On Respiration
by
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It is necessary to the vitality of every organized being, that the nutritious fluids, which flow its various tissues, should be exposed to certain chemical changes, with the surrounding atmosphere. All organized beings therefore, whether animal or vegetable, are so formed, that either the whole surface or particular part of their bodies, may expose their juices, to those chemical changes, which chemical changes constitute the grand function of Respiration.
What is usually supposed to be the Respiration of plants, though Mr. Burnett and Professor Draper are of a different opinion, is a process which is only carried on under the stimulus of light. It consists in the plant seizing on the Carbon of the Carbonic acid of the Atmosphere, and liberating the Oxygen During the night, or if the plant be placed in a dark room, it not only ceases to decompose Carbonic acid, but even gives off some of that gas to the

surrounding medium, so that during the day the tendency of plants is to puri-fy the atmosphere, whereas during the night a deteriorating effect is produced. But the latter is far more than counter-balanced by the former. This process is carried on by the green parts of plants generally, but by the leaves in particular, and it would appear indeed, that these organs bear a considerable resemblance to the lungs of animals. It being thus it would seem, though this is denied by various authors, that the crude Sap is elaborated, and prepared for the per-formance of various important func-tions in the economy of the plant. Some of the lower orders of plants, the Fungi for instance, continually exhale carbonic acid, they deriving their sup-ply of that necessary material, from the soil in which they happen to be growing. But others of the Cryp-togamia evolve Oxygen like the higher classes of plants, and to this class belong the ferns, mosses &c &c

There are also parts of the higher class-es of plants which absorb oxygen, these are the parts which are not green as the roots, the flowers also absorb a considerable quantity of Oxygen as likewise do the seeds in germina-tion. As the necessity for Respira-tion can be shown to be in due proportion with the activity of the organised being, so the demand and consequently the provision for respiration, is much greater in animals than in plants. The demand for respiration also differs in various animals. For in the low vegitative sort of life of the Polyppi and other lower class-es of animals, the demand for respiration is very small indeed; whereas, in insects from their constant activity the demand is exceedingly great. But in warm-blooded animals, increased activity and consequently increased waste of their tissues, is not the

only demand for Respiration
The same besides to keep up a temperature, usually greater than that of the surrounding medium, which cannot be done without a liberal supply of oxygen. In glancing one's eye cursorily over the animal kingdom, and observing the numerous forms of respiratory apparatus, with which nature has supplied its various classes, one might be lead to suppose them perfectly irreconcilable. But upon a close minute examination, we at once perceive that they are merely different means of obtaining the same end, namely an extension of surface upon which vessels may ramify, in order that the blood may be exposed to the surrounding medium. And this leads us to the consideration of the provisions for Respiration, made by nature in all classes of the animal kingdom.

In all the lower classes of animals such as the Infusoria, polyps, Medusae &c the external surface of the animal, being constantly in contact with the surrounding medium, is all that is necessary, for the proper performance of the function of respiration in these simple animals. But when we come to the Rotifera, we begin to find indications of a respiratory system, in addition to the constant respiration going on by the surface. Bory St. Vincent thought that the cilia attached to many of the Rotifera, were in reality gills by which the animals breathed. But he also thought, that the contracting gizzard was a heart, in which case they would be higher in the scale of the animal creation than the Insects. Ehrenberg also, conceived that he had discovered an internal respiratory apparatus in Notommata Centrura. He saw seven points on one side, and six on the other of the animal, which points he observed were in a state of constant vibration, and communicated with two long undulating viscera. Upon further examination he declared these points before mentioned, to be peculiar little organs, to each of which was attached a tail like a note in music, which floated in the abdominal cavity by their enlarged part, while they were attached by their tail to the long tubular organ before referred to. Into the abdominal cavity the water is admitted according to Ehrenberg, by a projection on the neck of the animal, so as to expose these little organs freely to the action of the water. But, seeing that the animals are constantly surrounded by water, and that the water is admitted into their abdominal cavity, one would suppose that in an animal as simple as the one mentioned, no other respiratory apparatus would be necessary. So complicated a respiratory apparatus, would also seem to imply a more complicated circulatory system, than one is inclined to believe really exists in Rotomata Centrura.

