A

PHILOSOPHICAL and EXPERIMENTAL

# ENQUIRY

INTO THE

## First and general PRINCIPLES of animal and vegetable Life:

LIKEWISE INTO

## ATMOSPHERICAL AIR;

WITH A

Minute Investigation of the different secondary Principles attendant upon each: Viz.

Animal Heat, Sanguification, animal Moisture, Age, Temperament, &c. &c. &c.

WITH A

Refutation of Dr. PRIESTLEY's Doctrine of Air:

Proving, by Experiment, that the Breathing of Animals, Putrefaction, &c. do not phlogisticate, but dephlogisticate the Air; and that the office of that essential Organ the Lungs is not to discharge Phlogiston to the Air, but to receive it from the Air.

*Corporis animique sanitatem cum philosophiæ studio, conjunctam cæteris vitæ bonis anticellere.*

By ROBERT HARRINGTON,

OF THE CORPORATION OF SURGEONS, LONDON.

LONDON:

PRINTED FOR T. CADELL, STRAND.

M.DCC.LXXXI.

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THE

# PREFACE.

IT requires the greateſt fortitude and reſolution for a young author to launch into the great literary world; and there to have his opinion canvaſſed by this learned age, particularly when his doctrine is intended, in ſome points, to refute the greateſt philoſophers that have wrote before him, and when he endeavours to elucidate ſome great points of knowledge, in which ſuch great men have failed; but every man, in his ſearch after philoſophy, if a thought ſtrikes him, which, upon being accurately inveſti-

gated philoſophically and experimentally, carries the fair outmarks of truth, he neither acquits himſelf to the public, nor to his own merit, if, with proper confidency and modeſty, he does not give it to the impartial public, there to be canvaſſed, whether it is to live or die. It is incumbent upon every one to ſearch; and it is equally as incumbent, after they have ſearched, to impart their obſervations and diſcoveries to the world; that, even if they have not been ſucceſsful in accompliſhing their purſuit, yet it may ſtill be of ſervice to others, to avoid their miſtakes; and, out of the variety of circumſtances, they may always cull ſomething uſeful. In any great diſcovery, many unſucceſsful attempts muſt be made before it is elucidated; but every attempt may diſcover ſomething neceſſary towards attaining a knowledge of it.

The

The following ſheets I have the greateſt right to give to the public; for I have entirely launched into an extenſive field of new matter: no philoſopher have I followed, but eſtabliſhed a new ſyſtem of my own, entirely originating with myſelf. And it is not a confined one of any little phænomena of nature, but a general and extenſive one, comprehending her whole principles of animal and vegetable life. I have likewiſe given a thorough inveſtigation of atmoſpherical air; ſhewing what a neceſſary agent it is to life; nay even elucidating its own life; the inveſtigation of air being now a univerſal purſuit with philoſophers; but I preſume they have got into errors which muſt ſhackle their progreſs, we differing in ſome very eſſential points; but where the error lies, is left to the impartial public.

The

The nobleſt purſuit that mankind can be employed in, next to religion, is certainly the inveſtigation of nature; particularly that part which belongs to the human ſpecies. What character is there that deſerves to be revered with more exalted dignity than Sir Iſaac Newton's? I have endeavoured not to obſcure my doctrine with technical terms, but to write in a plain, obvious, and eaſy ſtile, adapted as well for the philoſopher as the phyſician; nay, I hope any one who is in the leaſt acquainted with ſuch enquiries, will be able fully to comprehend it; and certainly ſo great and eſſential an enquiry is as incumbent upon the gentleman to know, as the profeſſed philoſopher. Every man ought to have a knowledge of the principles of life, in order to guard and protect his own; it will give him a general idea of the principles of medicine, and enable him with his own obſervations and feelings, to regulate his

own

own health: agreeable to the old adage, every man is a fool or physician at forty; for there are certain peculiarities of constitution which every man has, and which, by attention, he will be able to discover within himself; aided with a knowledge of the principles of life, he may be able to make the most useful and shrewdest observations; and thereby avoid the impositions of any presuming empirick: likewise, by knowing the principles of his life in that extended view, he will not be so fond of quacking himself; the medicines he does prescribe and take, will be upon a more liberal plan.

This whole system, as I now offer it to the world, I had ready for publication above four ago, and at that time waited upon Mr. Cadell, in order to publish it; but was called into the country, where I have been ever since: and from other circumstances taking up my attention, I had entirely neglected it.

A young

A young man, when he takes up ſo learned and extenſive a ſubject, and when he has to combat with the opinions of the greateſt men, requires a deal of reſolution; but I hope my readers will give an impartial canvas. It is a work of indefatigable labor, where you are to build a ſyſtem of your own; a ſyſtem which comprehends all the different ſciences, viz. natural philoſophy, anatomy, phyſic, chymiſtry, mathematics, &c. and not only to be well acquainted with theſe, but even to correct their errors, and make new improvements in each; otherwiſe I could not have eſtabliſhed this extenſive doctrine. And to do all this myſelf, without having any perſon to aſſiſt me, or to aſk a ſingle queſtion of; being tenacious about diſcovering any part; having from experience in one or two inſtances found my confidence betrayed, in my philoſophical enquiries.

Dr.

Dr. WASDALE, whom I ſhall ever revere and eſteem, and whoſe integrity, worth, and kind friendſhip I ſhall ever bear a grateful remembrance of, was the only perſon to whom I read it, about four or five years ago, truly ſenſible of his judgement and confidence.

In the great hurry I have publiſhed, having come upwards of three hundred miles, and being under the neceſſity to return immediately, the errors, typographical and others, &c. will, I hope, be candidly paſſed over; and the great variety of matter and ſubject I have made uſe of, being ſo very extenſive, (attending only to the great and general ſubject,) I could not give them that nice inveſtigation requiſite; but, being the production of a young author, I flatter myſelf I ſhall have an impartial inveſtigation; and, with ſuch a pleaſing reflection, I reſt contented.

AN

# AN ENQUIRY INTO THE FIRST AND GENERAL PRINCIPLES OF LIFE.

THE most essential consideration, next to the health of the soul, is that of the body. The latter, I may justly affirm, is the principal origin of all our griefs; for no enjoyment can take place without health; and with it, the greatest misfortunes may be overcome. And that man's happiness (in a general rule) will always be found to be the largest, who enjoys most health: as the mind always sympathizes strongly with the body, therefore he whose health is most perfect, will have a mind most content.

