Now that medicine as an art & science has been emancipated from the rude chaotic map of ancient mysticism, limited observation, & imperfect experiment; it has become the science of sciences: the collateral branches being her handmaids, or Euphrosyne-like, is supported by her allied sisters. As the more these fundamental principles are investigated & established, the more cultivated & powerful will the healing art become. Considering the nature & object of his profession, the Physician, of all men, should be among the most philosophic. Refusing aid from no source, limiting himself to no particular kingdom or quarter for agents, nor even rejecting the shadowy light of his fore-fathers, & the misty glimpses into bygone ages, let us humbly listen to their wisdom, & from the errors of the past let us learn to glean virtues. Thus by encouraging every art, furthering every scientific inquiry & entering into sympathy with every field of knowledge, our range of action is extended, our resources are multiplied, the reflected light from many points be-
-come

generalized facts - knowledge - knowledge is power -

No longer then is medicine a mere routine of drugs for
the skilful physician it not tied even to the three natural
kingdoms from pole to equator, but brings to bear upon
diseases the grandest generalizations from numerous sci-
ences - higher still brings forth from his own -
mind influences that will stimulate, amends
this. will Calm, moral power that will appare + En-
Courage; surely these are remedial agents of the highest
order + on these principles can the Christian Physi-
cian off with no pain, hope, indeed minister -

The study of mankind is man -

Psychology + a pure Ethics will lend their item in this
matter, + I know how doing much in our most val-
uable institutions where besides our common moral
ideals amidst there exists a mental delinquency.
As the range of science widens so our liability to fal-
lacy increases - our senses often deceive as especially
when having to deal with the intangible - the theories of
an intellectual mind are apt to be crude, + untenable.

true generalization is a synthetic process + more subtle
in its nature than Analysis, requiring great caution.
First as to the nature + purity of its elements or fa-

casts. + second the true measure of Combining for -
portions (to speak chemically) before a legitimate induction.

Can be formed from the advanced data. Hence the
value of division & classification in the vast field of science.

Thus man can, to an extent compensate for his limited
faculties & by concentration of thought contribute his part to
the common store. All of late, the powers of his senses
have been magnified by valuable inventions of instru-
ments enabling the investigator to reveal valuable
truths, wonderful mysteries of hitherto unknown worlds.

While with the telescope we that search out these hid-
der mysteries, & admire this look through Nature onto
Nature's God & will a true love of wisdom for
the sake of science itself - let us all as practical
men, endeavour to determine the true bond that
our hearts may rejoice to do as the Samaritan of old,
to our brother pouring in the wine & oil by the way side
of life in our deary pilgrimage through this earth.

Recent investigations have in the propely of knowledge
revealed facts proving the production of animal heat, the pro-
ceesses of digestion & respiration to be chiefly Chemical phe-
omena & not wholly vital as was formerly believed. It is
here proposed to consider more particularly the latter func-
tion & to enforce the duty & necessity of medical officers
giving more weight to the scientific truths connected with
it, first in their prophylactic treatment & exercise of their -
influence as scientific men for the welfare of the body politic.
Second, in their actual treatment of disease. Third, the
principles of ventilation, regarding a pure atmosphere as the
primary essential of all hygienic agents.

First, let us briefly glance at the method by which
this process is carried on, viz. inspiration or the function
of breathing. It consists of two acts viz.: 1° Inspiration,
or the taking in of air into the lungs; and 2° Expiration,
or the breathing out of air from the lungs. which takes place alternately with the preceding act. In a healthy person, the
inspiration is usually three times as long as the expiration,
these occur from 14 to 18 times in a minute. The measure
of air taken into the lungs during ordinary inspiration varies
from 20 to 25 cubic inches (Condyle xix.1839) in healthy
middle-aged men. Inspiration is performed by the contraction
of diaphragm, by the external intercostals, scaleni and
derruci muscles. Expiration principally by the elastic
contraction of lungs and walls of chest and abdominal muscles.

The air-passages from mouth to nose are composed of cartilaginous, fibrous, muscular, mucous and glandular tissues;
these are distributed in various amounts, thus the minute
and ultimate air-tubes are chiefly membranous. The lungs
are composed of small lobules connected by soft and elastic
vascular tissue to permit free expansion and ready contraction.
The cells of this tissue have no communication with the
air-vesicles of the organ. Each lobule receives a small bronchial tube, which subdivides into smaller branches, these have no cartilage, but consist of a fine elastic membrane upon which the capillaries ramify in a very minute network. Each tube finally leads into an irregular space or intercellular, from which proceed on all sides numerous little sacs or dilatations which are the air-cells. They are honeycomb-like owing to their border being pocked-like by little procerous the cell tissue putting forward, thus increasing the extent of surface for the ramifying of capillaries. The pulmonary Arteries subdivides like the bronchial tubes, \\
their ultimate ramifications spread over the air-cells to form an extensive & minute network of blood vessels to close that the interstices are even narrower than the capillaries themselves which are about \( \frac{1}{3000} \) of an inch in diameter. Now the design of this exquisite arrangement is to oxygenate the blood called venous which has become deteriorated in two ways, first positively in its passage through the body having taken up impurities, effete matter, debris or disintegrated tissues. Second by its giving out the nutritive fluids for the renewal of these tissues, of other matters termed secretions & excretions elaborated from it by organs which are named glandular which directly or indirectly minister to the common weal of the body aggregate. Change is life
by the latter mode is refined by the process termed —
nutrition. The removal of the former is in part performed by the lungs, thus constituting the function of respiration one of true excretion, or something more as will be presently seen. One of the most important and abundant impurities of venous blood is carbonic acid the removal of which, a substitution of oxygen constitutes the chief purpose of respiration. Let us briefly consider the various chemical theories that have been advanced to explain this process. The blood is a compound liquid having a sp. gr. of 1.055 at 60° F.; its temperature is generally about 100° F., that of blood in the left side of the heart being 1° to 2° higher than that in the right — Savory (Cexx.) it has a slight alkaline reaction, has an odor somewhat like that which issues from the skin or breath of the animal from which it was taken. The mean amount of this fluid in the human adult male is 34½ lbs.; in the female 26 lbs. (Valentin).

