two fixed points, but he was less critical and less rational than Rømer in choosing these points. He retained the freezing point, measured in melting ice, as one fixed point, but he obviously wished to avoid the use of a standard thermometer for fixing the second. He had termed water of 22½° Rømer (28·5° C.) "blutwarm", and in this way conceived the idea of using a slightly higher temperature for the second fixed point, namely, body temperature measured "when the thermometer is placed in the mouth or arm-pit of a healthy man and held there until it acquires the temperature of the body"[4]. This temperature (about 36° C. or 26½° Rømer) is not particularly constant, and Fahrenheit therefore felt the need of a further fixed point as a check. It appears indirectly from a letter sent from Copenhagen to the Royal Society in 1709[5] that it had been discovered that the zero on Ole Rømer's thermometer "very nearly approaches the Point of Artificial Freezing". Fahrenheit must also have been aware of this, and therefore used the temperature of a freezing mixture for checking his zero. He admits that this temperature (like body temperature) is not quite constant, but his experimental skill enabled him to use the two not very reliable fixed points to check one another, and hence to make thermometers which were satisfactorily concordant according to the standards of the times.

The figures for the fixed points on Fahrenheit's earliest thermometers were :

0° ; 7½° ; 22½° ; *as on Rømer's thermometers*, or 0° ; 30° (= 4 × 7½°) ; 90° (= 4 × 22½°) by dividing the degrees into four parts. Later he altered these figures to

0° ; 32° (= 4 × 8°) ; 96°, probably for convenience in calculation (as also suggested by Dr. Newton Friend).

Since the temperature 90° F. (corresponding to 26½° Rømer) is higher than Rømer's 4 × 22½°, Fahrenheit's degrees are larger than those of Rømer : hence if the graduation is continued in the same units, Fahrenheit's boiling point will be designated by a smaller number than Rømer's, namely, 212° instead of 240° (= 4 × 60°).

We thus see that Fahrenheit's scale is derived from that of Rømer. The honour of founding a great advance in temperature measurement is due to Rømer, but, like many of his other discoveries, it has passed unnoticed. Fahrenheit's skill in making thermometers enabled it to be put to general use, though in a somewhat incomplete form.

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[1] NATURE, **139**, 395 (1937).

[2] For a detailed review, see Kirstine Meyer, NATURE, **82**, 296 (1910).

[3] Quoted from "Daniel Gabriel Fahrenheit", by Ernst Cohen and W. A. T. Cohen-De Meester. *Verhandl. der koninklijke Akademie van Wettenschappen te Amsterdam.* Afdeeling Natuurkunde, Deel XVI, No. 2. Amsterdam, 1931. The authors have translated the letter from Dutch to German.

[4] *Phil. Trans.*, **33**, 73 (1724).

[5] *Phil. Trans.*, No. 324 (1709) ; cf. NATURE, **82**, 297 (1910).

IN historical matters there is always room for divergence of opinion when the principals concerned, long since passed away, have left behind insufficient details to enable us to reconstruct the entire picture.

I am sorry that Dr. Kirstine Meyer does not accept my suggestion that Rømer's zero was obtained with a mixture of ice and salt (or sal ammoniac). We are all agreed that Rømer chose the boiling point of water as his upper fundamental fixed point and named it 60°. Dr. Meyer would have us believe that, as his lower fundamental fixed point, Rømer chose the temperature of melting ice, called it 7½° and evaluated his zero "by marking off 7½ parts of the same size below the freezing point".

I cannot believe that the great astronomer could be so inartistic as to choose arbitrarily the curious figure of 7½ for his lower fundamental fixed point. This number, however, ceases to be curious if the scale had already been fixed with reference to a zero whereby the temperature of melting ice became an *incident* on the scale and not its *origin*.

Are we to believe, with Dr. Meyer, that it is a pure coincidence that Rømer's zero corresponds to the eutectic temperature of ice and salt—a mixture that was already well known in Boyle's time ? I think the paper in the *Phil. Trans.*, to which Dr. Meyer refers, will bear quite a different interpretation from that suggested by her.

Further, are we to assume that Fahrenheit, who copied Rømer's scale—not surreptitiously, for he openly acknowledged it—and Rømer's methods in their entirety, did not also copy the method of obtaining his zero from Rømer ?

Piecing all these points together, it appears to me that the balance of evidence distinctly favours the view expressed in my article, and I am extremely sorry to have to join issue with so great and well known an authority on Danish thermometry as Dr. Kirstine Meyer.

Having once devised his scale, there was nothing to prevent Rømer from preparing standard thermometers as described in "Adversaria", using as *control* points 60° and 7½° respectively. This is what one would expect, for the construction of a standard thermometer would naturally follow, rather than precede, the selection of the scale. Once the scale had been selected, any suitable control points could be used, as at the present time, in the graduation of standard instruments. Dr. Meyer has clearly confused this latter operation, as described in "Adversaria", with the invention of the scale itself, which is not described either in "Adversaria" or anywhere else so far as we know. Hence my suggestion as to its probable origin, and my statement which Dr. Meyer finds "difficult to understand".

I am sorry that Dr. Meyer is so critical of Fahrenheit's part, for Denmark owes much to Fahrenheit ; without him Rømer's scale would undoubtedly have sunk into oblivion like that of Newton. Newton's scale was a much more convenient one and antedated Rømer's by at least a year ; but Newton had no Fahrenheit to commercialize his thermometers and thus bring his scale into common use.

Personally, I wish Rømer's scale had also remained a historical curiosity and that the centigrade scale alone had survived. It would have saved much inconvenience to many of us.

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