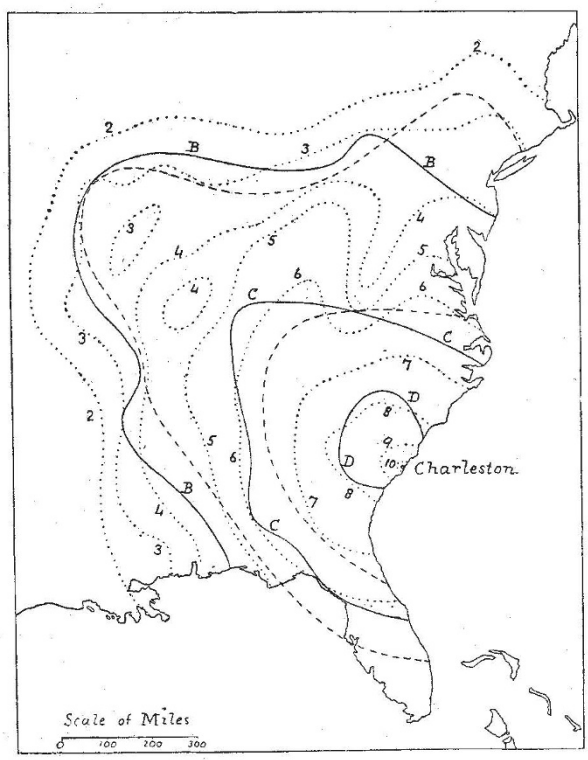
occurred at 9.51 p.m.], and all nearly crazed with fear and excitement. . . . A few steps away, under the gas-lamp, a woman lies prone and motionless on the pavement, with upturned face and outstretched limbs, and the crowd which has now gathered in the street passes her by, none pausing to see whether she is alive or dead . . . ; many voices are speaking at once, but few heed what is said." Between this, which must surely be almost the limit of wild fear in a crowd, and the merely interested curiosity of the most distant observers, there seems to be nearly every stage of mental effect recorded. Such terms as "greatest consternation," "fright and excitement unparalleled," and "terror amounting to wild frenzy," are, of course, too dependent on the narrator and too vague to be of any value as degrees in a scale of mental effects; but the resulting actions are less liable to error or exaggeration, and these may be roughly classified as follows, the different degrees being lettered to avoid confusion with the numbers of the soseismal lines:

(A) No persons leave their rooms.

(B) Some persons leave their houses.

(C) Most persons run into the streets, which are full of excited people.

(D) People rush wildly for open spaces, and remain all night out of doors.



In the third degree of the scale, I included at first the hasty dispersal of meetings; but, when the places at which this occurred are plotted on a map, it is evident that this effect would find an appropriate place under the second heading. A crowd in one room is more liable to excitement and fear than are persons in separate houses.

In the accompanying map, the dotted curves are the isoseismal lines as drawn by Captain Dutton. The continuous curves bound the areas in which the effects corresponding to the three higher degrees of the scale were observed. The curve for the first degree of course coincides with the outermost isoseismal line.

It will be seen that there is a certain rough agreement between these curves and the isoseismal lines. The curve D and the isoseismal 8 are not far apart; in other words, if the shock was strong enough to throw down chimneys or make cracks in the walls of buildings, then people thought it wiser to camp out for the night. The curve C and the isoseismal 6 coincide approximately; that is, people rushed precipitately into the streets if the movement made chandeliers, pictures, &c., swing. On the whole, the curve B roughly follows the isoseismal 3; so that, if the shock was not even strong enough to cause doors and windows to rattle, some persons were so alarmed that they left their houses, and public meetings were dispersed. Whether these effects were due to the rarity of the phenomenon or to the highly-strung nerves of the American people, it may, I think, be inferred that in no other civilised country would such alarm be shown at a sudden and unexpected occurrence.

Captain Dutton also gives many records of a feeling of nausea at the time of the earthquake; and, however excitable the observers may have been, these accounts are probably trustworthy, for this is not at all generally known to be a result of earthquake-motion. I have marked these places on a map, and it is curious that, with one or two exceptions, they all lie between the two broken lines of the figure. The most distant places at which the feeling was noticed are Blue Mountain Creek (New York), 823 miles, and Dubuque (Iowa), 886 miles, from Charleston. The outer boundary of the nausea area follows roughly the curve B, but is generally inside it; the inner boundary is so close to the curve C as to suggest that there may be some connection between them, that, in the wild hurry to reach the street, the slight feeling of nausea might escape notice.

CHARLES DAVISON.

THE CAMBRIDGE SENTINEL MILK STERILISER.