From Becquerel & Rodier's analyses it may be said generally that the blood contains 160 to 800 parts in 1000 of water; fibrin from 5 to 3 parts; albumen from 60 to 70 parts; blood corpuscles from 130 to 2150 parts; extraneous matters 1 part from 1 to 4 parts, and the saline matters range from 5 to 10 parts. Chiefly consisting of Chlorides, Phosphates
Carbonates are of Botta, soda, lime, and magnesia. Playfair and Boeckman found that the dried blood of the ox contained carbon 57.9 per cent. Hydrogen = 9.1, nitrogen = 17.4, oxygen = 19.2. Inorganic matter = 4.4 per cent. These results of the ultimate analysis of ox's blood afford a remarkable illustration of its general purpose, as supplying the materials for the renovation of the whole tissues. For the same analysts have found that the flesh of the ox yields the same elements in so nearly the same proportions, that the elementary composition of the organic constituents of the blood & flesh may be considered identical. It may be represented by the formula for both: C 45 H 39 N 6 O 15.

Liebig says the first conditions of animal life are nutritive matters & oxygen, introduced into the system. The observations of physiologists have shown that, the body of an adult man, supplied with sufficient food, has neither increased nor diminished in weight at the end of 24 hours; yet the quantity of oxygen taken into the system during this period is very considerable. According to the experiments of Favorits...
an adult man takes into his system, from the atmosphere, in one year, 746 lbs., according to Mertieus 8.57 lb. of oxygen; yet we find his weight, at the beginning t end of the year, either quite the same, or differing, one way or the other, by at most a few pounds. No part of this oxygen remains in the system, but is given out again, in the form of a Compound of Carbon & of hydrogen. The Carbon & hydrogen of the various parts of the body have entered into combination with the oxygen introduced through the lungs through the skin. I have been given out in the form of CO2 gas and the vapour of water. At every moment, with every expiration, certain quantities of its elements separate from the animal organism, after having entered into combination, within the body, with the oxygen of the atmosphere. Hence according to the measure of oxygen inspired, there must be an adequate quantity of Carbon & hydrogen supplied there are derived from the food. From the accurate determination of the quantity of Carbon daily taken into the system in the food, as well as of that proportion of it which escapes out of the body in the forms I write, unburned, that is, in some form in which it is not combined with oxygen, it appears that an adult, taking moderate exercise, consumes
13.9 oz. of Carbon daily. These 13.9 oz. of Carbon escape through the skin & lungs as Carbonic acid gas. To convert into Carbonic acid gas 13.9 oz. of Carbon require 37 oz. of Oxygen. According to the Analysts of Houpingault 'Ann. de Ch. et de Ph. XXXI,' a horse consumes in 24 hours 97.8 oz. of Carbon. A Milch Cow 69.9 oz. This Carbon is given off from the bodies of these animals in the form of Carbonic acid; it appears from them that the horse consumes, in converting Carbon into Carbonic acid, 13 lbs. 5/2 oz. in 24 hours, & the Milch Cow 11 lbs. 10 3/4 oz. of Oxygen in the same time. Two animals, which in equal times take up by means of the lung & skin unequal quantities of Oxygen, consume quantities of the same nourishment which are unequal in the same ratio. This shows the direct ratio of the nourishment required by the animal body, to the quantity of Oxygen taken into the system. The Consumption of Oxygen in equal times may be determined by the number of respirations; it is clear that, in the same individual, the quantity of nourishment required must vary with the former number of respirations. A child, in whom the object of respiration is naturally very active, requires food offered than an adult. It bears hunger less easily.
A bird, deprived of food, dies on the third day, while a serpents, with its sluggish respiration, can live without food three months or longer. The number of respirations is smaller in a state of rest than during exercise or work. The quantity of food necessary in both conditions must vary in the same ratio. But the quantity of oxygen inspired is also affected by the temperature and density of the atmosphere, so that the amount of oxygen absorbed and of carbonic acid to evolved varies according circumstances which will be noted under the subject of animal heat. The changes which this alteration of the blood produces upon it are:

1. Change of colour. 2. After passing through the lungs, is 1° or 2° warmer than it was before; 3. it coagulates sooner and more firmly; 4. contains, apparently, more fibrin; 5. that it contains more oxygen, less carbonic acid, and less nitrogen.

The existence of carbonic acid in both arterial and venous blood has been proved by several experimenters, who have obtained appreciable quantities of it by exposing the blood to the vacuum of the air-pump, or, more certainly, by agitating it with atmospheric air. Oxygen or other gases, such as hydrogen or nitrogen, by the latter process, can...
bonic acid may always be extracted from venous blood. Magnus states that Carbonic acid is not given out under air-pumps until the air in which the blood is placed is so rarefied that it supports only one inch of mercury, that heat does not evolve it from blood probably because the requisite temperature would coagulate its albumen, which would prevent its separation. The uncertainty of former experiments was corrected by the subsequent researches of Magnus (1845) from which it appears that Carbonic acid, Oxygen, and Nitrogen exist, both in Arterial and Venous blood. The quantity of Oxygen contained in Arterial blood is twice as great as that in Venous blood: being equal to from 10 to 10.5 per cent of the volume of the former, but only about 5 per cent of the volume of the latter. In Arterial blood 30 volumes per cent of Carbonic acid; in Venous 2.5 per cent. Nitrogen in blood varies from about 1.7 to 3.3 per cent, the greater quantity is believed to be in the Venous blood.

