it to a powder. It is the hard particles which the ruminating animals object to eating, since they cause diarrhea on account of their indigestibility. This difficulty may be obviated by care in breaking up the oil-cake a week in advance in such a way that it can be softened by absorbing moisture from the atmosphere without molding. One may avoid molding by placing the cake in a well-ventilated granary.

CONCERNING THE METHOD OF DETERMINING THE MELTING POINT OF BUTTER.[1]

BY ADOLF MAYER.

TRANSLATED BY W. H. KRUG.

IN my work on the relation between the constitution of butter fat and the feeding of the milch cows I have been considerably engaged with the determination of melting points, and found it important to make some experiments for the special purpose of determining the best method of carrying out these determinations. This work brought me to the following results, of which each will be accompanied by the experimental figures relating thereto.

1. Narrow tubes give lower melting and higher congealing points than wide tubes, and in this manner temperatures which are nearer together and thus assume an apparently greater accuracy as far as they are related to each other.

Experiments were carried on (1) with a certain butter fat, (2) with a fat of known uniform composition (caprylic acid), (3) with a known mixture of two fats (two parts oleic acid and one part palmitic acid).

The results were:

(1) WITH BUTTER.

	In tube of 16mm. internal diam.	In tube of 7mm. internal diam.
Melting point	40.4°	39.9°
After rapid cooling to low temperature	38.9°	38.5°
After slowly warming	36.8°	36.4°

Therefore in every case ceteris paribus about 1-2°C. lower in the narrow tubes.

[1]Read before the World's Congress of Chemists, Aug. 21, 1893.

(2) WITH CAPRYLIC ACID.

	In tube of 16mm. internal diam.	In tube of 7mm. internal diam.
Melting point	30.3°	27.3°
After rapid cooling to low temperature	30.2°	26.8°
After slowly warming	29.8°	26.4°

The result thus being analogous and at the same time much more manifest with a uniformly constituted fat. The difference amounts easily to 3°C.

(3) MIXTURE OF OLEIC AND PALMITIC ACIDS.

	In tube of 16mm. internal diam.	In tube of 7mm. internal diam.
Melting point	38.4°	38.0°
After rapid cooling to low temperature	37.8°	37.3°
After slowly warming	37.0°	36.4°

The result being in every respect similar to butter, which, as we know, is a mixture of fats.

The explanation of the phenomenon observed is apparent. The melting point when determined in a narrow tube (not so narrow that capillary attraction can exert any material influence) is always found lower because these tubes are more easily penetrated by the temperature of the surrounding liquid which is measured with a thermometer. This action is most manifest with a fat of uniform constitution as here the amount which melts at the same time is very great, causing the immediate absorption of considerable latent heat and permitting the rapid attraction of heat from the surrounding liquid to exert considerable influence. In these experiments we must always keep the fact in mind that in melting point determinations that temperature is noted at which the last particles of fat disappear, so also in the determination of congealing points that temperature at which the first solid particles appear, as it is impossible to obtain as accurate a figure for the first softening or the last stage of solidification. The primary softening and final melting are, however, near together in a uniform fat, while in mixtures where complicated phenomena of solution and supersaturation are important factors this is never the case.

One experiment will suffice to illustrate the higher congealing points obtained in narrow tubes.

MIXTURE OF OLEIC AND PALMITIC ACIDS.

	In tube of 16mm. internal diam.	In tube of 7mm. internal diam.
Congealing point	32.3°	33.1°
After rapid cooling to low temperature	33.1°	33.4°

The influence is therefore approximately of the same extent as with melting points. This is naturally exactly explained as before.

2. Lower melting points are always obtained when the fat is warmed slowly than when it is warmed rapidly. The former are without doubt the more nearly correct, as the melting fat has more opportunity to adapt itself and its properties to the conditions opposed by the new temperature. As proof for this statement the figures recorded above may be applied, though they must be arranged somewhat differently. The influence in this case is especially slight for a uniform fat (only a part of a degree) and large for the artificial mixture and the butter fat (several degrees). By a slow warming I mean a rise of 1° in five minutes, while in the other experiments the temperature was raised 1° every two and one-third minutes.

An explanation of this action can be found in the fact that the melting of a chemical compound is a much simpler phenomenon than the melting of a mixture where in reality at the final temperature a still solid body dissolves in the liquefied portion. Solution takes place, however, only on the surface, and thus more slowly, while liquefaction is instantaneous throughout the whole mass. The former process would, therefore, be benefitted by a longer period of time—an assumption which is verified by the results.

3. To obtain good melting points one must be careful that the previous congelation was complete, for which in butter-like substances a cooling to about 10° below the actual congealing point is absolutely necessary. This is especially important in repeated determinations with the same sample when heating and cooling follow each other rapidly.

For the experimental proof of this statement the figures given above are, however, of no value, although I there speak of rapid and extended cooling. The differences there observed disappear when the heating is conducted slowly and carefully, at least when the melting points are determined as they were in these experiments. If they are determined, however, as I have permitted them to be in other experiments, by the sinking of a drop of water in the sufficiently softened fat, it is self-evident that then the half-soft condition caused by a preliminary melting is not without influence upon the result. This, however, is a circumstance which can not be easily avoided. I have, nevertheless, when making melting point determinations of butters by this method, obtained fairly concordant or at least parallel results with those obtained when I took the mean of the melting and congealing points determined in the manner described.

The experiments were made by Mr. F. J. von Pesch, Assistant at the Station.

ROYAL EXPERIMENT STATION,
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NEW BOOKS.

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To read Cavendish's papers is inspiring. He did so much with so little. Accuracy in experiment and insight into the causes of phenomena characterize all his work, notwithstanding the phlogiston fog in which he moved. This booklet contains two of his papers both taken from the Philosophical Transactions; the first, read Jan. 5, 1784, relates to his discovery of the composition of water; the second, read June 2, 1785, tells how he discovered the composition of nitric acid by uniting the oxygen and nitrogen of the air by the electric spark. To those who do not have access to the originals this series of reprints will be invaluable. E. H.