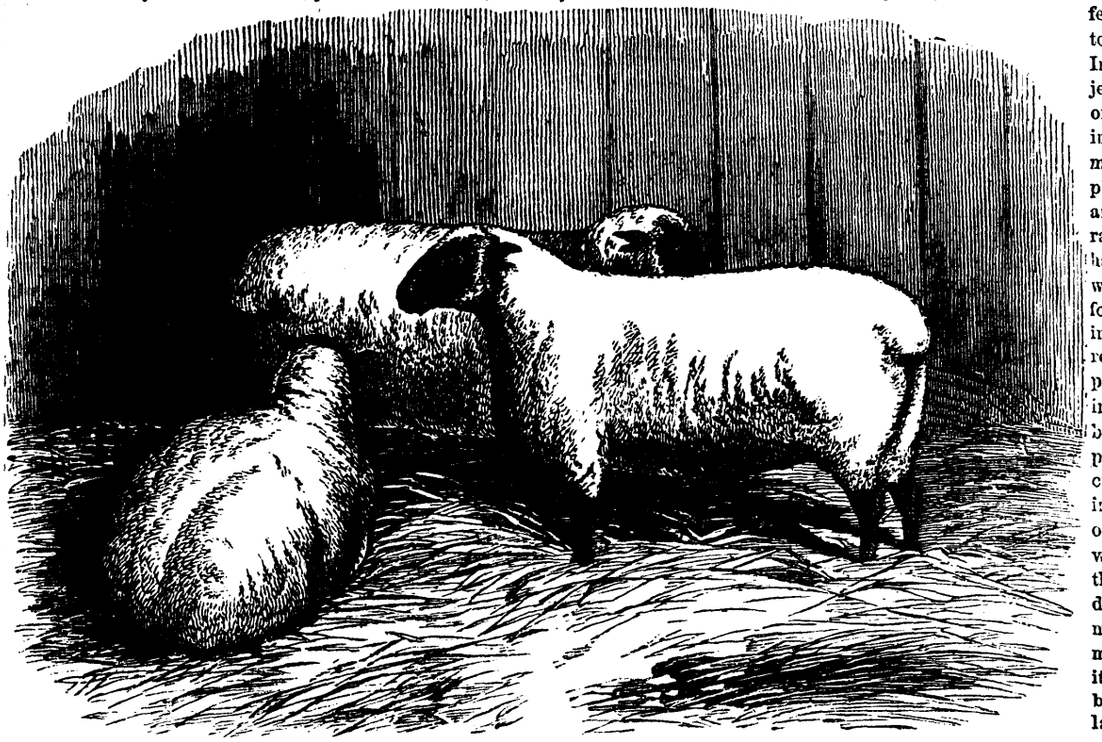
Stock Department.

Hampshire Down Wethers.

The accompanying illustration, taken from the *Farmers' Magazine*, represents a fine group of Hampshire Down wethers, the property of Mr. W. D. Canning, of Elston, Devizes, England. Some account of this valuable breed of sheep will be found in our last volume, page 37, with an excellent engraving of the animal that took the prize in this class at the Provincial Exhibition of the preceding year. In reference to the subject of our present illustration, the June number of the *Farmers' Magazine* says:—"These wethers were at all points one of the best pens of sheep exhibited at the last Smithfield Club Meeting. Mr. Canning's flock has indeed fairly earned the title of "*Improved;*" and his sort has been deservedly appreciated alike in the market and the show-ring. During the last few years the Elston sheep have taken ten of the Royal Agricultural Society's premiums, six of which were first, with ten from the Smithfield Club, in equal proportions of first and second. Mr. Canning was also a winner at the Salisbury Meeting of the Bath and West of England, the only occasion of his entering the ranks of that Society, while he has of course taken from time to time any number of local premiums.



This deservedly famous flock of Improved Hampshire Downs will be sold at Elston in August."

The Chemistry of Respiration

Having already considered the mechanism of breathing, we come now to examine the chemistry of the process. By this phrase is meant the changes in the air and blood that result from the contact of the two in the lungs. The air we breathe is composed of two principal elements, oxygen and nitrogen, in the proportion of one-fifth of the former to four-fifths of the latter. There is besides a very small portion of carbonic acid present in the atmosphere; but the ordinary proportion does not amount to more than four-parts of this gas in ten thousand parts of air. A varying quantity of watery vapour is also dissolved and mixed with the air. Such is the composition of air as it is inspired or drawn into the lungs; but the breath which an animal expels from its lungs is found deficent in the proportion of oxygen, and contains in its place a quantity of carbonic acid. The amount of this gas given off in each act of breathing is indeed very considerable. Taking the human lung as an example, it may be stated as a general average that, under ordinary circumstances, the quantity of carbonic acid exhaled into the air breathed by a healthy adult man amounts to 1345 cubic inches, or about 636 grains, in an hour. According to this estimate, the weight of *carbon* excreted from the lungs is about 173 grains per hour, or eight ounces in the course of twenty-four hours. The quantity of carbonic acid exhaled from the lungs of larger animals, such as the ox or horse, is considerably greater, and even in the case of smaller animals, as sheep, which are often collected together in large numbers, it will readily be understood that the air about them must soon become loaded with carbonic acid unless it is changed by a free ventilation.