These facts are supported by the experiments of Albrecht Pflüger, who found that when guinea pigs were made
to breathe in a mixture of oxygen & hydrogen. Nitrogen was given off, that in a quantity exceeding the volume of the whole body of the animal. According to Preparatory xxxii. the lower animals, especially insects, are said to exhale nitrogen, fish to absorb it from the water in which they breathe, though they do not absorb hydrogen (Humboldt, xxxii). The experiments of Boussingault, xvi. 1846) on turtle-doves would prove that, besides the nitrogen excreted from the digestive canal & kidneys, nearly 2/3 yrs. are daily discharged from the skin, lungs, & those of Reynaud & Reidel (8, 1848, & 53, 1849) on dogs, rabbits & fowls, prove constantly a certain exhalation of nitrogen, the proportion seeming to vary according to the nature of the food, while they also find that during prolonged fasting, nitrogen, instead of being exhaled, is absorbed. Traps placed in nitrogen exhale Carbonic acid. Gases could not be so exhaled did they not exist in solution in the blood. And there can therefore be little doubt which of the proposed theories of Respiration should be chosen for the explanation of the process. Until the existence of gases in the blood was clearly proved, the theory most accepted was, that the crypsis of the
atmospheric air permeates the membranous walls of the air cells, enters the blood, and there at once combines with carbon derived from disintegrated tissues, to form carbonic acid, which escapes, together with the greater part of the nitrogen previously absorbed from the atmosphere. But we know that all such chemical unions evolve heat, which is intense according to the period it is in taking place, the measure being the same whether evolved slowly or rapidly, hence if the former theory were correct the lungs would be greatly heated, and the blood after combination be of a much higher temperature than previously, but that in the left side of heart is never more than one or two degrees higher than that in the right.

Lagrange & Laplace proposed a theory, which, with some modifications, has been more recently advocated by Magendie & others, namely that the oxygen absorbed into the blood from the atmospheric air in the lungs, is in part dissolved, and probably, also in part loosely combined chemically with one or other of its constituents. In this condition, the oxygen is carried in the arterial blood to the various parts of the body, by means of the capillary system of vessels, brought into close relation or contact with the elementary parts of the tissues. Herein cooperating probably in the pro-
Eyst of nutrition, or the removal of disintegrated parts of the tissues, about one-half of the oxygen which the arterial blood contains disappears. A proportionate quantity of Carbonic acid and water is formed. The returned blood, containing the now formed Carbonic acid, returns to the lungs, where a portion of the Carbonic acid is exhaled, but a fresh supply of oxygen is again taken in. For a long time it was supposed that the volume of oxygen taken into the blood by the lungs was equal to the volume of Carbonic acid given off; but it is now known that the volume of oxygen taken in is far greater than that of the Carbonic acid given out. To this last theory therefore it may be objected that there is no ground for supposing that the part of oxygen is loosely chemically united to the blood, whilst the other part is merely absorbed. A third returned to the atmosphere exterior to the lungs unchanged. Certainly the lungs contain a volume of air which by no effort of expiration can be expelled; will by it. Since their perfect collapse would render inspiration a labour instead of the easy unconscious act, besides the danger in certain mortis conditions, there would be of their not expanding again—an even upon strong effort of inspi-
expiration, but does this measure of gas, which
they contain consist of pure atmospheric air or
of Carbonic acid gas or both combined? Neither
fills this theory of Lissauer satisfactorily account
for the whole of the oxygen taken in by the blood
in the lungs. Its function is to throughout the
whole system to combinations to ultimate dis-
posal. Liebig maintains that the globules of
the blood change their colour in their passage
through the lungs with this change of colour oxy-
gen is absorbed, an equal volume of Carbonic
acid is in most given out. The red globules contain
a Compound of iron but no other constituent of the
body contains iron. According to Liebig mere haem-
mine consists of Carbon 65.84 per cent. hydrogen
5.37; Nitrogen 10.4; oxygen 11.75; air 6.64.
The presence of so large a proportion of iron con-
sstitutes us peculiar feature in haematin. The mode
in which the metal exists in it has been much dis-
cussed. Liebig supposes it to be in the form of an
oxide or a salt, or in the form of Peroxyde in
arterial blood. 1 Carbonate of the Peroxyde of
iron in phlegm.

Davy maintains that iron is found in the paste
form in air.
Serum when in Contact with Oxygen does not separate or form off Carbonic acid, but will absorb from the air its volume to an equal volume of Carbonic acid. At ordinary temperatures, it is not saturated with that gas. Arterial blood, when drawn from the body is soon altered: its florid colour becomes dark red by the action of Carbonic acid. This change of colour affects the globules: for florid blood absorbs a number of gases which do not dissolve in the fluid part of the blood when separated from the globules. It is evident, therefore, that the globules have the power of combining with gases. This change may be owing to either a combination or to a decomposition. Sulphuretted hydrogen turns them blackish green and finally black. Oxygen will not restore them to their former colour. So that a decomposition must have taken place. But when globules are darkened by Carbonic acid, they again become florid in Oxygen with disengagement of Carbonic acid. This also takes place in nitrous oxide, here they are not decomposed, but have the power of combining with gases. While the compound they form with Carbonic acid is destroyed by oxygen.
The compounds of iron (protoxide) possess the property of
depriving other oxidised compounds of oxygen; while the
compounds of protoxide of iron, under other circumstances,
gains the oxygen with the utmost facility. Hydrated
protoxide of iron, in contact with organic matters dis-
integrate of sulphur, is converted into Carbonate of the
protoxide. This again in contact with water makes oxygen
be decomposed: all the Carbonic acid is
given off. By absorption of oxygen, it passes into
the hydrated protoxide, which, may again be converted
into a compound of the protoxide. The cyanides
of this metal exhibit similar properties. Prussian
blue contains iron in Combination with all the
organic elements of the body: hydroxonitrofen;
(Water + Carbon + nitrogen = Cyanogen). When it is
exposed to light, Cyanogen is given off, & it becomes
white; in the dark it attracts oxygen, & recovers its
blue colour. These facts lead likely to believe that the
the globules of arterial blood contain a Compound of iron
desaturated with oxygen, which in the living body, loses
its oxygen during its passage through the Capillaries.
The same thing occurs when it is separated from
the body, it begins to undergo decomposition. All
the Compounds present in arterial blood, which have
an affinity for oxygen, are converted, in the lungs, like,
the globules, into more highly oxidized compounds; a certain amount of Carbonic acid is formed, of which a part always remains dissolved in the serum of the blood. Hence, in the Animal organism, two processes of oxidation are going on; one in the lungs, the other in the Capillaries. By means of the former, in spite of the degree of cooling, & of the increased evaperation which takes place there, the temperature of the lungs is kept; while the heat of the rest of the body is supplied by the latter.