In the Echinodermata, the highest of the Nematoneura of Owen, we have the provision for respiration differing greatly in different individuals. For instance in the Asteridae, the sea water is admitted into their internal cavity, through numbers of minute tubes, which open on the surface of the body. The water thus admitted freely bathes all the viscera, and exposes the vessels which ramify on them to a supply of Oxygen. In

the Echinus, the water is also admitted into the interior of the animals body, and its circula=tion over the surface of the viscera, and also the membrane lining the shell, is secured by the con=stant vibration of cilia.
In the Holothuria we find a new and beautiful respiratory apparatus. In the Holothuria like the Asterias and Echinus, the wa=ter is admitted into the body of the creature, but unlike these two animals it is not allowed to play indiscriminately over the intestines. On the contrary, from the membranous expansion of the intestine at the cloaca, proceed two tubes. These tubes divide and subdivide, till they form what have been called the "Respiratory trees," into these trees the water is forced by the muscular contractions, of the intestinal expansion.

at the cloaca before mentioned. One of the trees is attached to the walls of the animals ~~body~~ body by tendinous bands, whilst the other is attached in the same way to the intestine.

In the Sipunculus also, there are two sacculi, which open near the anal extremity of the animal, the use of which is not precisely known, but they have been supposed by some to be the respiratory organs

We now pass on to the Homogangliata of Owen, so called on account of the nervous centres being ranged in two parallel lines, on each side of the animal; unlike the Nematoneurœ, which have their nervous matter aggregated into threads, but have not any arrangement of nervous centres.

In the Annelidæ we have two types of respiratory appara tus. One the Abranchiate, in which the air or water is admitted into sacs; the other the Dorsibranchiate, in which the bloodvessels pass to tufts, in order that the blood may be oxygenated. A very good example in the same class of animals, of the two types of breathing apparatus. In the first the Abranchiate, we have the inversion of the membrane in order to gain space for the vessels to ramify, being the type of the lung. And in the second the Dorsibranchiate, we have the eversion of the membrane for the same purpose as before, being the type of the gill. Amongst the Abranchiate we have the Hirudo medicinalis or Leech and the Lumbrici or Earth Worms. In the first of these the Leech the sacculi amount to thirty-four, seventeen on each side.

opening by narrow ducts through which the water is freely admit-ted. Attached to each of these sacculi is a long glandular look-ing body, for a long time sup-posed to furnish an impor-tant secretion, but now be-lieved to be instrumental in propelling the blood over the sacculi. But besides all this a a great amount of the respira-tory function of the leech is car-ried on by the skin, for which purpose it is peculiarly fitted, not only on account of its thin-ness, but also on account of the ramification of the min-ute bloodvessels underneath it. In the Lumbrici or Earth-worms we have three modes by which respiration may be carried on. First on account of the extreme thinness of the skin, a considerable portion of the blood may be oxygenated by means of it. Second. It is a long time since Willis (1672) described certain pores along the back of the earthworm, and he also remarked that when these pores were blown into, the air passed readily between the muscular integument and the intestine. Dugès also tried the same experiments with the same results, but he saw further that these pores did not terminate in follicles, but that air injected into them would pass freely from one segment to another, by the membranous compartment which surround the intestine. Now such an arrangement as this permitting the air to pass freely down to the deep plexus of vessels must necessarily contribute greatly to the oxygenation of the blood. And Lastly there is attached to each segment, a pair of follicles like those described in the leech, and supposed by many to constitute the proper breathing apparatus; but their real function is as yet not exactly made out, some supposing them to be merely secreting follicles, to keep up the proper lubrication of the skin. Dorsibranchiata In the Amphinome capillata, the respiratory organs are two fringe like appendages placed along the back on either side, the external vascular tufts of which communicate with a set of vessels within called the branchial plexus. The blood is collected from all parts of the body by suitable vessels, and poured into this branchial plexus, from whence it is distributed to the tufts, to be exposed to the influence of oxygen