Then as health is so essential to the happiness of mankind, how careful ought individuals to be in the preservation of it; and likewise the Physician, to whom it is intrusted,

ought to be a man of the moſt liberal and extenſive knowledge and principles; ſuch formerly they were, men exalted by the gifts of nature: but now the profeſſion has got into ſuch a variety of hands, that it is a mere trade, hackneyed by intereſt, being too often practiſed by thoſe who have little pretenſion either to knowledge or principle; whoſe conduct has hurt the profeſſion in the eye of the world; but nevertheleſs there are ſome of the greateſt characters ſtill at the head of the profeſſion.

It certainly is one of the moſt noble and intereſting characters, and ought to be held only by men of the moſt acute, penetrating, and extenſive judgment; being able to pry into the miſteries and intricacies of nature; anxiouſly to attend to every minute ſymptom, marking diſtinctly each of her ſteps, then abſtractedly to weigh every circumſtance, giving each its due balance, and from thence to form his judgment.

But not with an extravagancy of imagination, from a light ſymptom, to build imaginary whims, bantlings of the brain, forcing reaſon to their nurture: nor on the other hand to be entirely emperical, preſcribing upon the principles of an old woman's knowledge; ſuch a diſorder requires ſuch a remedy.

The

The variety of diſeaſes are ſo numerous, the variety of conſtitutions ſo different, that an empiric muſt be in a continual maze; often ordering the ſame remedies for oppoſite diſeaſes. But he ought to mark, with a keen, tenacious, and philoſophical eye, every ſtage of the diſeaſe, and every operation of his medicine.

On the other hand, the dogmatiſt is equally, nay often more dangerous; for I have ſometimes obſerved the father of the whimſical capricious bantling, ardently labour, at the expence of his reaſon, nay ſometimes his veracity, to make it leading-ſtrings, (anxious of oſtentation) :— the greateſt part of his hearers, or readers, being thoſe whoſe faculties are not the brighteſt, readily ſwallow all, looking upon the author as a man of ſuperior knowledge, and that each fact is correctly ſtated; and then only catching half of his meaning, each builds his peculiar theory upon it; and kills and ſlays unmercifully upon its flimzy authority.

But as health is the greateſt bleſſing, and as life is the firſt-impelling inſtinct, each character who takes upon him to be their guardian, ought to be aſſiduous and attentive to his education and practice. But it particularly behoves the world to be careful into

whose hands they expose their lives: it ought only to be into the care of men of learning and liberality.

Man is endowed with faculties of reason, great above the sensual which characterize other animals; and the grandest purposes of employing those, are, by investigating Nature, (there beholding the wise dispensations and omnipotence of God) particularly that part which not only exalts our species above the other part of the creation, feeding the most refined appetite in beholding the beauties of Nature; but likewise that part, which, immediately, is beneficial and useful in the preservation of the species.

Therefore, there is no doctrine which ought to actuate the researches of man so much, as the investigation of himself, being the most refined part of the creation.—As the Poet says,

The proper study of mankind is Man.

I hope I have satisfactorily made appear, that there is no Doctrine which is so noble or so useful, as the investigation of natural philosophy, particularly the most refined part of it, viz. man; to be able to alleviate his greatest misfortune, disease.

Philo-

Philoſophy in this century has greatly extended her ground; but there are many bars which are eſſentially neceſſary to be ſurmounted for her further progreſs, and which have kept our knowledge greatly in the dark, particularly that part of ſcience which relates to medicine; for the firſt and moſt eſſential principles of life, viz. animal heat, ſanguification, and animalization, have never yet been explained.

They have often been attempted, but upon ſuch trifling grounds, as neither philoſophy, nor common ſenſe have juſtified: The authors of theſe opinions have only ſhewed an anxiety and deſire to explain, and juſt gueſſed at the moſt ſuperficial circumſtances; being men great in other parts of knowledge; they thought it a duty incumbent to lay open every part of nature, which related to the human ſyſtem, at leaſt to attempt it. But knowledge is often the reſult of chance, ſpringing from thoſe who leaſt ſeek for it.

In Nature we find three diſtinct genera, which philoſophers have defined by the names of animal, vegetable and mineral; each genus having its proper link in the great ſyſtem of Nature, there being a regular gradation from one to another; and by an accurate in-

veſtigator, the chain may be purſued from man, the firſt of animals, to the moſt imperfect, unorganized mineral. This may be thought more a philoſophical declamation, than founded in truth; but every naturaliſt, who rationally and philoſophically contemplates upon it, will find it ſo: therefore no one can directly draw the line between each kingdom, they ſo imperceptibly run into one another; there being many bodies which partake of the properties of two kingdoms; that is, either of the animal and vegetable kingdoms, or vegetable and mineral kingdoms.

The general rule by which I define the animal kingdom, from the vegetable, is—the former poſſeſſing two obvious qualities, viz. animal heat, or a temperature above the heat of the other part of the creation around it; likewiſe a loco-motive power. There will be found ſome exceptions to this general rule, (but they are very few) owing to the gradation of theſe two genera into each other; which hinders a direct and general character being drawn, without an exception.

Therefore, as animal life is particularly characterized by having a principle or power peculiar to itſelf, viz. of raiſing its temperature above the incumbent atmoſphere, and other bodies

bodies around it, which power the other genera have not; hence this power of animal heat immediately ſtrikes one, as being the grand ſtep to be purſued towards the inveſtigation of animal life, to know its great principles; particularly as this heat marks the diſtinction between thoſe two great genera, the animal and vegetable world.

This animal heat, is not only the ſtrongeſt characteriſtic by which it differs from the vegetable and mineral kingdoms; but likewiſe the life of the animal immediately reſts upon it; for death is the conſequence of a deprivation of this animal heat; and as death approaches, in the ſame gradation does the heat diminiſh. So immediately is life depending upon this great principle, that the leaſt deviation from the point 96 (of Fahrenheit's thermometer) implies diſeaſe; that point being the phyſician's firſt guide.