Scherer & Mulder support the view, that the iron is combined as an element with the four essential elements. Carbon, hydrogen, nitrogen & oxygen, in the same manner as it is held. Sulphur is combined with them in albumen, fibrine, cystic oxide.

The principal evidence for this opinion is 1. that when Chlorine, which would not combine an oxide of iron, is passed through a solution of haematine, Chloride of iron is formed. 2. the iron thus removed from the other elements of the haematine, is replaced by Chlorous acid; 3. that all the iron may be removed from haematine by sulphuric acid, without abstracting from any of its oxygen, which would not be possible if the iron were more intimately united
with the oxygen than with the other elements of the haemato- 
aidine; 3, that pure haematin may be decomposed for several 
days by the action of dilute hydrochloric or sulphuric acid, without any loss of its iron; though these acids 
would dissolve an oxide of iron, or decompose a carb-
ate. The peculiar colour of haematin depends less on 
the iron than on its other constituents, for, as Scherer 
and Mulder have shown, haematin may retain its col-
our after all the iron is extracted from it. Therefore 
the changes of colour produced by respiration, i. e. the con-
tact of gases with the blood, cannot be referred to any 
change in the state of the iron in the haematin. It is 
doubtful whether the rapid change of colour which 
is effected in respiration, i. e. on the contact of various 
gases, can be referred to any chemical changes whatever 
in the haematin; much more probably, it is due to 
changes in the form of the blood-corpuscles at their con-
sequently different modes of reflecting and transmitting 
light. For 1. the changes of colour produced by carbonic 
acid, i. e. oxygen mixed with a solution of the colouring 
matter of the blood are very slight; they are gener-
ally scarcely perceptible, i. e. when they are seen, they 
are slowly produced, or are not more than may be 
explained by the action of the gases on some corpuscles 
still suspended in the solution. 2. the same change
of colour as are produced by Carbonic Acid + Oxygen, acting upon the Corpuscles, may be produced by distilled water, + strong solutions of Alkaline salts. A black, clotthy, blood becomes at once scarlet by washing it with salt, + it is not blackened again by Carbonic. A scarlet one is made black by washing it with distilled water, + is only very slowly reddened again by Contact with Oxygen. Now the Changes thus produced by a salt + by water acting on the Corpuscles, are not produced by the addition of the same substances to a solution of haematin, + are not Connected with any Chemical Change in that Substance or in the Corpuscles; but they are Connected with Alterations in the Shape of the Red Corpuscles: for -- Saline Solutions, if denser than the Liquor Batrachis, Contract + shrink up the Corpuscles, making them, deeply bi-concave; + distilled water has the Contrary effect, swelling out the Corpuscles, + making them, thickly bi-concave, or spherical. Changes Corresponding with these are produced by the Contact of Oxygen, + of Carbonic Acid with the Corpuscles; the former Contracting them, + making their Cell Membranes thick + firm; the latter dilating them, + thinning. I finally dissolve their Cell-Walls; I effecting these Changes.
in a degree which, however slight, it may appear to a single corpuscle, is enough to account for the change of colour in a mass of blood. Hence, then, is a sufficient explanation of the changes that the corpuscles undergo, without supposing any immediate chemical alteration in the haematinic; an alteration which should take place as well in a solution of haematinic as in the corpuscles. Scherer, in his several reports in Carlstall's Jahresberichte since 1844, also Reuter, in Henle & Pfeuffer's Zeitschrift from 1843 to 1847; Donder, Harlay, Marehund & Muller.

The most important constituents, now for our present purpose, are the inorganic matters found in the blood, which remain as ashes after its complete burning. One may observe in general their small quantity in proportion to that of animal matter contained in it. Those among these of peculiar interest are the phosphate & carbonate of soda. 

