



LII. New outlines of chemical philosophy

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LII. *New Outlines of Chemical Philosophy.* By EZ. WALKER,
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[Continued from p. 105.]

On Respiration.

Lynn, March 28, 1814.

SIRS,—IT has been ascertained by philosophers who have written on the respiration of animals, that no air passes through the membrane of the lungs into the blood, for the same quantity of air that enters the lungs is returned again into the atmosphere, but its properties are changed. Messrs. Allen and Pepys have proved by a series of experiments, that “when atmospheric air alone is respired, no other change takes place in it, than the substitution of a certain portion of carbonic acid gas for an equal volume of oxygen*.”

And Mr. Ellis observes, that “in man, as well as in the lower animals, the conversion of oxygen gas into carbonic acid constitutes the only essential change which the air of our atmosphere experiences in the lungs during its respiration†.”

The modes in which the atmosphere is depraved by the living functions of animals, is a chemical process which has never been clearly explained. But from the preceding theory of combustion‡, the changes induced on the air, and on the temperature of the blood, in respiration, will admit of an explanation which may not be deemed unsatisfactory.

Part of the thermogen which is contained in the air, taken into the lungs, passes through their thin membrane into the blood, in the same manner as the electric fluid passes through this or any other animal matter, and, meeting with photogen, generates animal heat, in a manner which will be more fully explained hereafter.

But the generation of carbonic acid gas in the lungs may be explained thus :

Let Q represent a quantity of oxygen gas contained in the lungs, and let it be divided into two parts, a = the greater part, and b = the less : then $a + b = Q$.

Let the thermogen in b be attracted into the blood by the photogen which it contains, and a will represent the oxygen gas remaining. Suppose a attract a quantity of carbon from the exhalant vessels of the lungs $= c = b$; then the whole quantity Q will become carbonic acid gas, when Q is divided according to the proportion of oxygen and carbon which a given quantity of that gas contains.

* Phil. Trans. 1809, p. 427.

† D. Ellis on Atmospheric Air.

‡ Phil. Mag. vol. xlii. p. 367 ; and vol. xliii. p. 22.

According

According to M. Lavoisier, carbonic acid gas consists of 28 parts of charcoal united with 72 parts of oxygen, and that carbonic acid gas is composed of these two bodies combined in that proportion.

Example. Suppose $Q = 100$.

Then $a + b = 100 =$ the given quantity of oxygen gas ; consequently $a + c = 100 =$ the quantity of carbonic acid gas expelled from the lungs in respiration.

$a = 72$ oxygen.

$c = 28$ charcoal.

$a + c = 100$ carbonic acid gas.

On Animal Heat.

I believe that it has never been explained, in a satisfactory manner, how animal heat is generated, although different hypotheses have been invented to account for this wonderful effect. It is, however, generally supposed that heat is generated in the lungs. Indeed, from the construction of the lungs, and the change which takes place in the air in respiration, there remains little reason to doubt of the truth of this supposition.

The internal surface of the lungs in man is estimated by Dr. Keil to be about ten times the external surface of the whole body, or about 150 square feet*. On this surface the blood is exposed in respiration ; and part of the thermogen contained in the air being attracted by the photogen in the blood, heat is generated by their union, in the same manner as in all other processes which cause an increase of temperature. The heat thus generated is carried through the whole animal system by means of the circulation of blood, to supply that heat which is constantly flying off from the surface of the body.

On the Renovation of the Atmosphere.

It has been ascertained in the most satisfactory manner, that the atmosphere is depraved by the living functions of animals and vegetables, by combustion, and by various other processes ; and yet it has been found by Dr. Priestley and other chemical philosophers, that the air in crowded cities contains as much oxygen gas as that of any other places. Dr. Priestley supposed that the purity of the air was preserved by the living functions of vegetables : but this hypothesis is highly objectionable ; for the air is as pure in winter when all Europe is covered with snow, as in summer when vegetation is in the utmost perfection.

It appears, however, an obvious truth, that if the oxygen gas which is withdrawn from our atmosphere, by entering into new

* Tentam. Med. Phys. p. 30.

combinations,

combinations, were not restored to it again, the air would soon become unfit for the supporting of animal and vegetable life. And if the thermogen which enters the animal system, by means of the lungs, were not conveyed out of the body as fast as it is received, this invisible element would be constantly accumulating till it put a total stop to all the animal functions.

As neither thermogen nor photogen can be annihilated, we may infer, that the thermogen which is taken into the blood, after having entered into new combinations and passed through the animal system, flies off from the surface of the skin in combination with photogen. When this compound comes into the atmosphere, the thermogen is converted into oxygen gas by uniting with the moisture contained in the air; and the photogen, by the same means, becomes hydrogen gas, and ascends to the upper regions of the atmosphere, from whence it descends to the earth in a manner which will be described in some future communication.

The following facts are sufficient to show in the most satisfactory manner, that a strong attraction obtains between thermogen and moisture.

The electric machine never acts so well in a moist atmosphere as in a dry one, because the moisture attracts the thermogen (positive electricity) from the apparatus, and prevents its accumulation. And we experience more cold in a damp atmosphere, the thermometer being at 40°, than when the air is dry, though the thermometer may be as low as 25°. The reason is evident: the moisture in the air attracts the thermogen from the animal system faster than it is supplied by the lungs.

To Messrs. Nicholson and Tilloch.

EZ. WALKER.

[To be continued.]

LIII. *Notes and Observations on the Tenth and Part of the Eleventh Chapters of Mr. ROBERT BAKEWELL'S "Introduction to Geology;"—embracing incidentally, several new Points of Geological Investigation and Theory. By Mr. JOHN FAREY, Sen., Mineral Surveyor.*

[Continued from p. 190.]

Notes, &c.

P. 231, l. 23, agitation of the waters*.—* A paper of Sir James Hall's, just printed in the Edin. Trans., treats very fully on this subject.

252, l. 25, artificial tarras*.—* The (late patent Cement of Parker, is made from the Clay-balls or Ludus Helmontii found in the London Clay, Rep. i. p. 111: a superior article