We have now arrived at one of the most peculiar and at the same time one of the most interesting divisions of the animal kingdom viz the Insecta. The breathing apparatus of the Insecta is constructed evidently with a view to the mode of progression of these beautiful lit the animals Instead of having an external apparatus or gills on the one hand, or an internal apparatus or lungs on the other, either of which would not only have added considerable weight to the animals body, but would have required such a complicated system of vessels, to carry blood to or from the lungs or gills as the case might have been, as would have made the animals body much to large and unweildy, In the many and varied movements, which these little animals are well known to perform. Instead, therefore, of having either lungs or gills, they have a series of minute tubes opening on the surface, and passing to all the internal parts of the body. The blood therefore in insects, instead of being brought to the oxygen, has the oxygen brought to it, and that too by a contrivance which instead of adding to the animal weight, materially decreases it. If then we take any large insect, and minutely examine its external skeleton, we find ten minute pores called spiracles on each side, on the soft membrane between the plates, at each segment of its body. They seem to be placed in this particular position, to enable them to be opened or closed at pleasure, which would not have taken place, had they been situated on the harder surface of the plates. There are two beautiful contrivances in these animals, to prevent the entrance of foreign matter. The one is that the edge of each spiracle is frequently surround=ed by thick horny lips, to which muscles may be attached so as to close them. The other is, and this especially noticed in those which creep on dusty ground, that the spiracles are seen covered with strong hairs, which cross each other so as to form a sieve of extreme fine=ness. If the spiracle is traced inwards, it is found to give a number of smaller tubes called tracheæ which pass to every part of the body, and dividing and subdividing till they at length attain ex-treme fineness, they ramify among the viscera, so that air is supplyed to all parts of the body. Upon further examination it is ascertain-ed, that these tubes differ in different parts of the body, being in some parts mere simple tubes of extreme delicacy, in other parts they dilate them-selves into little reservoirs, as it were, of air, in other parts a-gain we meet with them of a somewhat racemose ap-pearance, that is to say they have little vesicles hanging from them. The second form of tube, however, though met with in many, is not met with in all insects. But the most beautiful of all the contrivances, connected with these tubes yet remains to be noticed. When looking at these exquisitely fine tubes, we would naturally suppose

that when the air was with=
=drawn from them, that they
would at once collapse, so as
to obstruct the passage of the
air. The contrivance by which
this is prevented, is at once
beautiful and effective, the
object is attained by a spiral
thread being wound round
the trachea, between the two
thin membranes which form
its walls, and this may by
means of the microscope traced
down to the very finest of the
tracheæ. That this is the only
way that object could be ef=
=fected is manifest, for when we
come to think upon the other
method, namely, that of mak=
=ing the tubes stiff and un-
-yielding, it is clear that this
would never have answered
for tubes which were to pass
amongst viscera, which might
be dilating and contracting and

constantly in motion. And to conclude the insects, How does the air get into the tracheæ. If the belly of a living insect be watched carefully, it will be found performing certain expansions and contractions at regular intervals, vary=ing in different species from twenty to fifty or sixty times in a minute, but always more rapidly when the in=sect is in motion than when it is at rest. At each expan=sion, air is drawn into the ~~abdomen~~ tracheæ and rushes to every part of the body, and upon each contraction it is forcibly expelled. Burmeister has supposed this sufficient to explain, the humming noise made by some in=sects.

In the Pulmonary Arachni-
=dans, we still have the air
admitted into the body by
spiracles, not into tracheæ, but
into an arrangement of
respiratory apparatus peculiar
to that class of animals. This
apparatus is in fact a sort
of compound of the gills of
aquatic, and the lungs of
terrestrial animals. Each spi=
=racle leads into a sac called
a pulmo-branchia, which
has its lining membrane so
folded, and arranged in lam=
=inæ as to resemble gills.
These pulmo-branchiæ have
also been supposed to com=
=bine the action of lungs and
gills, which has been rendered
necessary by these animals
frequently inhabiting moist
situations
In the Crustacea we have a
variety of different methods

by which the blood is proper-
-ly äërated. In the very lowest
tribes, many of which are micros-
-copic, no particular organ seems
to be necessary for the accom-
-plishment of the object in
question, but in the higher
orders some very beautiful
contrivances are to be found.
In the Daphnia for instance,
the legs used for swimming
are converted into broad fringed
lamellæ, which answer the
purpose of gills, and insure
by their incessant motion the
constant changing of the water
In the Squilla the false feet
placed on the ventral surface
of the animal, become expand-
ed into broad vascular lamel-
læ, and answer the purpose of
gills. A change of water is ob-
tained, by the creatures swim-
-ming about, by means of a
broad tail which it posses for

that purpose. In the lobster the branchiæ are pyramidal tufts, having a central stem with small filaments arranged perpendicularly to it. In the centre of the stem is an artery an vein, each of which gives a receives branches to or from the before mentioned filaments. The only difference between the gills of the lobster and those of the crab is, that the filaments mentioned in the lobster, are replaced in the crab by thin lamellæ, placed one above another. These respiratory organs are placed in two large chambers, on each side of the body, and covered by the great cephalo-thoracic shield. These chambers are lined by a very delicate membrane reflected from the base of each tuft, and so becomes continuous with the membrane of each vascular filament a layer of which the gill is composed. In the crab and lobster, the water passes freely in at one side of the body and out at the other, so as to bathe the gills most effectually.