Therefore as heat is ſo neceſſary a principle in the human ſyſtem, it immediately becomes the object of the phyſician, to enquire into its cauſes and effects. We ſee its wonderful reſtorative power, in the means made uſe of to recover people who are apparently drowned; for all the late medical improvements center in this; an endeavour to reſtore the exhauſted animal heat.

Their first principles of conduct are, in keeping the body extremely warm, by artificial heat, by strong frictions, application of warm spirits, externally and internally, and imitating respiration; all of which evidently tend to restoring the deprived animal heat: and so great is their influence and power, that there are many instances, well attested, where the animal, after having laid some hours in water, has by those means got its life renewed, or revivified.—What stronger proofs can we relate, to shew the nobleness of our doctrine?

The known advantages of the discovery of its great principles; have struck the first physicians with the enquiry, and a number of different hypotheses have been framed; for certainly an elucidation of this great doctrine will give greater light into animal life, than any other of the human system, which has ever been delivered before. Indeed, most of them have shewn a greater wildness of invention, than strength of reason; the imagination having been greatly exerted, forming various opinions, which we shall, I hope, candidly canvass.—Boerhaave's opinion, as being the most respectable authority, shall first come under our investigation.

Boer-

Boerhaave is of opinion, that the lungs are the authors of ſanguification, upon the principles of mechanical force; by the action of the elaſticity of the air, and the force of the impelling heart, and reſiſting arteries; whoſe joint influence, preſs, agitate, propel, grind, and diſſolve (uſing his own terms) the blood and chyle.

Firſt, Let us inquire, if ſuch mechanical powers do exiſt.

Secondly, If ſuch mechanical powers are demanded for ſanguification.

Thirdly, If theſe mechanical powers are the entire uſe of the lungs, being ſo compatible with life, that a ceſſation of this mechanical preſſure will extinguiſh life in five minutes; that being really the caſe when the lungs ceaſe to act.

Fourthly, If the air, from its elaſticity, produces this great force, which Boerhaave ſpeaks of.

Fifthly, If there is ſuch a configuration of the red globules (which Boerhaave aſſerts) viz. that they are compounded of ſix of the yellow globules; and thoſe to conſiſt of ſix of the lymph globules.

Sixthly,

Sixthly, If that theory will account for the different physical phænomena, viz. animal heat, accretion, and excretion, &c.

First inquiry, If such mechanical powers exist in the lungs. First then, let us enquire into Boerhaave's great and first power, which he supposed produces this great influence and force; which is the heart, that this great power is imputed to. But let us candidly investigate if such influence and force is justly assigned to it.

The heart is compounded of two ventricles, or muscular bags, each capable of containing about two ounces of blood; which blood they throw out into the adjoining vessels at every systole. This great organ the heart, gives the first mechanical impulse to the motion of the blood; being its first and great organ of motion in both its circulations: the blood having properly two grand channels; the first through the lungs, which fits it for the other; the great and general circulation, passing through the whole body indiscriminately.

As I before observed, the heart is the great author of the blood's motion; and likewise, that one circulation of the blood, is a very partial one, only through one of the viscera; while

while the other is general and extenſive; therefore all-great and wiſe provident Nature hath adapted the ſtrength of each ventricle to each particular circulation: that ventricle which ſends the blood through the lungs, having only a partial degree of blood and veſſels to act upon, comparatively with the other, is therefore conſtructed conſiderably weaker; while the other, the left ventricle, having to ſend the blood through the whole ſyſtem, is therefore conſiderably ſtronger.

Nature having conſtructed the ſtrength of each ventricle, to the reſiſting powers they have to overcome; therefore upon diſſection of each ventricle, you will find the left muſcular powers, which throw the blood through the general frame, conſiderably ſtronger than the right. Certainly then, if there was this mechanical preſſure (of which Boerhaave ſpeaks) acting upon the blood, it muſt receive it far more conſiderably through the general circulation, than through the partial one, the lungs; as the former's moving and reſiſting powers are moſt conſiderable Indeed, the rapidity of the blood's motion through the lungs, implies that the reſiſting powers there are conſiderably leſs, comparatively, than the reſiſting powers in the general circulation. For the moving powers, we have demonſtrated, are con-

considerably ſtronger in the general circulation, yet it moves conſiderably ſlower: which circumſtance, if Boerhaave had maturely conſidered, would entirely have deſtroyed his great doctrine of mechanical force in the lungs. Therefore, if the blood receives any ſtrong attrition, it receives it by far moſt conſiderably in its general circulation; being there expoſed to muſcular motion, which exceeds the preſſure of the heart and arteries, by many degrees; but it has none of this muſcular motion in the lungs. I think, with the utmoſt impartiality, we may candidly eſtimate the blood to receive fifty times more preſſure in its general circulation, than in its partial one through the lungs. Therefore Boerhaave is demonſtrably wrong in his firſt propoſition.

Second inquiry, if ſuch mechanical force is demanded for ſanguification.

All animals draw their ſubſiſtence, either primarily or ſecondarily, from the vegetable kingdom. The part of the vegetable which gives the nouriſhment, is univerſally allowed to be the farinaceous part; ſimilar to a lymph which we diſtinctly mark in animal blood.

This vegetable lymph, by being thrown through the lungs in the general circulation, becomes

becomes highly alkalescent; being formed into large red globules, considerably, (as Boerhaave acknowledges) larger than its particles or globules, when in its vegetable state. Then what man's idea of mechanical force, can suppose it, to give these properties, to make the blood globules so much larger. Force, applied in the manner which Boerhaave speaks of, with every reasonable man, must imply breaking down its globules, not increasing them, or building them up. But the gross supposition of its giving that alkalescent quality, that strong animal heat, that red colour, from an exertion of force; can be defended by no points of philosophy, that I have ever yet heard or read of.

Third inquiry, If this mechanical force, allowing it to take place, is the entire and sole use of the lungs, so compatible with life, that a cessation of this mechanical pressure will extinguish life in five minutes; which is really the case when the lungs cease to act.

This question, Boerhaave himself acknowledges in the negative. Indeed it appears so absurd, that I shall not attempt to refute it.

Fourth Inquiry, That the air acts by its elasticity.

