The Nutriment in Edible Fungi.

It is a favorite theory with some that the nutritive value of many of the fungi that are used as food is almost equal to the nutritive value of meat. A recent statement by the eminent chemist of Germany, Mr. C. T. Morner, is to the effect that the total nitrogen in this class of fungi varies between 2 and 3.64 per cent in the dry material; that 41 per cent of the total nitrogen is useful in alimentation; that all the rest belongs to non-assimilable bodies; and that, notwithstanding the relatively high figures, fungi constitute a very mediocre food, since the figures relate to dry material, and fungi contain enormous quantities of water. Mr. Morner, in this connection, gives a number of tables which show the amount of the several fungi that would be required to equal a pound of beef: mushrooms, 9 pounds; *Lactarius deliciosus*, 24 pounds; chanterelle, 41 pounds; morel, 15 pounds; *Polyporus ovinus*, 67 pounds.

Some recent experiments at the agricultural experiment station of the State of New York do not appear to sustain the statements of Professor Morner. A quantity of mushrooms (*Agaricus campestris*) growing in a pasture was gathered and subjected to an analysis, and the digestibility of the albuminoids determined by the pepsin method. The results were as follows:—

	Fresh Substance.	Water Free
Water	89.15	....
Ash	.85	7.80
Albuminoids	6.08	56.00
Crude fibre	.76	7.05
Nitrogen-free extract	2.27	21.83
Fat (ether extract)	.79	7.32
Total nitrogen		8.96
Albuminoids digested		84.50

The total nitrogen found in the dry substance was about 2.5 times as great as the highest figures given by the German chemist, while the digestibility placed it among the exceptionally rich nitrogenous foods. Experiments were also made with puff-balls. A very large one was found to have been broken into many fragments by careless handling. Many of the broken fragments were gathered together and taken for analysis. This specimen was in fine edible maturity. Another fresh one, a fine large specimen of *Lycoperdon giganteum*, was examined. The following measurements were taken in connection with the analysis: greatest diameter, 12.5 inches; height, 7.5 inches; horizontal circumference, 37.25 inches; vertical circumference, 33.5 inches; weight, 2,864 grams, or 6.35 pounds. The puff-ball was kept until the following morning before examination, when it was found to have lost 5.93 per cent by weight. A slice from the centre was taken for analysis. This contained 92.18 per cent of water. In the following table, No. 1 refers to the whole puff-ball, which was larger and more mature than No. 2, the broken one.

	No. 1.		No. 2.
	Fresh Substance.	Water Free.	Water Free.
Water	92.18	....	....
Ash	.58	7.47	6.97
Albuminoids	5.19	66.34	57.44
Crude fibre	.89	11.42	11.07
Nitrogen-free extract	1.05	13.33	22.05
Fat (ether extract)	.11	1.44	2.47
Total nitrogen		10.63	9.19
Per cent albuminoids digested		70.04	81.72

The total nitrogen for one of the puff-palls was about three times as great as the highest figures by Morner; and, even with the large percentage of water, it compares favorable in nutritive value with meat. It would seem, from the analyses which were made at the station, that Morner's specimens must have been very poor ones, or else the fungi in Germany are not so rich in albuminoids as those growing wild in the State of New York.

Frederic G. Mather.

Albany, N.Y., Feb. 14.

A Worm in a Hen's Egg.

On Sunday, Feb. 12, 1888, a lady in this city, on opening the egg of an ordinary hen, observed a worm lying coiled in the albumen or 'white' of the egg, near the lesser or pointed end. She placed the egg in a saucer, and the albumen flowed out through the opening in the shell, carrying the worm with it. After exhibiting to friends during the day, it was brought to me, Feb. 12. Upon examination, I find it to be an *Ascaris lumbricoides* about four inches in length; and, with the statement verified, the phenomenon becomes interesting in many ways.

G. C. Ashmun.

Cleveland, O., Feb. 14.