In the next grand division of the animal kingdom the Heterogangliata of Owen, the Mollusca of Cuvier, the Cirropoda deserve notice. In these animals the lateral appendages are usually supposed to be the proper respiratory apparatus, but there is no doubt that the cirrhi play a very important part in the proper performance of this function; and this idea is supported by the fact ~~that~~ that two large vascular trunks traverse the entire length of each cirrhus, one of which trunks is apparently venous and the other arterial. In the Brachiopoda the respiratory apparatus differs from the rest of the mollusca. Instead of possessing a proper branchial organ its mantle is converted into one, and on its surface countless vessels ramify in all directions, beginning at first in a variable number of large trunks. The renewal of the water over this surface is procured by the constant vibration of cilia. In the apparently helpless conchiferous mollusk, there is a beautiful provision of nature for the constant renewal of the water over the gills which constitute the branchial apparatus of these animals. This provision is the countless myriads of cilia which are scattered over the gills, and which contribute to the health and comfort of the animal, not only by renewing the water, but also by the currents which they produce, sweeping the various nutrient particles, which constitute the food of the animal, to the immediate neighbourhood of its mouth. In the Gasteropoda, the forms of branchial apparatus are exceedingly various In the snails being terrestrial animals, we have an apparatus for breathing air. It consists in a large chamber on the dorsal aspect of the body, communicating with the atmosphere ~~with~~ by a large orifice, on the right side near the margin of the shell The entire roof of the chamber is covered by a network of vessels, by which means the blood is exposed to the action of the air, which is constantly renewed by the contractions of its muscular floor, which seperates it from the viscera and acts like a diaphragm. Nor is contrivance confined to terrestrial Gaster

opoda, for we find that many fresh water air-breathing species have a similar apparatus.
The whole of which species ter-restrial and aquatic, have been classed together under the name of Pulmo-branchiata. In the marine Gasteropoda, the ar-rangement differs on account of the different circumstances, in which the animal is placed. In some as in the Doris, one of the Nudibranchiata, the branchiæ are naked, and form a beautiful star round the a-nal orifice; in another exam-ple of the same class, the Tri-tonia, they extend along the back. In another class the respiratory organ is on one side only, and in a third the Pectinibranchiata, which includes all the inhabi-tants of marine spiral univalve shells, the water is received into a cavity, from the roof of which

the comb like branchiae are sus-
-pended. In a fourth division,
the branchiae are set all round
the body of the animal, so
as to form a fringe between the
edge of the body and the foot;
this is the cyclobranchiata.
In various others of the Gaster-
-opods, too numerous to mention,
the arrangements are equally
beautiful with those already
described. In the Cephalopoda
the respiratory organs are branchia,
in some cases two, in others four
in number. In either case
however, the branchiae consist
of a central stem to which vas-
cular laminae are attached,
whereby a large surface is obtained
for the exposure of the blood, to
the renovating influence of
the oxygen. These branchiae are
in the visceral cavity, but sepa-
rated from the other viscera by
a membranous septum, so

that a chamber is formed, into which the water freely enters, be-ing sucked in through an open-ing provided for the purpose, by the action of the walls of the cavi-ty, and is ejected with such force through the funnel, as to form ~~the~~ in many cases, almost the only method of progression of which the animal is possessed.
The respiratory system of Fishes is extremely simple. It consists of vascular fringes attached to the branchial arches, which are usu-ally four on each side, attached by one extremity to a series of bones situated behind the os hyoides, while the other extremity is at-tached to the base of the cranium by means of ligaments. These branchial arches communicate with the mouth, where are fre-quently placed a number of teeth or small particles of bone so arranged as to catch any par-

=ticles of food, which perchance might be making their way in that direction, along with the current of water. A branch of the branchial artery passes round the convexity of each arch, and sends a twig to each lamella, which after bifurcating twice, breaks up into a plexus which covers the lamella, thereby ex=posing the blood to the current of water, which is kept up by the animals constantly receiv=ing water into its mouth and forcing it over the gills.

