Correspondence.

A Storm of Snow Balls.

To the Editor of the Scientific American:

On the morning of February 21, the snow here presented a novel and striking appearance. During the previous night about two inches of light snow had fallen while there was a fresh southwesterly breeze, which afterward changed to northwest, and the morning was beautifully clear.

The surface of the snow, where the land was not very uneven or much inclined, was strewn with snowballs, varying in size from about nine inches through down to very small ones. Some were nearly spherical in general form, but nearly all were merely rolls of snow, funnel-shaped at the ends. These rolls, at the circumference, measured about the same (or a little less) in length as in diameter. There were many over nine inches through and myriads of small ones. The surface of the snow was marked with shallow furrows as the snowballs were formed, showing the changing direction of the wind. The balls were of sufficient consistency to be handled carefully.

J. M. MERROW.

Merrow Station, Conn., Feb. 21, 1883.

The Chemistry of Cookery.

BY W. MATTIEU WILLIAMS.

The Boiling of Water.—As this is one of the most rudimentary of the operations of cookery, and the most frequently performed, it naturally takes a first place in treating the subject.

Water is boiled in the kitchen for two distinct purposes: first, for the cooking of itself; second, for the cooking of other things. A dissertation on the difference between raw water and cooked water may appear pedantic, but, as I shall presently show, it is considerable, very practical, and important.

The best way to study any physical subject is to examine it experimentally, but this is not always possible with everyday means. In this case, however, there is no difficulty.

Take a thin* glass vessel, such as a flask, or better, one of the "beakers," or thin tumbler-shaped vessels, so largely used in chemical laboratories; partially fill it with ordinary household water, and then place it over the flame of a spirit lamp, or Bunsen's or other smokeless gas burner. Carefully watch the result, and the following will be observed: First of all little bubbles will be formed, adhering to the sides of the glass, but ultimately rising to the surface, and there becoming dissipated by diffusion in the air.

This is not boiling, as may be proved by trying the temperature with the finger. What, then, is it?

It is the yielding back of the atmospheric gases which the water has dissolved or condensed within itself. These bubbles have been collected, and by analysis proved to consist of oxygen, nitrogen, and carbonic acid, obtained from the air; but in the water they exist by no means in the same proportions as originally in the air, nor in constant proportions in different samples of water. I need not here go into the quantitative details of these proportions, nor the reasons of their variation, though they are very interesting subjects.

Proceeding with our investigation, we shall find that the bubbles continue to form and rise until the water becomes too hot for the finger to bear immersion. At about this stage something else begins to occur. Much larger bubbles, or rather blisters, are now formed on the bottom of the vessel, immediately over the flame, and they continually collapse into apparent nothingness. Even at this stage a thermometer immersed in the water will show that the boiling point is not reached. As the temperature rises, these blisters rise higher and higher, become more and more nearly spherical, finally quite so, then detach themselves and rise toward the surface; but the first that make this venture perish in the attempt—they gradually collapse as they rise, and vanish before reaching the surface. The thermometer now shows that the boiling point is nearly reached, but not quite. Presently the bubbles rise completely to the surface and break there. Now the water is boiling, and the thermometer stands at 212° Fahr., or 100° Cent.

With the aid of suitable apparatus, it can be shown that the atmospheric gases above named continue to be given off along with the steam for a considerable time after the boiling has commenced; the complete removal of their last traces being a very difficult, if not an impossible, physical problem.

After a moderate period of boiling, however, we may practically regard the water as free from these gases. In this condition I venture to call it cooked water. Our experiment so far indicates one of the differences between cooked and raw water. The cooked water has been deprived of the atmospheric gases that the raw water contained. By cooling some of the cooked water and tasting it, the difference of flavor is very perceptible; by no means improved, though it is quite possible to acquire a preference for this flat, tasteless fluid.

If a fish be placed in such cooked water, it swims for a while with its mouth at the surface of the water, for just there is a film that is reacquiring its charge of oxygen, etc., by absorbing it from the air; but this film is so thin and so poorly charged, that after a short struggle the fish dies for lack of oxygen in its blood, drowned as truly and completely as a living, breathing animal when immersed in any kind of water.