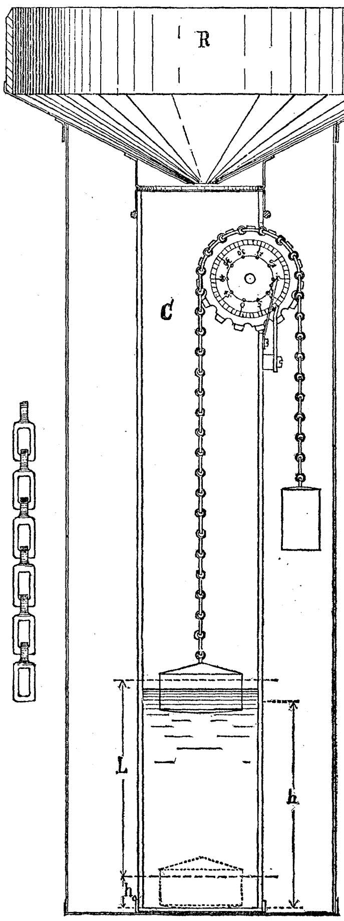
Self-Recording Rain-Gauge.

This recording mechanism is designed to be attached directly to the Signal Service standard gauge, now in such general use at all regular stations, and also at nearly all volunteer stations.

The figure is a sectional elevation of the gauge with the recording devices in position. The rain is received in the cylindrical part *R*, and is conducted by means of the funnel-shaped bottom into the inner tube or tall cylinder, which is made of drawn brass tubing, accurately sized, so that its sectional area is just one-tenth that of the receiver *R*, thus magnifying the rainfall tenfold. *R* is made eight inches in diameter, and the brass tube is twenty inches high, and holds two inches of rainfall, any in excess of this quantity overflowing into the outer cylinder, where it is retained and subsequently measured.

The recording mechanism needs little explanation. Definite, positive rotation of the dial-wheel in response to movements of the float is secured by use of the sprocket wheel and chain. A few links of the latter in enlarged view are shown on the left. The sprocket-wheel is graduated into divisions, each corresponding to a hundredth of an inch of rainfall. At intervals of every five divisions the wheel is set with small pins, which, when the wheel revolves, successively deflect a feeble spring, and momentarily close an electric circuit, thus recording successive five-hundredths of an inch of rainfall. The record is made in precisely the same manner as that in which the wind-velocity is now recorded at all signal service stations. Wires from the rain-gauge lead to a battery and an electro-magnet which operates an armature provided with a pen or pencil that traces a line on a sheet of paper wound on a cylinder slowly revolved by clock-work. When the electric circuit is closed, the pen is drawn aside, and makes a small notch in the line, each notch representing five-hundredths of an inch of rainfall.

Although the chain is quite light, weighing but a few grams per foot, yet its weight cannot be neglected, modifying, as it does, the conditions of equilibrium between the float and counterpoise. Thus, imagine the gauge to be empty, and the float resting on the bottom. It is evident that a certain quantity of water must be added before the float will begin to be lifted on the water. This condition is indicated in the figure by the dotted lines, and with the height of the water marked h_0. In order to properly include in the measurement this quantity of water, which must be added before the float just begins to be lifted, the graduated disk, which for this purpose is made adjustable on the sprocket-wheel, is set, not with its zero-line to the index-point, but with some other line, — a line corresponding in its value to the quantity of water required to just support the float when at the bottom of the gauge. Allowance is thus made once for all, and the graduated disk, with its pins, firmly and finally attached to the body of the wheel. Now, as more water is added, the float rises. But it is observed, that, as the chain passes over the wheel, its weight is not only added to that on the counterpoise side, but is also subtracted from that on the float side; so that the equilibrium is, on the one hand, disturbed by twice the weight of the chain passing over the wheel, and, on the other hand, is restored by the rise of the float itself in the water. It follows, therefore, that the float gradually rides higher and higher on the water as more and more chain passes over the wheel. All mechanical arrangements of fusee or other expedient to secure uniform flotation are entirely unnecessary, since the variable flotation in this case follows a well-defined linear law, and is perfectly compensated for by a proper choice of the diameter of the wheel taken in connection with the number of divisions into which it is graduated; that is, we do not make the divisions on the disk to correspond to the amount of chain passing over the wheel, but to the actual rise of water in the tube, regardless of what the former may have been. However, since we wish to record each five-hundredth of an inch of rainfall, the rise of water in the tube necessary to cause the wheel to make



just one revolution must be some multiple of five-tenths of an inch, as the pins in the graduated disk must be equally distant throughout, and five-tenths of an inch of water in the tube correspond to five-hundredths of an inch of rainfall.