It appears most probable, that the blood owes its alkaline reaction to both these salts of soda. The existence of the tri-basic phosphate, a salt consisting of one equivalent of phosphoric acid with two of soda & one of basic water, $\text{PO}_4 + 2\text{Na}_2\text{O} + \text{H}_2\text{O}$, was proved by Enderlin (F. 1844) the presence of carbonate of soda.
has been proved by Lehmann & others. In illustration of the characters which the blood may derive from the phosphate of soda, Liebig points out the large capacity which solutions of that salt have of absorbing carbonic acid gas, it then very readily giving it off again when agitated in atmospheric air, when the atmospheric pressure is diminished. It is probably, also by means of this salt, that the phosphate of lime is held in solution in the blood in a form in which it is not soluble in water, or in a solution of albumen. Of the remaining inorganic constituents of the blood, the oxide of iron phosphate of iron, referred to exist in the liquorCUSUMINUS, independent of the iron in the corpuscles. According to Bernard the glucose of portal system, disappears to a great extent in its passage through the lungs.
Libbey states the production of animal heat thus - the mutual action between the elements of the food and the oxygen. Conveyed by the circulation of the blood to every part of the body is the source of animal heat. The carbon of the food which is converted into carbonic acid within the body, must give out exactly as much heat as if it had been directly burnt in the air or in the pure oxygen gas. The only difference is that the amount of heat produced is diffused over unequal lines. In oxygen, the combustion is more rapid, the heat more intense in the air it is slower. The temperature is not so high, but it continues longer. It is obvious that the amount of heat liberated must increase or diminish with the quantity of oxygen introduced in equal times by respiration. In the animal body the food is the fuel: with a proper supply of oxygen we obtain the heat given out during its oxidation or combustion. In winter, when we take exercise in a cold atmosphere, when consequently the amount of inhaled oxygen increases, the necessity for food containing carbon and hydrogen increases in the same ratio; by gratifying the appetite thus excited, we obtain the most efficient protection against
the most piercing cold. A starving man is soon
frozen to death; but, one knows that the ani-
imals of prey in the Arctic regions far exceed in
vigor and those of the torrid zone. But clothing
is merely an equivalent for a certain amount
of food. The more warmly we are clothed, the
less urgent becomes the appetite for food, be-
cause the loss of heat by clothing is consequently
the amount of heat to be supplied by the food
is diminished. If we were to go naked like cer-
tain savage tribes, or if in hunting or fishing
we were exposed to the same degree of cold
as the Samoyedes, we should be able with ease
to consume 10 lbs. of flesh. I perhaps a dozen
of tallow candles into the bargain, daily, as
warmly clad travellers have related of these
people. We should then also be able to take the
same quantity of brandy or brandy oil without
bad effects, because the carbon t hydrocarbons
of these substances would only suffice to keep
up the equilibrium between the external
temperature and that of our bodies. Accord-
ing to these facts the quantity of food is regula-
ted by the temperature of the air, by the num-
ber of inspirations, and by the amount of heat.
given off to the surrounding medium. The hydrogen of the food seems to play as important a part as that of Carbon for the accumulation of fat in hibernating animals. Previous to their entering into that state, entirely disappears during their re-creation, the oxygen in the respiratory process consuming without exception. As also in cases of starvation, all such substances as are capable of entering into combination with it, the deficiency of hydrogen is the only reason why Carbonic acid is the chief product: for at the temperature of the body, the affinity of hydrogen for Oxygen far surpasses that of Carbon for the same element. I know, in fact that the Carnivora expire a volume of Carbonic acid equal to that of the oxygen inspired, while the Carnivora, the only class of animals whose food contains fat, inspire more oxygen than is equal in volume to the Carbonic acid expired. Hibernating animals then maintain sufficient heat during their semi-hibernating condition in three ways. 1. By the slow oxidation of accumulated fat etc. 2. By the few respirations and non-expenditure of tissue by muscular exertion etc. 3. By their warm retreats and protection from atmospheric cir-
fluences by the bad-conducting power of their warm, shaggy fur. The true cause of death in starvation is the respiratory process that is the action of the atmosphere. So also in all chronic diseases, death is produced by the same cause, the chemical action of the atmosphere. When these substances are wanting, whose function in the organism is to support the process of respiration; when the diseased organs are incapable of performing their proper function of producing these substances; when they have lost the power of transforming the food into such shape in which it may, by entering into combination with the oxygen of the air, protect the system from its influence, then the substance of the organs themselves, the fat of the body, the substance of the muscles, the nerves, the brain, are unavoidably consumed. It is believed to be well established that the normal temperature of the body is nearly uniform, it varies but 2 or 3 degrees under whatever normal conditions the body may be placed. Dr. Brown-Séquard's experiments and observations upon himself, and those of Mr. Ringer on fowls, prove that the standard of temperature may vary from a point below 98° to 102°F. in children; it ranged about 2° higher in febrile diseases; high about 107° in others; low as in Asiatic cholera; it may sink to 74° or even lower.
Respiration is the falling weight, the heart spring, which keeps the clock in motion: the inspirations and expirations are the strokes of the pendulum which regulate it. In our ordinary time-pieces we know with mathematical accuracy the effect produced on their rate of going, by changes in the length of the pendulum or in the external temperature. Few, however, have a clear conception of the influence of air temperature on the health of the human body: yet the research into the conditions necessary to keep it in the normal state is not more difficult than in the case of a clock. This grand prophylactic truth so well expressed by Liebig is truly substantiated by a short paper written by Henry Holland in which he says "Few things not more delicately in practice towards the prevention of pulmonary disease, as well as the improvement of general health, by expressly exercising the organs of respiration?"

Though suggestions to this effect occur in some of our best works upon consumption, as well as in the writings of certain Continental physicians, they have hitherto had less than their due influence; the principle, as such, is little brought into general application. The proper exercise of this function is beneficial, first in maintaining their healthy.
structure, by keeping all the air passages duly open;
secondly, in preventing congestion in the
pulmonary circulation; thirdly, in providing more
completely for the necessary chemical action on the
blood, by changing at each act of respiration a
sufficient proportion of the whole air contained
in the lungs, it giving it more complete access to
the vascular tissues, all objects of great impor-
tance, all capable of being promoted more or less
by the means in question. The ingenious suggestion
of Dr. Carrel, as to the practice of more frequent lobe-
cauterization superior lobes of the lungs, as well known,
its application to this part of the subject also in the
work of Sir James Clark On Consumption.
The acts of sighing and yawning are instances where
Nature endeavours to relieve the lungs when oppres-
sed in their functions. Coughing, another mode
of expiration, less indeed to be dreaded in itself than
from the inference it conveys, is an instrument
in keeping the air tubes free from obstruction; in
there are cases often occurring, where it might be
practically superseded, or ministered in beneficence, by the
phlegm exercise of respiration. The more distinct
knowledge that has been acquired of the tubercular
diseases, of the tendency in certain habits in
particular features in the growth, or deposit of a pecu-
liar morbid matter, 1 of that more especial nature, to
the lungs, warranting Louis's assertion, that after
the age of 15 tubercles are never found in any part
without appearing also in this organ. — Points direc-
tly to a specific Constitutional disease, for which
none other than a specific antidote is likely to be
of complete or certain avail. Now the only antidote
in the present state of our knowledge is the hygiene,
preventive principle of treatment — not only is more
attainable but we hold that as yet it has never
had its due weight. The physician, until now
never recognized with that necessary alacrity the
indisputable beginning of an incipient phthisis —
when more urgent symptoms were brought
under the notice of both the physician & patient
when probably too late to arrest its onward march
to misery & death. The cause or causes were
sought remotely - hence the effects of ill-directed treatment, while for instance the evil spirit
stalked at large unheeded. The main root of evil
was too near home to be for one moment suspected
of such dire effects. A polluted stream, a foul
drain - a damp cellar, non-ventilated rooms.
Lustig ignorance & bad habits, these I say were
too true matters too familiar will to receive anything like Secondary importance not even Secondary for seldom were they ever recognized as serious tangible facts in the maintenance of health for the community and life for the individual in truth they were not known as the hot beds of disease the seeds of premature dissolution until they were forced upon us as truth no longer to be ignored lest our nations should be swept away as well as our cities made desolate