This

This power in the air's action, Boerhaave lays a great ſtreſs upon; thinking that quality alone will account for the air's great influence upon the ſyſtem. For in one part of his works he triumphs, aſking the queſtion, If this is not the ſecret pabulum of the alchymiſts, ſo much ſought after? Then in other parts of his writings, that ſanguine thought is over-ruled by his reaſon; inſinuating that there muſt be ſome great quality in the air's operation upon the ſyſtem, which we are ſtrangers to; being ſtruck with this forcible argument, that when an animal is bereft of it, it is killed in five minutes.

Indeed, through all his theory of ſanguification, his judgement ſeems never to have directly aſſented to it. His arguments upon the doctrine, being very far from that perſpicuity which we obſerve in the reſt of his writings.

Yet his theory of animal heat, ſanguification, &c. is by far, in my humble opinion, the moſt rational and philoſophical of any that has been yet offered to the world; indeed all his works ſhew the ingenious philoſopher; which is not the caſe with many learned treatiſes that the world is loaded with; moſt of them being at direct enmity with common ſenſe.

But

But to our enquiry concerning this great elasticity of the air in the lungs: Air is a body capable of strong elasticity, and of being highly rarefied by the application of heat; proved very sensibly by a bladder only half filled with air, being held to the fire, becoming fully distended, almost immediately, by the air's expansibility; so strongly acts, that if the application be continued, the air will soon burst the bladder. But if you wound the coats of the bladder, forming a connection between the confined air, and the general atmosphere, the former's power of expansion upon the bladder is entirely taken off; which is a direct similar case to the air within the lungs; the connection there, of the air within and the air without, being still continued. If immediately upon the air's being inspired by the lungs, the glottis had forcibly shut, the natural temperature of the animal body being at 96 of Fahrenheit's thermometer, would have rarefied the inspired air, and so have made this wonderful compression which Boerhaave speaks of: yet to have been able to have done this, the tender air vesicles must have been a hundred times stronger than they really are, to have withstood this great, wonderful, mechanical force of expanded atmosphere. We all know that the blood's motion and circulation are immediately necessary to life, and must go forward; then what

what powers were there to move it, against this powerful elasticity of the air? Why, the weakest part of the heart, the right ventricle; which I have proved is universally allowed to be considerably weaker than the left. Yet the right ventricle has not only the resistance of the pulmonary arteries and veins to overcome, but likewise this immense elastic power of the air; whose powers, agreeable to Boerhaave, press, agitate, propel, grind, and dissolve the blood. Oh wonderful! To this theory there must be an addition, making a complaisant treaty between the elastic power of the air, and the muscular force of the heart; that upon the latter's action, the former would march away quietly out of the lungs; for it would be physically impossible for the poor heart to overcome this immense fabricated action of the air's elasticity. But we shall find, that if an animal holds in his breath ever so strongly, yet the heart shall still continue to propel the blood through the lungs, as it was wont to do; nay further, I do insist, that the air instead of impeding the blood's motion, greatly assists and promotes its free passage; for in the fœtus, the blood never circulates through the lungs, 'till the air has opened that passage, by being inspired into them.

Fifth

Fifth inquiry, If ſuch a configuration of the red globules (which Boerhaave ſpeaks of) takes place; viz. that they are compounded of ſix of the yellow globules, and thoſe yellow globules do conſiſt of ſix of the lymph or ſerous ones.

This is Lewenhoec's doctrine;—a man very eminent for his microſcopical obſervations. He built his opinion upon obſerving, that the red globules of the blood were conſiderably larger than any other part; from their appearing to him round; from their ocularly appearing occaſionally to be broke down into yellow globules; and from the received opinion, that all fluid particles were globular; and likewiſe from the principles of Mathematics, it is demonſtrated, that ſix ſpheres make the moſt perfect globe. Then let us enquire, if theſe circumſtances authorize the concluſion.

Firſt then, their being larger, we ſhall conſider.

That they appear larger to the eye than the reſt of the blood, no one can deny; but from that, there is no philoſophical argument to be drawn, that they are formed of ſix globules of the yellow part of the blood. But when I come

to ſpeak of my doctrine, I will ſhew why they put on that appearance.

The ſecond circumſtance which induced him to this opinion, was, their appearing to him round, when viewed with a microſcope; but in this he has been miſtaken; for the ingenious Mr. Hewſon has evidently and ſatisfactorily proved them to be flat, reſembling the form of a guinea:—He ſays,

"Theſe *particles of the blood*, improperly "called *Globules*, are in reality *flat bodies*; "Lewenhoec and others have allowed, that "in fiſh, and in the *amphibia*, they are flat and "elliptical, but in the human ſubject and in "quadrupeds, almoſt all microſcopical ob "ſervers have agreed in their being ſpherical. "When we conſider how many ingenious per- "ſons have been employed in examining the "blood with the beſt microſcopes, it will ap- "pear wonderful that the figure of theſe par- "ticles ſhould have been miſtaken; but our "wonder will be leſſened, when we conſider "how many obvious things are overlooked, "till our attention is very particularly di- "rected to them: and beſides the blood in the "human ſubject, and in quadrupeds, is ſo full "of theſe particles, that it is with great dif- "ficulty we can ſee them ſeparate, unleſs we "find

" find out a method of diluting the blood. It " is to ſuch a diſcovery, that I attribute my " ſucceſs in this inquiry; for having examined " the blood as it flows from the veſſels of the " human body, it appeared a confuſed maſs, " notwithſtanding I ſpread it thin on glaſs, or " a piece of talk. It then occurred to me to " dilute it, but not with water, for this I knew " diſſolved the particles, but with *ſerum*, in " which they remained undiſſolved. By the " *ſerum* I could dilute it to any degree, and " therefore could view the particles diſtinct " from each other; and in theſe experiments I " found, that theſe particles of the blood were " as flat as a guinea. I likewiſe obſerved, that " they had a dark ſpot in the middle, which " Father de la Torre took for a hole; but " upon a careful examination, I found it was " not a perforation, and therefore that they " were not annular. I next made experiments " by mixing theſe particulars with a variety of " other fluids, and examined them in many " different animals, and the reſult of theſe ex- " periments was, that their ſize is different in " different animals.