Moreover, the outer circumference of the wheel must likewise be some multiple of the length of the links of the chain in order that the teeth may be equally distant. The dimensions of the wheel and other parts to fit any particular chain are therefore chosen under certain limitations, but are easily found as follows: —

Let D = the diameter of the tube C.
" d = " " " " float.
" w = weight of unit length of chain.
" w' = " " " volume of water.
" R = radius of the wheel on its pitch line.
" m = number of pins to be placed in the wheel.
" n = " " teeth in wheel.
" l = length of links of chain from centre to centre.
" h_0 = depth of water when float is just supported at bottom.
" h = any depth of water to be measured.
" L = length of chain passing over wheel while the float rises on this water.
" h' = amount the float rises out of the water in coming to this position.

In its upper position the float displaces less water than when just supported at the bottom, the difference being a volume,

$$\frac{\pi d^2}{4} h',$$

and the weight of this volume is equal to twice the weight of chain passing over the wheel in reaching its upper position, or

$$\frac{\pi d^2}{4} w'h' = 2wL, \text{ and } h' = \frac{8wL}{\pi d^2 w'}:$$

hence, while the float has risen a distance L, the surface of the water has risen a distance $L-h'$, and its height from the bottom of the tube is $L-h'+h_0$; but the gauge is so made that the true rainfall is measured not from the surface around the float, but from the surface the water would assume were the float entirely removed.

The volume of water occupying the annular space around the float is

$$\frac{\pi}{4}(D^2-d^2)(h_0-h').$$

When the float is removed, this volume may be considered as spreading itself out in a layer of thickness t, given by the expression

$$\frac{\pi D^2}{4} t = \frac{\pi}{4}(D^2-d^2)(h_0-h').$$

But the former thickness of the annular volume of water was h_0-h'; hence, on removing the float, the surface of the water will fall a distance $(h_0-h')-t$, which will be found to be

$$\frac{d^2}{D^2}(h_0-h').$$

The true amount of rainfall is therefore found, after reduction, to be

$$h = L\left\{1-\frac{8w}{\pi w'}\left[\frac{1}{d^2}-\frac{1}{D^2}\right]\right\}+\frac{D^2-d^2}{D^2}h_0.$$

The last term is the amount of rainfall in true measure that must collect before the float begins to be lifted, and is the number on the graduated disk that must come opposite the index-point when the float touches the bottom of the gauge.

To find the radius of the wheel, we will consider one complete revolution and the rise of water in the tube necessary to produce this amount of motion.

For this we must have

$$0.5m = 2\pi R\left\{1-\frac{8w}{\pi w'}\left[\frac{1}{d^2}-\frac{1}{D^2}\right]\right\},$$

but $2\pi R = nl$

$$\therefore\ m = 2nl\left\{1-\frac{8w}{\pi w'}\left[\frac{1}{d^2}-\frac{1}{D^2}\right]\right\},$$

$$\text{or } m = n\left[a-\frac{b}{d^2}\right],$$

for the quantities are all known but m, n, and d.

This equation may also be written

$$d^2 = \frac{nb}{an-m},$$

and from these the value of R is found as follows: a trial value of d is assumed of approximately its desired final value. With this in the first of the last two equations, a few values of m are computed, using such consecutive values of n (the number of teeth) as would correspond to a wheel of reasonable size. In all probability, none of these values of m will be whole numbers, but some one of them will doubtless be very nearly a whole number. Taking the integral part of this and the corresponding value of n, the final value of d is computed from the last equation. With the same value of n, the radius of the wheel is given by the expression

$$R = \frac{nl}{2\pi},$$

and all the elements of the gauge are completely determined.

C. F. MARVIN.

Washington, D.C., Feb. 13.