Spring water and river water that have passed through or over considerable distances in calcareous districts suffer another change in boiling. The origin and nature of this change may be shown by another experiment as follows: Buy a pennyworth of lime water from a druggist and procure a small glass tube of about quill size, or the stem of a fresh tobacco pipe may be used. Half fill a small wine glass with the lime water, and blow through it by means of the tube or tobacco pipe. Presently it will become turbid. Continue the blowing, and the turbidity will increase up to a certain degree of milkiness; go on blowing with "commendable perseverance," and an inversion of effect will follow; the turbidity diminishes, and at last the water becomes clear again.

The chemistry of this is simple enough. From the lungs a mixture of nitrogen, oxygen, and carbonic acid is exhaled. The carbonic acid combines with the soluble lime and forms a carbonate of lime which is insoluble in mere water. But this carbonate of lime is to a certain extent soluble in water saturated with carbonic acid, and such saturation is effected by the continuation of blowing.

Now take some of the lime water that has been thus treated, place it in a clean glass flask, and boil it. After a short time the flask will be found incrusted with a thin film of something. This is the carbonate of lime, which has been thrown down again by the action of boiling in drawing off its solvent, the carbonic acid. This crust will effervesce if a little acid is added to it.

In this manner our tea-kettles, engine boilers, etc., become incrusted when fed with calcareous waters, and most waters are calcareous; those supplied to London, which is surrounded by chalk, are largely so. Thus the boiling or cooking of such water effects a removal of its mineral impurities more or less completely. Other waters contain such mineral matter as salts of sodium and potassium. These are not removable by mere boiling.

Usually we have no very strong motive for removing either these or the dissolved carbonate of lime, or the atmospheric gases from water, but there is another class of impurities of serious importance. These are the organic matters dissolved in all water that has run over land covered with vegetable growth, or, more especially, which has received contributions from sewers or any other form of house drainage. Such water supplies nutriment to those microscopic abominations, the *micrococci, bacilli, bacteria,* etc., which are now shown to be connected with blood poisoning—possibly do the whole of the poisoning business. These little pests are harmless and probably nutritious when cooked, but in their raw and wriggling state are horribly prolific in the blood of people who are in certain states of what is called "receptivity." They (the bacteria, etc.) appear to be poisoned or somehow killed off by the digestive secretions of the blood of some people and nourished luxuriantly in the blood of others. As nobody can be quite sure to which class he belongs, or may presently belong, or whether the water supplied to his household is free from blood poisoning organisms, cooked water is a safer beverage than raw water.

The requirement for this simple operation of cooking increases with the density of our population, which on reaching a certain degree renders the pollution of all water obtained from the ordinary sources almost inevitable.

Reflecting on this subject, I have been struck with a curious fact that has hitherto escaped notice, viz., that in the country which over all others combines a very large population with a very small allowance of cleanliness, the ordinary drink of the people is boiled water flavored by an infusion of leaves. These people—the Chinese—seem, in fact, to have been the inventors of boiled water beverages. Judging from travelers' accounts of the state of the rivers, rivulets, and general drainage and irrigation arrangements of China, its population could scarcely have reached its present density if Chinamen were drinkers of raw instead of cooked water.—*Knowledge.*

* In applying heat to glass vessels, thickness is a source of weakness or liability to fracture, on account of the unequal expansion of the two sides, due to inequality of temperature, which, of course, increases with the thickness of the glass. Besides this, the thickness increases the leverage of the breaking strain.

Eclipses of the Sun.

Recently Professor Langley lectured in the Lowell Institute course, Boston, upon the corona as seen in total eclipses of the sun. He remarked that the very brightness of the sun prevents us from seeing many things that are going on near to its surface. All lesser lights, which, if seen, would fascinate us with their strange beauty, are extinguished in its presence. Day after day the sun shrouds from us the stars, and but for its withdrawal below our horizon we should not know of their existence. The illuminations of the moon and that of the aurora borealis and the zodiacal light in like manner are dissipated by the sunlight. The light of that outer rim of the sun, which is called the chromosphere, is in the same way usually hidden from us. Nor can any device of man so screen and subdue the light of the sun that that of the chromosphere will become visible. Only in the presence of a total eclipse are these phenomena, which are more wonderful and beautiful than any other of the celestial spaces, to be seen. The duration of visibility then is but two or three minutes. While total eclipses of the sun are not infrequent, but few persons, comparatively, have seen one. The explanation is that the space over or along which a total eclipse is visible is not of more than eighty or one hundred miles width. That which was visible in this country in 1878, passed diagonally across the territory of North America. The shadow entered in Alaska and passed through Texas and across the Gulf of Mexico in two or three hours' time, being visible, at totality, not more than three or four minutes at any point.