" It may not be improper to obſerve here, " that the accurate Lewenhoec, not having " diluted the human blood or that of quadru- " peds, ſo as to ſee theſe particles ſeparate

" from each other, was thence not qualified to
" describe them from his own observations, as
" he has done those of fish and of frogs, and
" suspecting a round figure was more fit for
" circulating in our vessels, was thence led to
" suppose these particles spherical in the hu-
" man subject. But I shall hereafter be able
" to shew from his own words, that it is not
" his observations, but his speculative opi-
" nions, or his theory, that differs from what I
" have discovered by these experiments."

The opinion that all fluid particles are globular, originated from the evident appearance of their fluidity, having such an easy motion; each particle appearing to move or roll over one another; likewise from the known principles of Mechanicks, that spheres have the easiest, smoothest, and quickest motion; from mercury or quicksilver appearing evidently globular. But our present knowledge of philosophy has taught us, that these appearances are fallacious; the doctrine of fluidity being most ingeniously discovered by the very eminent Dr. Black, Professor of Chemistry at Edinburgh; whose doctrine I shall take a cursory view of hereafter.

Lewenhoec's next argument, of the red globules appearing to be broke down into yel-
low

low ones, I ſhall hereafter explain upon different principles.

From ſix ſpherules, demonſtrable upon the principles of Mathematics, to make, when joined together, the moſt perfect globe; is no argument that the ſame configuration and union take place in the red globules; as I have juſt before quoted Hewſon, who proves that they are not globular, but reſemble the ſhape of a guinea.

The ſixth inquiry: If this theory of Boerhaave's mechanical preſſure will account for the different phyſical effects, viz. animal heat, accretion, and excretion.

That the lungs are the principal authors of animal heat, Boerhaave ſeems very determined in opinion; and his arguments ſeem to have ariſen *à priori*.

But his explanation how that heat is formed and conducted, is vague and inconcluſive. Allowing him his full extent of mechanical preſſure and force in the lungs, to really exiſt;—in what manner can we ſuppoſe that that preſſure can act, to produce ſuch a high temperature of continued heat? Smooth, pliant, watery bodies, being impelled againſt each other, with

ever ſuch a determined force, will not produce by any means this heat. Give a fluid a hundred times the preſſure and motion out of the ſyſtem, and ſee if any heat is the reſult: A vague argument indeed! But the other phyſical effects aſſigned to this doctrine of mechanical force, viz. accretion, and excretion, are ſtill more undetermined; in what manner force can give the blood theſe properties and effects, is a chaſm that no man's reaſoning can fill up.

But that the lungs are the authors of theſe properties and effects, ſeem demonſtrable; for not a ſingle drop of blood goes to the nouriſhment of any part of the ſyſtem, but what has firſt undergone that great and neceſſary circulation, through that grand viſcera. The coronary artery, which ſupplies the heart with nouriſhment, ſprings from the aorta, and goes back again to the heart. The lungs themſelves have their blood from the pulmonary vein, being of that blood which has juſt undergone the circulation through the lungs. But I will give you Boerhaave's own words upon the ſubject.

"The action of the lungs is therefore of greater moment in a healthy body, than that of any of the other viſcera; ſince there is no part

part of the whole that receives ſo much as a ſingle drop of arterial blood, 'till it has firſt been exquiſitely ſtrained through the lungs: It alſo appears that the whole maſs of juices in the body paſs through the lungs, in the ſame time that they compleat their circuit through all the other parts; ſo that while all the other viſcera receive only a ſmall portion of the blood, the lungs receive and tranſmit the whole maſs. Hence we diſcover the lungs to be the principal elaboratory of ſanguification, and for converting the chyle, which is all brought hither, into nutritious juices. In this organ, the whole maſs of juices receive that degree of fluidity and attenuation which fits them to circulate freely through all the ſmalleſt veſſels, and which they cannot receive in any other part: and it is therefore here chiefly that the blood and its juices, are prepared and fitted to make the ſeveral ſecretions, and to perform all the actions of life and health which depend on the efficacy of the fluids."

Such were the ſentiments of the great Boerhaave concerning the lungs. His judgement led him to ſee, that this noble organ ſerved the grandeſt purpoſes in the animal frame. He further adds,

"This obſervation holds true throughout all kinds of animals that have two ventricles in the heart, and breathe air into their lungs *like ourſelves*; even the blood of the whale kind of fiſh, that inhabit the frozen ſeas, is equally hot with ours, ſince they breathe: but theſe reptiles and amphibious creatures, which do not breathe, or have but one ventricle in the heart, have their blood near as cold as the element they inhabit."

Such circumſtances appeared to this great man, a ſtrenuous argument, for his opinion concerning the great office of the lungs; but when he came to philoſophize, and explain how nature conducted the operations of this viſcus, truth deſerted him, giving bent to a whimſical imagination.

Though he ſaw with greater penetration and perſpicuity, the functions and diſeaſes of the human ſyſtem, than moſt men; yet ſuch is the fallacy of human intellects, that the greateſt men are apt to be deceived. Upon this theory, he formed his great doctrine of lentor and viſcidity; making in the whole a moſt ingenious ſtructure; and yet we ſee upon what an uncertain foundation. This

ſhould

should teach physicians the restraining of their imagination.

But let us consider his doctrine further, doing it in a general way.

If the advantage the blood received in the lungs, was owing to its being compressed by the elastic power of the air; a man might artificially be kept alive, by having a large bladder fixed to his mouth; so large, as to contain more air than his lungs would hold; so that having inspired, some air would still be contained within the bladder; after his lungs had destroyed the natural elasticity of the air, and therefore agreeable to his doctrine, the elastic power of the air being destroyed, its compressive force would likewise be destroyed, and in consequence its vivifying power: But if artificial force was exerted upon the bladder, to make up for the destroyed elastic power of the air; life would still be conducted: artificially, the bladder might be compressed and relaxed alternately, imitating inspiration and expiration. Upon this mechanical plan, a person might live under water, by having a spring fixed to the bladder, to give this compression to the air within it alternately. But I suppose neither Boerhaave, nor his advocates, would like to risk their lives upon the experiment.

periment. He generouſly acknowledges, that he does not ſee, upon the principles of his theory, but that water might have been breathed to equal advantage.

If there required this great attrition betwixt the blood and its veſſels, which Boerhaave ſpeaks of, in order to diſſolve the groſſer parts into leſſer, the ſmaller compacted into larger, and the aſperities abraded from both; certainly all this would be done in the courſe of the circulation, and muſcular motion; where there are fifty times more mechanical force exerted upon the blood, than there is in the lungs. For if this great force really exiſted there, the tender air veſicles of the lungs would ſoon be abraded and lacerated.