In the Reptiles, the Respiratory appar-atus is of three kinds; first that of the perfect reptile such as the Tortoise, which consists of a large membranous sac, from the internal surface of which, septa pass off forming a num=ber of polygonal cells which decrease in number from before back=wards, till in some specimens as in serpents, they cease altogether and the lung becomes a membranous bag, like a bladder. The air is admitted into this lung by means of a trachea, which unlike that of the other Vertebrata does not break up into bronchi, but terminates abruptly in one or two of the most anterior cells. In the Perenni-branchiata, we have permanently both lungs and gills. In these animals, the blood which passes over the gills is composed of both venous and arterial blood mixed, and after having been thus purified is thrown into the great vessels. Besides this circulation, they also a pulmonary one which consists in a small twig from the aortic system passing to the lung, and being returned in a purer state to the left auricle of the heart. In the Caducibranchiata, the respiration is first that of fishes, secondly that of the Perennibranchiata, and thirdly that

of perfect reptiles.
The Aves, "the Insects of the verte-
-brata" as some author I forget whom
has called them, posses a respiratory
system of a very high order, and
they in this much resemble the
Insecta, that the air is not
confined to lungs merely but
passes through almost the
whole of the animals body.
The lungs are sponge-like mas-
=ses of great vascularity, unto which
the bronchi plunge and divide
into innumerable branches, but
the main trunk, passing on opens
by a wide mouth in each lung,
into the cavity of the thorax.
By which means, the whole of
the viscera in the thoracico-ab=
=dominal cavity, are bathed in,
air, on account of that fluid pas-
sing from cell to cell, which cells
are formed by the lining serous
membrane. This respiratory
system of birds, must aid their

flight in two ways. First penetrating as the air does to all part of the body, up between the muscles of the neck, and even into the bones themselves, the blood will be readily and thoroughly äerated, and thus the animals muscles will be kept constantly vigorous. Secondly, the air passing through the animal in the manner described, must necessarily add greatly to the lightness of the bird, and thus it will require less muscular exertion to support it in the atmosphere.

It will be unnecessary to enter into a description of the lungs &c of Mamalia, the rest of that order having like ourselves two lungs, each lodged in a seperate chamber lined by a ~~mucous~~ serous membrane. I have thus given a description, doubtless disproportionately long, of the many and varied forms of respiratory apparatus to be met with in the Animal Kingdom. But the interest of the subject must be my apology, for who can see, or read of the various beautiful organs, with which Nature has endowed the Animal Kingdom; without at once admiring and wondering, at the care and watchfulness, of an All Seeing Providence for the lowest and meanest of His creatures.

Let us now look for a short while, first to the changes produced by respiration upon the air, and secondly to the changes produced by the same process, upon the blood. After which one or two words may be said upon the Theory of Respiration.

There are obvious changes ~~which~~ in the respired air, which will at once strike the most casual observer, namely, increase of heat and consequently increase of bulk, and increase of moisture. But there are other and less apparent changes which take place, these are increase in Carbonic Acid, and decrease in Oxy-gen. The air which we breath is well known to be a mixture of Oxygen and Nitrogen, with a little Carbonic Acid and Hydrogen. The proportions are nearly the following in a hundred parts of air.

Nitrogen 79
Oxygen 21

Carbonic acid and Hydrogen being of exceedingly variable amount, but about 1.0 each. In the expired air the proportion has changed considerably, for we find that rather a greater volume of Oxygen has dissappeared, than that of Carbonic Acid which is formed. The following experiment of Sir Humphrey Davy will illustrate this. He breathed, making 19 respirations in a minute 161 cubic inches of air, consisting of in 100 parts 72.7 Nitrogen, 26.3 Oxygen and 1.0 Carbonic Acid; during the same time he expired 152 cu-bic inches of air, in 100 parts of which there were, 73.2 Nitrogen, 15.1 Oxygen, and 11.5 Carbonic acid. In this experiment therefore, excepting a loss of 9 cubic inches of air, and a small addition of Nitrogen, it would appear that 11.2 per cent of Oxygen had dis-appeared, and 10.5 of Carbonic acid had been formed. In an-other experiment performed by Messrs Allen & Pepys, in a 100 parts of expired air, there were 79 of Nitrogen, 13 Oxygen, and 8 of Carbonic acid; which, supposing the air to have been of the nor-mal constitution, would give the following result, namely that 8 per cent of Oxygen had dis-appeared and somewhat more than 8 per cent of Carbonic acid generated. The experiments of Du-long, Despretz, Lavoisier and