THIS is a simple and automatic milk steriliser for domestic use. It is made in three forms; in one, which is intended for use on an ordinary fire, a tube which carries an alarm bell at the top is inserted through the lid of the saucepan. When the desired temperature (85° C.) is reached, a trigger contained in the tube is automatically released, and the bell rings, thus warning the attendant to take the pan off the fire. In a second form the action is automatic. A saucepan containing the sensitive trigger is placed on a gas stove, and when the proper temperature is reached the release of the trigger causes the supply of gas to be automatically cut off. A third form is arranged for use with a spirit lamp. In each case, the automatic mechanism is actuated through the melting of an easily fusible alloy.

For the apparatus it is claimed (1) that it is simple and works automatically, (2) that the temperature (85° C.) attained does not impair the flavour or the nutritive qualities of the milk, (3) that injurious micro-organisms, including tubercle, are destroyed. Dealing with these claims in order, the apparatus certainly acts automatically and seems to be of simple construction. With regard to the first or bell form, however, the sound of the bell is so slightly audible that it would certainly be missed unless the attendant were listening for it, and in all probability in nine cases out of ten the milk would be boiled. The second form, with gas stove and automatic cut-off, works quite well and is much to be preferred. With regard to the temperature at which the signal is given or the cut-off takes place there is some difference, according to the amount of fluid which is being treated. Dealing with the two-pint size we have observed the following temperatures:

		Bell Form.		Cut-off Form.
Water	Half pint	94° and 95° C.	.....	95° and 93° C.
	One pint	87·5° ,, 89°	.....	86° ,, 87°
	Two pints	87° ,, 86°	.....	84° ,, 85°
Milk	Half pint	98° (frothing)	.....	95°
	Two pints	87°	.....	84°

It will thus be seen that there is a considerable variation in the temperatures.

As to the second point, we consider that the temperature of 85° C. is too high, and we believe that the experiments of Duclaux and others have conclusively shown that milk cannot be heated above 70° C. without altering its flavour and nutritive qualities. Tested practically, milk heated in the apparatus and immediately cooled has a pronounced flavour, little less marked than milk which has been just boiled and then cooled. Three samples—(1) untreated, (2) sterilised in the apparatus and immediately cooled, (3) boiled and cooled—were submitted to three individuals, who separately tasted them; two of the individuals were unable to distinguish between the sterilised and boiled samples; the third said "that the sterilised sample seemed a little less boiled than the other." The flavour being so markedly altered, we doubt whether the claim that the nutritive qualities of the milk are unchanged can be substantiated.

The temperature 85° C. was probably chosen because it may be relied upon with certainty to kill pathogenic organisms, especially the tubercle bacillus. We believe, however, that a temperature of 65° C., acting for twenty minutes, is sufficient to kill the tubercle bacillus, and that, therefore, pasteurised milk, *i.e.*, milk heated to 68° C. for twenty minutes, is quite safe, and certainly its flavour is almost unaltered. We are aware, of course, that some observers claim that tuberculous milk may retain its infective properties after pasteurisation, but the work of Theobald Smith seems to explain the contradictory results which have been obtained. He found that tubercle bacilli suspended in water, saline solution, bouillon or milk were destroyed at 60° C. in 15—20 minntes. If, however, a pellicle forms on the milk, then the tubercle bacilli in the pellicle seem to be protected, and may survive an hour's heating at 60° C. (*Journ. Exper. Med.*, iv, 2, p. 217).

NEW SYNTHESES OF SOME DIUREIDES.

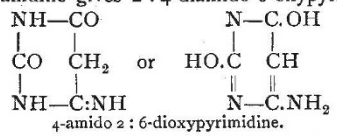
W. TRAUBE publishes in the present number of the *Berichte* further details on the new syntheses of uric acid, xanthine and the methyl derivatives of the latter—theobromine, theophylline and caffeine. The starting point is either cyanacetic acid or its ester. Cyanacetic acid and urea in presence of phosphorus oxychloride form cyanacetyl urea,

$$NH_2.CO.NH.CO.CH_2CN.$$

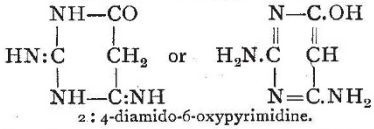
Also cyanacetic ester and guanidine combine with the separation of alcohol, forming cyanacetyl guanidine,

$$NH_2C(:NH).NH.CO.CH_2.CN.$$

The further treatment of these two compounds is similar. With alkalis they are converted into cyclic (pyrimidine) compounds. Cyanacetyl urea forms 4-amido-2 : 6-dioxypyrimidine, whilst cyanacetyl guanidine gives 2 : 4-diamido-6-oxypyrimidine

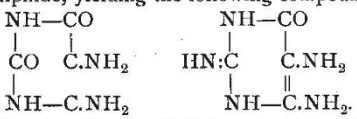


4-amido 2 : 6-dioxypyrimidine.