But we obſerve this mechanical force received in the circulation through the general ſyſtem, along with the great muſcular motion, which the blood is there expoſed to; inſtead of aiding the lungs' action and power upon the blood; ſo alters its properties and powers, which it received from the lungs; that it requires a freſh paſſage through that viſcera, before it can fit it for the ſecond or general circulation through the ſyſtem.

I ſhould

I ſhould ſuppoſe that every one will allow, that life is ſupported in every animal, by the ſame principles: If any one ſhould offer to contradict it, I ſhall not think the contradiction worthy of being at any trouble in refuting.

Fiſh is an active vigorous animal, which poſſeſſes red blood; in general they have no lungs, and in conſequence can breathe no air: what makes their ſanguification then? where are their fluids compreſſed? As a diſſection of that ſpecies of animals, is elucidating and entertaining, I will enter upon it: I ſhall quote *Boerhaave*, who ſays,

" In fiſh, the heart lies in the head, in a ſort of bag, with only one cavity or ventricle. A kind of ſacculus receives the blood from the vein below, which is inſtead of a cava in fiſh; which ſacculus contracts, and conveys it to the heart above, which next contracts, and propels the blood into an artery or aorta; the firſt branch of which goes to the viſcera; and the next dividing into two, ſends one of them to the bronchia or gills, which are cartilages dividing into a multitude of arches, under the lower jaw; upon every one of which are extended branches of this artery, in a reticular diſpoſition:—theſe gills in fiſh, are conſtantly

and

moving, both above and under water; in the manner of lungs, whose office they supply."

That the gills are the lungs of the animal, where their sanguification is performed, every philosopher will allow; but then there is no compression here; the gills only gently move up and down, merely, with this evident intention in Nature, to make a new application of some fresh water; which certainly conveys something similar to the animal that air does. But what that vivifying principle is, we shall consider hereafter.

In the hatching of the chick from the egg, the only thing demanded is an application of heat, which vivifies the egg: this heat may be either the animal heat of the mother, or an artificial application of it in any other way. It acts by forming sanguification, first in the *punctum saliens*; which shews itself by a little red speck in that part of the egg. There is no mechanical force or compression exerted here in vivifying the egg. Indeed Boerhaave himself acknowledges, that this question, how the egg is animated, (upon the principles of his theory) is most difficult to solve; not even attempting to answer it.

But

But indeed all the boasted calculations of Pitcairn and Keill, the great authors of mechanical force, which they say is exerted upon the different organs of the system; express more a knowledge of a wooden man, than that great, noble, and divine machine, the human system; it being wooden doctrine indeed!

But how weak-sighted man is liable to err, is demonstrated by the different theories of digestion, which have been given to the world: One making the stomach a stew-pot, where the aliment is digested on the same principles, that the meat is cooked upon the fire; by being actually broke down by the direct force of the fire. Another great theorist, finding that his predecessor was wrong, for that the stomach would also be stewed, as well as the aliment; therefore stewing could not be the process of digestion, founded a new theory; that the stomach secreted a liquor, something similar to oil of vitriol; which digested the aliment by its great dissolving power. A third reflecting that the corroding power of this liquor was such, that it would act implicitly upon all the viscera; they likewise would be in danger of being digested; therefore he planned a new doctrine, drawn from the muscular stomach of birds; and as muscular action was plainly demonstrated there, he thought the same took

place

place in the human ſyſtem; and that our ſtomach performed its office, upon much the ſame principle as a mill grinds corn; and from his known laws of mechanics, that little hard bodies being thrown into the ſtomach, muſt aſſiſt the grinding office of the ſtomach, by producing a greater attrition; and from analogy, birds naturally ſwallowing little ſtones, to aſſiſt their digeſtive organs: therefore his theory directed our ſpecies to do the ſame; and from being a perſon of authority in the medical world, it was received; and patients were ordered to ſwallow hard bodies; whoſe refractory qualities not being to be digeſted by the ſtomach, often cauſed obſtructions in the inteſtines, and produced death.

Indeed the mechanical idea of ſanguification, when accurately inveſtigated, ſeems equally as fallacious: I having no occaſion ſo anxiouſly to combat it, but from its being the doctrine of that great maſter Boerhaave; and certainly his authority deſerves the moſt ſerious refutation, and conſideration.

The air's paſſage into the lungs is nothing more or leſs, in its compreſſing power, than taking a bladder, pulling up its ſides to admit the atmoſpheric air, and then letting the ſides collapſe again, which will force out the air by their

their own gravity. The compreſſion of one hundred pounds, which Boerhaave ſpeaks of upon Keill's authority, would lacerate the tender air veſicles in a hundred places: they being, agreeable to his own words, ten times thinner than writing paper: a thin, lax membrane, which, upon diſſection, contradicts the ſuppoſition of any great compreſſing force being exerted upon it; for if there was, it would take on a hard tough membranous appearance, ſimilar to the appearance of all membranes which are ſtrongly acted upon. But I do poſitively aſſert, that there are no membranes in the whole ſyſtem, which are compreſſed with the force, that Boerhaave ſays is exerted in the lungs. What ſhould confine the air from ruſhing out again, if it acted with that prodigious force? We obſerve no power in the conſtriction of the glottis, nor any part of the larynx; they being conſtructed of a cartilaginous ſubſtance; expreſſing this evident intention in Nature, to hinder it from cloſing, that the air may have a free paſſage, both in its entrance and exit.

We know very well, that the air within, balances the air without; demonſtrated from our bodies being free from the weight of the atmoſphere; and even in cavities it is the ſame: for if, from whatſoever cauſe, the air

paſſes

passes into any cavity of the body, naturally closed; it does not lacerate and tear that cavity, or express the least weight upon it: For example, observe the womb after delivery; a viscus that is naturally closed from the air's influence; yet after delivery, when the air has a free access, it compresses it not; for if it did in the least, at that time the organ has such sensibility, from its exertion in the expulsion of the child, that it would certainly feel it, and receive injury from it. Indeed, when we have the appearance or sensation of weight upon the system, it is from the opposite cause; from the air's being lighter than usual; observable in damp weather, when the mercury in the barometer is lowest.