Epidemics raged with renewed vigour. Pestilence the Plague had indeed come with our dwelling with the fell sweep of a destroying angel. I was in vain to stem the tide. The only hope and refuge was in flight. To stay was almost certain death. How how far it may be asked was man accountable for such devastation? Was it not wholly by a visitation of divine Providence? Did the sweep of fatality to millions not commence at one quarter of the globe? Steadily make its march of destruction onward over every nation. History but too truly points out the fact that whatever may be the theories of a morbid poison such but too readily found the necessary circumstances for its generation in the gross ignorance and total disregard of the laws of health the intemperate habits of bygone ages—
Pure air is rendered impure by the process of respiration, which in the first place heats it. 2° the Carbonic acid is increased; 3° its oxygen is diminished; 4° its watery vapour is increased. Its temperature varies between 97° and 99°, acquiring, whatever its previous temperature, that of the blood before being again oxygenated from the lungs. The Carbonic acid in respired air is always increased, but the quantity of exhaled CO₂ in a given time is subject to change from various circumstances. If the air be already charged in some degree with Carbonic acid gas, the quantity exhaled is much less. A circumstance which strongly points out the necessity of ventilation. This is evidently from the general description of the whole system introduced by the sufferer. Pure CO₂ cannot be inhaled, because it causes tracheal closure of the flaps. Lindau found that animals can live in air until they have repeated respirations. Its CO₂ has increased by 1° or even 18 per cent. If, however, they were at first transferred from pure air to an atmosphere containing such a percentage of Carbonic acid, they are immediately killed, even though an abundance of oxygen be simultaneously present. Dr. Müller found that animals placed in closed vessels of sufficient size are not affected by the gradual augmentation.
of the Carbonic acid, until they have absorbed about a third part of their bodily volume of Carbonic acid. Symptoms of Narcosis, such as coldness of the extremities, slowness of the respiratory acts, rapidity (combined with weakness) of the heart's action, then set in; after the animal has absorbed 56 or 58 per-
cent of its own volume of Carbonic acid, death in-
duces without any Convulsive actions, although plenty of oxygen for the support of life still remains. Now from the former observations, those of Bénédict are exhibited the wonderful powers of Nature in the principle of accommodation, to which is verified in our every day experience. Being those who appear in good health, swallowing poisonous doses, what would be le to others, of Quinin, Tobacco, others breathing the most noxious gases, living in a hale of Steam. Carbonic Acid, & Carbonic Acid & some all but frozen, others fine-boiled, others half-baked. But on the other hand we are also shown by the observations of Müller that con-
tinued impure respiration tends to deprive the whole vital powers & cause premature death. Now this is evident from two Causes first positive slow poisoning by the tending in (if not of Carbonic acid) of other very prejudicial toxic
agents such as Sulphured hydrogen to according to the nature of the emanations by which we are surrounded. By the interference with the natural process of elimination of effete matter, the result of disintegration of the tissues. According to Helleyer Carbonic oxide is the fatal constituent of choke-damp, Leblanc poisons death, by its combining very readily with the blood and displacing the oxygen. The amount of Carbon evolved varies with weight, age, labour, condition of the digestive system, condition of the Atmosphere, moist or dry or atmospheric pressure, period of day, season of the year, sex, quantity, quality of food.

Lehmann found from experiments on wood-pigeons, green finches, rabbits, that the weight of Carbonic acid excreted in moist air greatly exceeds that eliminated in a dry atmosphere. Professor Day remarks these experiments seem to have a direct bearing on the treatment of disease. When we wish to check the too rapid waste of tissue (of which the excreted Carbonic acid is a measure), we should clearly recommend a dry in preference to a moist atmosphere.
Dr. Edward Smith in his work on the Chemical and other Phenomena of Respiration etc. has fully investigated the effects of the different seasons on the respiratory process. There are great variations from season to season, so that as the hot season advances, all the respiratory phenomena are affected. The diminution in myself at the middle of August was 30 per cent of air 32 per cent. In rate of respiration, 17 per cent of Carbonic acid. Spring is the season of the greatest, & the autumn of the least activity of the respiratory & other functions. The relation of temperature & pressure to the Carbonic Acid is an inverse one, the former acting in an increasing ratio in cases of sudden increase.

The period of permanent decline in the Carbonic acid is May to June, the period of minimum quantity; there is the greatest uniformity. The period of the day has been considered in its influence upon respiration but we must remember that all internal conditions of the organism, especially those which affect nutrition, consequently the state of the blood, exert a marked influence on the respiration, such as starvation, digestion, etc.
R. Smith found that in a prolonged fast of 27 hours the diminution per cent. from the quantities in a day with food was 25 of Carbonic acid, 80 per cent. of air, 37 of vapour, 17 of rate of respiration, 2 6 p. c. of rate of respiration. At the end of the 27 hours the quantity of CO₂ exhaled was the same as at 4 ½ hours after the beginning of the experiment. The composition of the expired air thus appears to be very uniform during fasting.