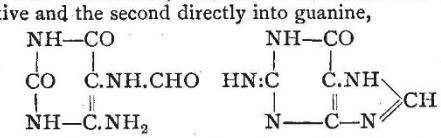


2 : 4-diamido-6-oxypyrimidine.

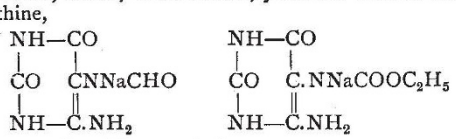
They are then treated with nitrous acid, which replaces the hydrogen of the methylene group by an "isonitroso" group, and this group is then reduced to the "amido" group by ammonium sulphide, yielding the following compounds :



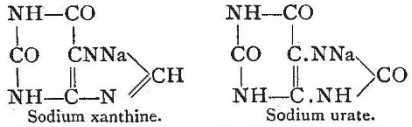
Boiled with formic acid, the first is converted into a formyl derivative and the second directly into guanine,



If chloroformic ester is used in place of formic acid, the first yields a urethane. Both formyl derivative and urethane form sodium salts, which, when heated, yield the sodium compound of xanthine,



and that of uric acid respectively,



Sodium xanthine. Sodium urate.

Guanine may be readily converted by Fischer and Strecker's method into xanthine, and by methylation into theobromine and caffeine, whereas by using methyl urea in the formation of cyanacetyl urea in the first method, or by methylating the formyl compound, theobromine, theophylline, caffeine and the corresponding uric acids may be produced. A patent has been taken out by the discoverer for these processes.

ARTIFICIAL RAIN.[1]

THE question perpetually arises in the popular mind as to whether man cannot produce rain or drought according as his needs may dictate. The possibility of doing this is never questioned by barbarians, who have their professional rain makers and great medicine men, and superstitiously attribute to them all power over nature. In some parts of the Christian world it has been believed that man could bring about rain or drought, not by his own power, but by intercession with the Creator, who would, perhaps, work a miracle on his behalf. During the past thousand years miracles have been confessedly rare, and some consider it almost impious for a man to dare to interfere with the operations of nature on a large scale; some even refuse to be doctored for disease.

The recognition of the truths revealed by modern science has made it evident that man can affect the weather only by understanding and making use of the laws of nature. He must do it in a natural or scientific way, not through any supernatural power or in any miraculous way. In fact, those who have a very imperfect knowledge of the laws of nature, if any at all, are often inclined to believe that there really must be some process known to science, or still to be discovered, by which man can bring abundant rain from the clouds when and where he needs it. They point to the popular belief that rain follows great battles, as proving that there is some way by which to affect the clouds—it may be through the noise of the battle, or it may be the burning of the gunpowder, or it may be a possible electric disturbance. They point to the reputed influence of lightning rods, which are supposed to draw the lightning from the skies and prevent the formation of hail.

In these and other matters there is abundant room for self-deception. It would be a great mistake to conclude that any battle by reason of its noise, or heat, or gunpowder has had any effect in the way of producing rain, or that the lightning rods have had any effect in producing or preventing hail. The statistics that are supposed to substantiate such conclusions do not really prove anything of the kind, and yet many are deceived by them because in reasoning upon the phenomena of nature they forget to apply the simplest laws of logic, and are carried away by emotions or preconceived opinions or the plausible suggestions of others. This is not at all singular, for the history of man's progress in knowledge is the history of a long series of mistakes covering thousands and tens of thousands of years. All have to learn by bitter experience, and if science seems to have made rapid progress during the past century, that should not blind our eyes to the fact that errors may still prevail among the professional men of science as well as the rest of mankind.

In the special matter of the artificial formation of rain we heartily endorse the statement that if it is in any way possible to bring this about we must labour to discover it; in fact, we eventually shall discover the way, if there be one, but thus far nothing has been accomplished to justify us in believing that feasible methods exist or are likely to exist. Various methods have had their advocates both in Europe and America, and the citizens of the United States, with a nervous energy that is greatly to be admired, have given a full and fair trial, at great expense, to several methods advocated by men of imperious natures that would brook no denial short of nature's own experimental demonstration of their errors. Thus the rain-making by explosives was most thoroughly tested by order of Congress at an expense to the public of many thousands of dollars, and the results have been discussed sufficiently, both in public and private, to show that nothing in the way of rain, and probably nothing in the way of cloud or mist, was produced. One of the first experimental trials was made quite near Washington, D. C., at night-time, November 2-3, 1892, when a series of clouds with showers were passing over the neighbouring country, and these continued right along for several hours

[1] Abridged from a contribution by Prof. Cleveland Abbe to the U.S. *Monthly Weather Review.*