In a wound of the muscular substance, we observe the most tender filaments stand erect; which would not be the case, if they had to bear the weight of the atmosphere, it being so considerable. Nature shews such a sensibility and injury from preternatural compressions, that the least force acting constantly, will destroy the hardest bones; exemplified in an aneurism in the thorax, destroying totally the breast-bone from compressing it.

I should hope the candid reader is sufficiently satisfied with the solidity of my arguments; I pre-

ſume the refutation has appeared all along ſo obvious, that I muſt have exerciſed his patience, ſpinning it out ſo long. But I ſhall apologize upon the conſideration of whoſe authority I am refuting.

Two great intentions of this treatiſe are, to explain the doctrine of animal heat, and ſanguification; they being the baſis of the knowledge of the ſyſtem, and of medicine: for till they are elucidated, our medical knowledge muſt be empirical, and greatly confined. Boerhaave, ſenſible of their conſequence in extending our knowledge, undertook the inveſtigation, and upon his theory, reſulting from thoſe reſearches, he built the ground-work of his medical practice, which we have endeavoured to prove is fallacious. There has been another theory offered to the world, to explain animal heat only; not endeavouring to prove, or throw the leaſt light upon ſanguification; which we ſhall next take under conſideration. Who firſt hatched it, and gave it to the world, I am a ſtranger to; but however, it is mentioned as one of the doctrines of the day.

This ſecond doctrine, which we ſhall next conſider, only relates to the explanation of animal heat. As it is in this quality that animals differ from the other part of the creation,

being capable of generating heat, *sui generis*; and as the life of the animal so immediately rests upon it, it has exercised men's judgment; and various hypothesis have been framed about it. The one I am now going to examine, is the supposition, that it is the effect of putrefaction in the animal system.

Their first argument, that they draw their conclusion from, is an opinion, that an animal body is in a constant state and tendency to putrify, some part of it constantly entering into that state, and being evacuated by the different excretions.

Secondly, they observe from analogy, that vegetable and animal bodies, when under a state of putrefaction, generate heat.

Let us consider their first argument, that an animal body is in a constant tendency to putrify; some part of it constantly entering into that state, and being evacuated by the different excretions.

Let us define what putrefaction implies.—Putrefaction is a state of dissolution in a body's component parts, being broke down, and taking on a different form and quality; strongly characterized by fetor: and likewise its matter

matter acting as a yeast or ferment to the dissolution or putrefaction of other bodies.

Now let us see if such a state of putrefaction takes place in a healthy living animal.

Nature has formed every living body, both the vegetable and animal, in a constant state of necessity, to have a fresh supply of matter; one evident cause for this repeated supply of fresh materials, is the natural abrasion and wearing down, from the motion which is constantly taking place in living bodies; and we know a constant attrition, the consequent effects of motion, will wear down the hardest bodies. Then it is not at all wonderful, that it should have this effect upon the animal system; as the constant motion of every minute fibre is still going on, and a circulation of every fluid particle: therefore, from the known principles of mechanics, there must be an abrasion or wearing of the animal fibres; being compounded of soft parts easily abraded; which after being set loose, are discharged by the different excretions. But let us enquire, whether these excretions partake of the principles of putrefaction.

The principal excretions of the system are, perspiration and sweat; next to these, urine, saliva, and likewise lesser ones, not worth taking

notice of. That by ſtool I do not mention, as being the rejected part of the aliment mixed with the bile, pancreatic juice, and mucous of the inteſtines; all which animal juices, I preſume no one will ſay are thrown out as being the excrements of the animal; and the refuſe of the food cannot be called part of the animal, as it never entered the circulation. Therefore perſpiration, ſweat, urine, ſaliva, &c. are the principal excretions, all of which we have in our power ocularly to examine; then let us ſee if their compoſition comes under our definition of putrefaction; which is a diſſolution in a body's component parts, being broke down, and taking on a different form and quality, ſtrongly characterized by fetor; and likewiſe its matter acting as a ferment or yeaſt, to the diſſolution and putrefaction of other bodies,

In perſpiration and urine, we obſerve no diſſolution of their parts, till they have been a long time expoſed to the air; and we know that time and air will putrefy the firmeſt bodies) they will ſtill retain their properties and qualities: after ſtanding ſome time, they generally will depoſit a mucous, which they kept ſoluted, from the heat which they received from the temperature of the body; but after loſing that heat, there will be a ſmall ſubſidium;

dium; and if that ſubſidium be examined, it will not be highly putrefactive. As to the fetor reſulting from thoſe animal excretions of perſpiration and urine; it is by no means ſuch a one as ſprings from animal putrefaction: but is ſimilar to a ſmell, which we obſerve proceeds from the different internal parts of the animal; nor will its matter act as a ferment. Put meat along with urine, and you will find it act as an antiſeptick; it being principally compounded of ſtrong volatile ſalts, viz. ſal ammoniac, &c. which we know to have an antiſeptick quality. If putrefaction took place ſo ſenſibly in the ſyſtem, every living animal would ſmell like a cadaverous ſubſtance. But let a man put only ten grains of putrid fleſh in his pocket, and he will ſoon be *noſed*, as Hamlet pathetically calls it.

But even to allow them their firſt propoſition, that there is a putrefactive ferment conſtantly taking place in the ſyſtem, being evacuated as generated by the excretions; let us ſee if their ſecond propoſition would even then evince their doctrine.

Which ſecond propoſition is, that they obſerve from analogy, that vegetable and animal putrefaction generate heat.

I believe their fact in respect of animal putrefaction generating heat, will be greatly doubted. The ingenious Mr. Beaumé candidly declares, from his own experiments and observations, that animal bodies generate no heat in their putrefactive state. Dr. Pearson, in his ingenious thesis upon the principles of animal putrefaction, declares the same. I myself have examined many whole putrid animals, in the highest state of putrefaction, where every fibre was undergoing this ferment; yet I could not observe this heat: and certainly, if in that strong cadaverous state no heat was generated, can we suppose, (allowing the extent of their opinion, of putrefaction taking place in the living animal) that heat could be generated by it; when the dead animal, in the highest and most general putrefaction, gave none.—The heat produced by the living animal, is so considerable a one; being a constant heat of 96 of Fahrenheit's thermometer; and giving this great degree of heat under all circumstances.