Moleschott found that light (independently of the period of the day) exerted, in the case of plants, a decided influence in promoting the excretion of Carbonic acid; this fact may have a bearing on Prouit's experiments. In plants we find that light directly influences their absorption of CO₂ and the evolution of their various beautiful colours. We had the opportunity of observing fully the influence of light to in the growth of several broods of chickens of different species and during different seasons of the year. One series were hatched in an airy open situation with a Southern aspect, of the several broods in the quarter none died but one or two whose desks could be traced to accidental causes. While another series were hatched, they did not above half a mile
distant in equally good air. Of similar species to the former, of healthy parents. 4 were fed upon same the food + equally well sheltered with the former, but the situation had a northern aspect + to surround by high walls that the sun always cast a shadow upon the garden in which the fowls were confined. Of the 5 or 6 broods of this series only home 6 or 7 fowls lived - 2 even then appeared more or less delicate & stunted in growth, while all the rest dropped off the by. The before the end of third month after leaving the shell. Upon both external examination we could find no appreciable lesion but great absorption of the fatty tissues & smallness of the muscular + other structures. In fact general atrophy. This is supported also by the facts of scientific investigations as to the development of young animals through their various stages. Melan Edwards showed that tad-poles placed at the bottom of the Nile in total darkness remained tad-poles, but upon exposure to light their progressive development began. Plants in darkness do not eliminate their colour - i.e. the skin of man is subject to variety in the deposit of pigment. According to the
effects of light. But besides this peculiar power of light, we believe it to exercise a beneficial influence upon the atmosphere, a something independent of the seed with which it is more or less associated. Dr. Edmittel says sunlight is undoubtedly powerful in sustaining vital action, but in some of our experiments we proved that it increases the morning pulsation 10 or 12 beats per minute. Hence the absence of it at the period when the greatest vital action is required, must be one of the elements of injury. Males from childhood upwards excrete more Carbonic acid than females. This influence of sex has been found to be equally well marked in man and the lower animals. Sidder & Schmidt found that fat animals excrete far less bile than lean ones. They also excrete less Carbonic acid.

It follows from numerous experiments that food may be divided into two class viz. those which excite certain respiratory changes. Excito-respiratory & those which do not. The excito-respiratory are nitrogenous foods: milk, its components, eggs, human beer, short the Cereals & potato. The non-exciters are starch, fat, certain alcoholic compounds, the volatile elements of wines, & spirits & Coffee beans. 2°. Of the hydro-Carbons.
fine starch exerts but an insignificant influence over -
the increase of Carbonic acid, t the addition of fat is rarely
food lepers, rather than increases the influence of the
latter; fats as Olive + Cod liver oil taken alone diminishes
the respiratory Changes; while Sugar in every form is a pow-
erful respiratory excitant. The quantity of food also exercises
an influence on the execution of Carbon.
It is a common + doubtless a truthful remark, that the
study of the mind of learning is as fatiguing as is the labour of
the handi-craftsman, t the only difficulty is to ascertain in
what way this occurs. The indirect action of mental
labour upon the health of the system t in inducing a
sense of fatigue is very well known. The Con-train-
sed posture for a lengthened period, whether from sitting in
the Chair at home or in the Railway Carriage, will
induce fatigue. The want of the muscular exertion which
sustains the Current of blood t increases vital action;
the want of movement in the surrounding Air; the
less pure Condition of the inspired Air; the higher tem-
perature t the increased light of the Sitting room are
all surely as many Causes tending to lessen vital action,
t to lower the degree of health of the body. But al-
these, will be far from increasing certainly lessen the
amount of Wheat + Carbon evolved t of food ingested.
the effect of mental labour has its remedy in bod-
by exertion in the open air, which will increase the vital action, the appetite, & the exertion of area.

Now since we find that owing to the absorption of oxygen by the builing of poisonous fumes & effete matter that it is necessary for preserving health to provide for an adequate amount of the former & remove the latter, how much more necessary must it be in disease, where deprived vital action. Consequently, already prevents the elimination of pent-up dead matter while the emanations that do proceed from the sick bed is in a stagnant atmosphere. Must have a vile reaction on the patient & be thoroughly injurious to those about him. The first duty then of a medical officer is to maintain to place his patient under all the true hygienic conditions, but especially that of free pure vital air which every moment is essential to keep the sparks of life from flickering out. for how often do we not see in our hospitals, particularly where the organs of this function are the heart of brain, the best devised plans of treatment & the greatest scientific knowledge of no avail then very often becomes the true hygienic conditions are wanting. Do not our most experienced doctors admit this - Our arterialization of the blood is
familiar as a physiological doctrine but it has not been sufficiently considered by Physicians in relation to the prevention or treatment of disease—by it the Blood circulated more freely in the Capillaries which Haller called the drawing of blood to a point. Halley also showed the use and value of the Blood’s arterial circulation. We have no doubt but that proper exercise of the respiratory organs with other hygienic agents would not wholly remedy greatly aid in its doing, the condition of Chlorotic Blood. We are well aware of the effects of Venous Blood upon the Brain; hence the origin of many diseases of Nervous Depressions that Vital Stimulus when functionally deranged influence the whole Economy. Producing in some Constitutions dyspepsia & its sequels in others Convulsions, hysteria & hypochondriasis. Knowing these things I Commanding this function as we do to a great extent, both in the quality & amount of which is inspired we are bound to take every advantage which this important powers can afford us for the relief of disease.
Dr. Southwood Smith, in his lectures upon epidemics, lays down 5 conditions as essential to civilization. I show how utterly they were lost at thought at the period of the ‘Great Mortality’; I in great part down to the 16th century. There are: 'Sovereign authority; laws incorruptibly administered; physical comfort generally diffused; intellectual development & activity generally diffused; re-cognition of the fundamental principles of religion & morality. But at the period in question, the king was nearly powerless; the barons were tyrannical; violence, bloodshed, & robbery were universal; two thirds of the country were Moor, forest or bush swamps; the houses were small & square, built of wood, mud, or wattle, thatched with straw. Without chimneys or conveniences: the floors without boards or bricks, covered with straw or hay, which remained for months saturated with reeking filth; the streets were narrow, tortuous, unpaved, with uncleaned gutters, covered with filth & garbage; the towns were surrounded with stinking ditches; there were few fruits, vegetables; the meat was salted throughout the winter; the cattle were without store of fodder; the roads throughout the country were unpaved, almost impassable; there was a lack of fuel amongst the poor; intemperance & obscenity were almost universal.
And now we come to our third practical deduction from the truths connected with the chemistry of the respiratory process, viz. the principles of Ventilation, regarding a pure atmosphere as the primary essential of all hygienic agents. Now the average composition of the atmosphere is of oxygen 20.61 per cent., N. 77.95, CO₂ 0.04, Water 1.40 g. NO₅, NH₃, CH₃ & other traces. In town air we find also traces of Sulphuretted Hydrogen, Sulphurous acid, Organic matters. Leaving out of consideration, exhalation & evaporation from the skin, the lungs return the oxygen in expired air about 0.85 to 16 volume of CO₂ in expired air. One seventh to the atmosphere chemically united with carbon; its volume is greater than the inspiration partly on account of increase of temperature (97.2° to 99.5°), partly owing to its being saturated with moisture. The quantity of this aqueous vapour being according to Valentin about 14.8% in 24 hours. Virchow found it about 11%. Recent investigations show there is a small excretion of Nitrogen, a portion of which occurs in the air. 10% expired air under the form of Ammonia, but it is believed that NO is often absorbed as in disease. Cannibalism - hyperventilation to volatile matters may also be expired according to the nature of the food we -
alcohol, phosphorous, camphor, ethereal oils, etc. and hydro-
peroxide of proto-carburetted hydrogen. The dry gas accor-
ding to Reynolds & Reid is revived even in normal respira-