The passage over the earth of the swiftest moving objects with which we are familiar, the most rapid express trains, is at a rate of about sixty miles an hour. This shadow moves along at thirty miles in a minute. The form which this shadow assumes in space is that of an extremely elongated cone, the base of which corresponds to the diameter of the moon, and the length to the distance between the earth and the moon. Our conception of it must be somewhat different from that which is ordinarily suggested by the word "cone." It is to be imagined rather as having the relative proportions of the finest cambric needle, the point of which barely touches the earth. The vision of this dark shadow, as it approaches from the distant horizon, is the most imposing phenomenon in nature. More terror would doubtless be inspired by an earthquake, but the sense of awe would be greater in an eclipse. The impression thus produced is felt by all men, and is shared by the more intelligent of the lower animals. A scientist once tried a curious experiment on a dog in this way: Among other preparations for the eclipse, he confined the dog several days beforehand, giving him nothing to eat. Just as the shadow began to come on, he threw down before the dog an appetizing bone, but the animal would not touch it for the space of five minutes or more, or until the darkness had wholly ceased and the sun shone brightly again. When the American observers had made their preparations in Shelbyville, Ky., for the eclipse of 1869, negroes living in the vicinity gathered around to witness the show which they had learned was to come off, but the nature of which they did not understand. Surmising it might be something like a circus, they, by a false analogy, thought it would be well to take positions in the branches of some of the neighboring trees. When the appalling shadow came down upon the scene, their fright was excessive, and its effect was described as being audibly like that of the continuous falling of ripe fruit from the trees. They scampered for the safe inclosure of their several homes.

In every company of men, whatever may have been the foregoing hilarity, silence and a feeling akin to terror overcome the gazers as the dark shadow comes down like a material thing moving with swiftness inconceivable over hill and valley from the horizon. A strange light precedes it, which is partly of a greenish tint but wholly unlike any other. The lecturer described the moments of suspense during which men of science await their opportunity as the shadow approaches, which they know will continue but two or three minutes and for which they have spent days and perhaps months of preparation, and which, in most cases, they have traveled hundreds or thousands of miles to witness and record. The feeling must be similar, he said, to that experienced by one who for the first time goes into battle or enters upon any undertaking of great peril. There is an extraordinary tension of the mental faculties, which makes cool observation almost impossible, and it proves that ten or twelve observers viewing the phenomenon from the same point will have as many different descriptions to give of it. Their penciled sketches of what they saw do not agree. The photographic lens, which has no nerves, does better, but it, for reasons which the lecturer explained, fails adequately to represent the wonderful sight. The Boston *Advertiser* says: The illuminated screen was freely employed for more definite explanation by the lecturer, who, with his photographic assistant, Mr. Black, had contrived a representation of the bursting forth of the light of the corona from behind the dark face of the moon, which was very realistic and which evoked generous applause.

The New Salt Field of New York.

A press dispatch from Warsaw, N. Y., dated February 13, states that the representative of a syndicate of English capitalists had selected that new salt field as a site for large works for the manufacture of caustic soda, to be used in soap making, bleaching, dyeing, and other purposes. For this commodity this country now relies solely upon Europe, one company in New York selling $4,000,000 worth the past year. Investigation of the brine underlying Warsaw proved it to be of the exact strength and the salt of the desired purity for manufacturing this article.

Land has been purchased at Warsaw, and the expectation is that the English company will soon begin the erection of extensive soda works, to give employment to perhaps 1,000 men, and to have a capacity to decompose 100,000 tons of salt a week.

Experienced salt manufacturers assert that the Warsaw district is certain to become the future salt field of the United States. A general salt fever seems to pervade western New York. In all towns of any size stock companies are being formed to investigate. Pifford, on the Rochester, New York, and Philadelphia; Castile, on the Erie; and Pike, on the Rochester and Pittsburg, will sink wells. In Wyoming and Greggsville salt has already been found. Leroy has two wells which produce brine of varying strength. Warsaw seems to have all the natural advantages desirable, and experienced men locate their wells here after very short examination. Prospectors, contractors, derrick builders, speculators, and capitalists are coming to town daily from all over the United States.