+ And Carbonic acid added, (The numbers apply to the Carbonic acid)

Seguin, yield similar results
Various opinions however, are held
with regard to the amount of
Oxygen absorbed*; Allen and Pepys
make it out at from 8 to 8.5 per
cent; Davy in the above experi-
ment states it at 10.5 per cent
and elsewhere at 3.95 to 4.5 per
cent; Menzies at 5 per cent,
Murray at from 6.2 to 6.5 per cent
Berthollet at from 5.53 to 13 per cent
Prout at 3.3 to 4.6 per cent; Fife
at 8.5 and Irvine at 10 per cent
The great discrepancies not only
between different experimenters,
but also between different state-
ments by the same experiment-
-er, would seem to lead us to the
conclusion, that the amount
of Carbonic Acid eliminated dif-
-fers in different individuals
And Prout has also shewn it dif-
fers at different times; for that
experimenter found, that the
amount of Carbonic Acid elimi

nated was smallest towards mid-night, from which time gradually increased till midday, when it reached its maximum, and gradually decreased towards mid-night. Prout also found that the carbonic acid was increased when the mind was tranquil and during gentle exercise; whilst on the other hand, it decreased upon active exertion, mental depression, and the use of spirit-uous liquors. The mean amount of water exhaled during twenty four hours has been stated at 8000 grains or one pound.

The most obvious distinction between arterial and venous blood is the colour, being a much brighter red in the former than in the lat-ter. This change takes place evi-dently in the lungs, and more-over can be caused to take place out of the body, upon exposing the blood to the influence of oxygen.

Another difference is in the temperature, although this has been very much disputed, yet the majority of opinions seem to be in favour of the arterial being a little warmer than the venous. The venous blood has also a rather higher density than the arterial; in consequence of the amount of water taken out of the blood by the Kidneys Skins &c &c &c. Various opinions also have been formed as to which had most Fibrine, Blood corpuscles, and Albumen Osmazome Fat &c, but the majority seem to incline towards the idea that the arterial has the greater quantity

The result of numerous experiment seems to show that with regard to the gases of the blood, in venous there is most Carbonic Acid, whilst on the other hand in arterial there is most oxygen, in both venous and arterial the azote remaining much the same

There are four views with regard to the action which takes place in the lungs, between the blood and the atmosphere.

First, that of Lavoisier, La Place and others, viz, that the carbonic acid of the expired air was generated in the lungs, by the combination of hydro-carbon with the oxygen of the inspired air. This view is now abandoned

Second, That of La Grange and Hassenfratz, who believed that the carbonic acid was free in the blood and exhaled at the lungs, when the oxygen was absorbed and held in solution by the arterial blood.

Third, That the oxygen absorbed enters into a chemical combination with one or more constituents of the blood. That this oxygen combines with carbon in the capillaries, to form carbonic acid which does not combine with the blood but is held in solution till it reaches the lungs when it is thrown off.

Fourth. In the first place the Oxygen combines chemically with the blood in the lungs; secondly, this oxygen combines with carbon in the capillaries to form carbonic acid, which also combines with the blood, and this combination of the carbonic acid and the blood is dissolved by the oxygen, upon the blood again arriving at the lungs.

In truth nothing seems to be settled about this much discussed subject, the Theory of respiration. Some physiologists seem inclined to think that the oxygen is merely held in solution by the blood; others again in consequence of the difficulty of detecting free oxygen in the blood, think that it is chemically combined, but cannot make up their minds as to which constituent it is combined with. Some uphold that the corpuscles are the carriers of the oxygen; others again maintain that the oxygen combines with some one or more of the other constituents of the blood. Another class believe that the greater part of the oxygen is in simple solution, but that a part of it is chemically combined with some part or other of the blood, in a way of which we a present know nothing. And they further believe, that a mere interchange of part of the carbonic acid of the blood for oxygen, is not the entire process which changes venous into arterial blood; they also take into account the admixture of the chyle with the blood, and believe that the proper elaboration of that fluid into blood is completed in the lungs; which would neces sarily make a great difference between the blood of the arteries and the veins.

With regard to the formation of the carbonic acid, the almost universal opinion is, that that process goes on in the systemic capillaries, by the combination of the oxygen with carbon.

Wm Brown