The have seen how the Carbon of the body is con-
verted into CO₂ in the varied circumstances which
cause its increase or diminution. 18 grs. only being e-
dminated per minute, walking at the rate of 2 miles
an hour while at the rate of 3 miles it is increased
to 2.6 grs. and about 4 or 5 grs. only given off at 9 a.m.
during sleep. An average man produces 14.000 grs.
of CO₂ per day, but when working he expires 18.500 grs.
per day.

Physiologists tell us that 1 per cent of CO₂ in our
breathing atmosphere would be quite intolerable
for any length of time, hence the obvious necessity
of exercising every caution to prevent self poising,
intervention of disease & death by taking in this effec-

Tissue along with other noxious exhalations, or what
amounts to the same, by preventing the true elimin-
ation of the burnt up species which, nature is
temperature & constant in her demands that there
shall be no inflation, what at one moment
was indeed the elixir of life now the next became
the messenger of pestilence or insidious death.
When then the atmosphere has become impregnated with the presence of the oxides of Carbon, or when the amount of aqueous vapour is too large or too small or when organic effluvia is present from increased temperature, emanations from the deceased—the then ventilation is urgently demanded, by which must be made perfect in its means that the free pure air of heaven may rapidly circulate, and sweep away to the forests the poison of to-day to become the food of to-morrow— even as the foaming being wave is the deep rolling ocean current rushing through our seas and channels to chase and chase our Albion shores. Now to this effect we must first have an excess of air necessary to carry off these oxides and other poisonous effluvia matters of Mr. Hobbs when he investigated this matter found that 20 cubic feet per minute for each man was the least quantity that could be supplied with safety to health. It is not sufficient for health that a room or other place of Congregation of animals should contain the quantity of air requisite for the respiration of its inhabitants during a given time, since long before
its exhaustion it will contain a quantity of Carbonic acid sufficient to interfere with the necessary excretion from the blood. Hence the headache and other symptoms often experienced in breathing confined air.

The manner in which oxygen is absorbed and Carbonic acid given off, seems only to the physical law described by Professor Graham with respect to diffusion of gases; the quantity of the former which enters being greater than the latter which passes out.—The value and importance of this rapid diffusion is readily understood, when we consider what would be the result were this wide provision not afforded whenever a number of animals congregated together. Heat we doubt aids this by causing currents for Carbonic acid has been found mid the air of the high Alps, hence why crowded theatres, halls, saloons and other places can be so long tolerated by the system. Though even this has dire effects, slow but sure undermining of the whole functions of the system whose wheels become stopped by its own debris. The general debility, apathy, loss of consciousness, nervous depression mark the dangers of an imperfect or neglected ventilation. The clap of Aethiotic fevers springing up, become epidemic and spread death far and wide over the city, district, even too often over a whole nation.
Now besides the immediate dangers involved to the individual by the imperfection or neglect of our sanitary conditions, there is a grand moral truth in the matter—a law which should never be transgressed if we wish to maintain our true social relations, our duty to our neighbours. How far can a man injure himself without injuring that law of justice? We answer in no method, to no extent whatever, for the health and well-being of the individual is the wealth of the body politic.

But again, through physical causes can be brought about physical effects. Let us forget that we are linked to this earth by a material bond; reflect the laws revealed regarding that matter; the result is that the mind of the man becomes degraded.

The "sana mentis in corpore" may have its exceptions, but generally it holds true. There is an intimate relation between mind and matter. The blending of the corporeal with the spiritual; however high we would soar into the regions of the infinite, we must ever remember the mutual reaction that exists between them, that any violation of the laws of the one will affect the other to the detriment of both. It is our duty as Physicians and Officers of health to investigate and study those laws and to ex-
Let us then learn to elevate the man by making good his physical conditions, in order that his cultivated life of the pure and good may lead him to aspire to a higher platform, even that spiritual purity whose light speaks not only, but shines the more and more until the perfect day.

The flowers may stand, the trees may bloom,
Yet time their strength will bear.

[Further text not legible]