The presence of carbonic acid in the expired air is easily shown by a simple experiment. If we breathe through a tube into lime water, that fluid very speedily becomes charged with carbonate of lime, and assumes a milky appearance. The cause of the change is that the carbonic acid from the lungs unites with the lime dissolved in the water, forming carbonate of lime, which being very sparingly soluble, becomes diffused through the liquid as a fine powder. This will gradually settle to the bottom if the water is allowed to stand. Besides the carbonic acid expelled from the lungs, a considerable amount of watery vapor is exhaled in breathing.

The foregoing are the chief effects produced on the air by respiration. We cannot here very minutely explain the changes which the blood undergoes, but will merely state the principal alterations to be observed in this fluid during the same process. The blood, as already explained in the previous article, when it returns to the heart after completing the circuit of the body, is altered in colour, being dark instead of bright red. This change of colour is due to the presence of carbonic acid distributed or dissolved in it. As the blood permeates the minute vessels of the lungs, every drop of it is exposed to the air, and here it parts with its carbonic acid, and absorbs instead the oxygen of the air. This restores the bright color of arterial blood, and the change renders the fluid again fit to circulate through the body. Nitrogen is also absorbed and given off, but of this it is not necessary for our present purpose to take any account. The fresh portion of oxygen imbibed is probably in part immediately combined with some of the constituents of the blood, but most of it is merely dissolved, and carried in the circulation to various parts of the body, where in the ultimate capillaries it unites with carbon thrown off from the tissues in the constant process of change going on, thus forming carbonic acid; for this gas, it is scarcely necessary to inform the reader, is a chemical compound, in definite proportions, of oxygen and carbon. The carbonic acid thus produced is carried in a state of solution by the blood to the right side of the heart, and thence into the lungs, to be exhaled, and replaced by a fresh portion of oxygen.

It is absolutely necessary that the venous blood charged with carbonic acid should undergo this change before it passes again through the body. Without this chemical alteration it is a fatal poison to the system, and nature indeed resists its circulation through the body. For if pure air is not admitted into the lungs, the dark blood will scarcely pass on its course; the lungs, therefore, are gorged with blood, the left side of the heart becomes empty, and the right side distended and overfilled; what little blood returns from the lungs into the left side is venous, and this being sent to the brain, augments the mischief, till both the acts of breathing and the beating of the heart very soon cease altogether. If air is completely excluded, as in drowning, a very few minutes serve to extinguish life. In the human subject the contraction of the heart ceases in less than five minutes after complete submersion, and persons are rarely saved if they have been under water more than four minutes. The instances in which recovery has taken place after a longer immersion are probably to be explained by the occurrence of fainting at the moment of the accident; for, with the circulation thus enfeebled, the deprivation of air may be endured much longer than it can while the blood still circulates quickly and accumulates carbonic acid.

It is obvious, then, that carbonic acid, mixed in any but the smallest proportion with the air we breathe, is highly poisonous. Its presence in even small quanties is deleterious, for it is only when the air is perfectly pure that the proper exchange of gases will take place. If carbonic acid already exist in the air, a much smaller amount is given off by the lungs, so that the mischief very rapidly assumes threatening and dangerous magnitude. We learn also, from the manner in which the ordinary gaseous elements of the air are absorbed by the blood, with what facility any impurities can by the same means be introduced into the vital fluid, and work out according to their nature, slowly or quickly, but most surely, their injurious and often fatal effects.

From these considerations the necessity of thorough and efficient ventilation becomes obvious. It is not necessary that the air should be vitiated to the point of suffocation to become a source of disease. The breathing of a single animal soon renders an apartment impure, and unless fresh oxygen—that is, fresh air—is supplied, and the carbonic acid and other impurities dissipated, the neccessary change in the blood cannot be duly effected, morbid matter is introduced into the system, and disease in some form, if not a speedy extinction of life, will assuredly follow. There is indeed no more certain method of infecting poison into the blood than by the air we breathe, which is none the less potent because impalpable and unseen.