he broke the ball, and found the mercury changed to a solid body. The quicksilver, which yet remained in the tube, was also become solid, and appeared like a loose silver wire, attached to the ball, which was flexible every way. He gave the ball of quicksilver several blows with a turned ax, and it became flat like a half-ruble, or English half-crown; but receiving thereby some cracks, it dissolved in about 20 minutes. These experiments were made when the air was at about 208 degrees of cold.

Mr. Kraze, Mr. Zeicher, and the first apothecary Model, and again Mr. Æpinus, repeated the same experiment with the very same success. It is to be observed, that at the second experiment by professor Zeicher, on the 31st of December, as the air was then only at the 183d degree of cold, in taking the thermometer from the mixture, in which the quicksilver was at 300 degrees, it fell yet 100 degrees

grees more in the open air. The testimony of so many philosophers, each of whom had respectively made the experiment, will, no doubt, be sufficient to prove the truth of it. But in order to remove all doubt about it, it must be remarked, that distilled quicksilver only was made use of in every experiment; nay, in some, the quicksilver was revived from sublimation. There can therefore be no suspicion, that what they used was impure, or mixed with any heterogeneous matter. This appears to have happened to Mr. De Lisle de la Croyere, when he says, that in Siberia he found the quicksilver congealed in the barometer: and even his papers, which are in the academy, shew that he made a mistake in his remarks; for, according to them, the mercury became solid as soon as it fell to about 195 or 200 degrees: but the mercury, which is pure, does not congeal at that degree; for otherwise it would not be very extraordinary with us to see it take a solid form, because it is not rare to find the cold at this degree here. We may believe, that the quicksilver used by Mr. De la Croyere was impure, and therefore might sooner become an amalgama than pure mercury.

Now there are two things we cannot reason upon with any certainty: As to the hardness of the quicksilver congealed, it appeared to have had, in some essays, less hardness than lead, and in others more: also we cannot be very sure of the degree of cold, by which the mercury is consolidated. The greatest part of the experiments agree in this, that the quicksilver becomes solid, when it falls in the thermometer to 500 degrees, more or less. Nevertheless, they do not so sufficiently agree as to deduce any thing certain about it.

Although

Although in the experiment made by Mr. Lomonossov the quicksilver fell to 1260 degrees, this philosopher nevertheless says, that he could not sufficiently observe, in his hurry, whether the ball might not have received some crack, and the quicksilver thereby perhaps might have had liberty to fall the lower, which otherwise would not have happened; for the same thing happened to Mess. Braun, Zeicher, and Æpinus, that the balls of their thermometers were cracked and broken. By the experiment of Mr. Æpinus, made on the 25th of December, in which the quicksilver fell suddenly in the thermometer, and the cylinder of quicksilver of the thickness of one's finger becoming solid so quickly, it may be observed, that the degree of cold then produced ought to exceed 300 degrees. Nevertheless, whatever the degree be, we cannot determine how the common thermometer ceases to be of use as soon as the mercury begins to become solid.

Here follows an account of the manner, in which these experiments may be made, that other philosophers may be capable of repeating them. It is therefore to be observed, that it is necessary to use fuming spirit of nitre, or of such as is evaporated till the fumes become red; for the common aqua fortis, which is used, had not the desired effect. Mr. Æpinus has found, that this experiment is very easily and speedily made in the following manner. Take spirit of nitre, cooled as much as possible, and with it half fill a wine-glass, throwing in as much snow at the same time, and stirring it till it becomes of the consistence of pap: then you have almost in an instant the necessary degree for the congelation of the quicksilver.

quickfilver : not only Mr. Æpinus used this method, but also Mess. Krafe, Zeicher, and Model, who followed Mr. Æpinus, and found it the most convenient method. Now, in reflecting upon the procedure of other philosophers, especially of Mess. Mufchenbroek and Reaumur, for producing artificial cold, by the commixtion of snow with aquafortis, as the former has mentioned in his edition of the experiments of the academy of Florence, tom. i. p. 174. and Mr. Reaumur, in the memoirs of the academy of sciences of Paris for the year 1734. it is astonishing how it happens, that these learned men have not obtained, by a great deal, the degree of cold produced by the gentlemen of the academy of Petersburg; for their manner of making the experiments does not seem to differ much from that of Mr. Braun, as to what relates to any essential circumstances, nor from the manner mentioned before, so as to hinder them from producing effects nearly equal. Perhaps they may, in time, and by continued researches, be able to find out the circumstances, that prevented their success in the experiments of these great men: it may be, because the spirit of nitre was not endowed with its proper quality. In fine, I must further observe, that a certain degree of external cold appears absolutely necessary to the experiment. Mr. Æpinus, who made it the 28th of December, in a room where De Lisle's thermometer shewed 122 degrees of cold, cooled the spirit of nitre in liquifying snow to 150 degrees, and the snow, which they used, came to the same degree; in making the mixture, the result was an augmentation of cold to 300 degrees. It must then happen, that they had obtained the surprizing

degree necessary to congeal the mercury; which Mr. Zeicher also at length obtained; the degree of cold of the air being the 175th degree of De Lisle's thermometer, or the 30th of that of Fahrenheit.

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LXV. *An Account of a complete Luxation of the Thigh Bone, in an adult Person, by external Violence; by Mr. Charles White, Surgeon, at Manchester. Communicated by George Lloyd, Esq; F. R. S.*

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1760.

**A**S Robert Hogg, (a farmer in Clyfton, about four miles from Manchester) a strong, robust, middle-aged man, was taking a load of wheat from off a horse, on the 20th of March 1759, his foot slipping, he fell backwards; his breech upon the pavement, and the load of wheat upon his belly and thighs. The servants carried him into the house, and laid him upon a bed, where he remained in the most racking torture, when I came to him, which was about two hours after the accident happened. I found his right buttock as large again as the other; the knee and foot of the same side turned inwards; and the thigh much shortened. Upon endeavouring to make the thigh perform its rotatory motion, there was not the least crackling to be heard. This convinced me, that the head of the bone was thrown out of the acetabulum; and, upon examination, I could distinctly feel it under the glutæi muscles: to which situation of it, and not to any bruise,