If an immense pile of green vegetables be heaped together, so that their inmost parts shall have no access to the air, actual fire will often take place; seen in hay-stacks when improperly dried taking fire: but will any philosopher, with a grave countenance, say, there is any analogy between the hay-stack and the living

ing animal? Likewiſe another body, manure from the ſtable, being compoſed of animal excrements and ſtraw, &c. if a large quantity is compiled together, in the courſe of time it will generate heat; but both the hay-ſtack and manure require ſome months of time, and likewiſe to be compiled in a large body, before this putrefaction will take place: but if it is put up in ſmall piles, equal in diameter to a common-ſized animal, little or no heat is generated: the ſmalleſt inſect, nevertheleſs, has animal heat; and no man's organs of ſmell are ſo fine, not even a dog's, as to be ſtruck with its putrid effluvia.

If an animal body be immenſely large, it may very probably generate heat, as well as a huge pile of vegetables, if under a ſtrong putrid ferment. The late ingenious Dr Monro's obſervation of the putrid whale, in ſome meaſure corroborates the ſuppoſition: upon thruſting his arm into it, he thought he diſcovered ſome heat; which, I preſume, was owing to the immenſe quantity of fat or oil having become putrid. But we obſerve no ſuch huge pile of fat in the human ſyſtem; and one of that ſpecies will give a conſtant heat of 96 degrees of heat, of Fahrenheit's thermometer, if it be ever ſo lean; and this whale gave no ſenſible heat upon its ſurface; and the heat it

gave was far inferior to animal heat. Indeed, maturely considered, it appears a most vague opinion; it expresses such a desire to account for this grand cause of heat, that they are determined to fix upon some idea, if it be ever so irrational. If this theory of animal heat was founded in truth, a person when dead would have a stronger animal heat than when living; but when death takes place, there is an entire cessation of it. For you may accurately mark, as death comes on, in the same gradation is the animal heat extinguished. In putrid fevers, where we are sensible a putrefactive ferment is going forward, there is considerably less animal heat than in inflammatory fevers, where there is the reverse disposition of a putrefactive ferment taking place: In the putrid fever there is, no doubt, a greater degree of heat taking place than ordinary, but that superior degree of heat originates from the fever: the greater impetus of the blood, and other causes depending upon that fever; but of all fevers, a putrid one has the least heat.

We observe likewise, that the heat always bears an equal proportion to the impetus of the blood; that, upon the blood's impetus being increased, the heat is likewise increased; so *vice versa*, as the blood's impetus is diminished,

niſhed, the animal heat is diminiſhed. Nay, farther, the ingenious Drs. Fordyce and Solander have endeavoured to prove, that the ſyſtem has a generating power of cold as well as of heat; for they went into a room, heated to twice the temperature of animal heat; and, what is ſingular, their bodies did not partake of the temperature of the room, which every inanimate thing about them did. The buttons of their cloaths were quite hot upon being touched, and their breath, (which we know partakes of the temperature of the ſyſtem) felt quite cold and cordial to their hands and face. *Then can it be ſuppoſed* the ſyſtem has a direct inſtantaneous power of increaſing and diminiſhing putrefaction; that, in this caſe of Doctor Fordyce's, the ſyſtem ſhould ſuddenly and entirely ſtop its putrefactive ferment, even at a time when ſo great a degree of heat was prevailing to promote it: but, even allowing the ſyſtem a power to ſtop its prutefaction, how comes it to generate cold, which the Doctor ſays ſenſibly took place. If they can reconcile all theſe circumſtances and facts to their principles, I ſhall candidly aſſure them, their reaſon and mine differ very eſſentially.

Another theory (which has been eſtabliſhed, concerning this great and material knowledge,

viz.

viz. animal heat) endeavours to prove, that it is owing to the motion of the blood; its particles rubbing against one another, and likewise against the sides of the vessels; is in my opinion, equally as fallacious and unphilosophical as the other theories.

What man's knowledge of mechanics can suppose, that the trifling attrition of the fluid bodies (which takes place in the animal) rubbing against one another, and against the sides of resisting lax vessels, lined with a mucous, to defend them from attrition; could possibly give a universal and constant heat over the whole system indiscriminately, of 96 degrees of Fahrenheit's thermometer. Nay, a fact, which directly and pointedly contradicts their opinion is, that children have a stronger and higher degree of heat than adults. This is a direct contradiction; for, agreeable to their theory, we should expect their heat considerably less in them than in the adults; for it must be universally allowed, that in children (being of a lax tender fibre), that the mechanical powers exerted upon their blood and vessels, must be considerably less than in the adult; The fibres of the latter, having got to that animated and perfect stamina, must be many degrees superior in force and action to the lax tender fibres of the new-born infant; yet wonderful

derful to relate to the advocates of this theory, the new born infant's heat is ſtronger than the heat of the firm elaſtic ſyſtem of the adult. If hard bodies, metallic, &c. are ground together by a ſtrong force, they will produce heat; but it requires ſuch a ſtrong force, as even to tear their component parts. But if water, mucous, or oil, intervene, betwixt the two bodies, they deſtroy the effect, heat is not generated: therefore, if even they were to prove, that this immenſe attrition, (which takes place when heat is produced, by rubbing metallic bodies together,) did really exiſt in the ſyſtem, the blood and other fluids of the animal would deſtroy its effect in producing heat, as they all have either an oily or mucous quality; the blood having ſenſibly that oily feel, when rubbed betwixt the fingers. Therefore, we have proved, that if even this powerful mechanical force required to produce heat, was really exerted in the animal, its fluids would deſtroy the effect of heat being produced; and I likewiſe do aſſert, that if thoſe great mechanical powers were exerted, the animal would be rent and torn in pieces in five ſeconds of time. We know very well that the ſmall animal, a fly, poſſeſſes animal heat; and can any philoſopher aſſert, with a grave countenance, that there is that impetus of the blood and veſſels in that animal, ſo as to produce this mechanical

mechanical force, unphilosophical. Make an artificial animal, having a circulation analogous to that in the human system, giving its fluids all the force that art can invent, and you will not give it animal heat. Soft unctious bodies rubbing together, with the trifling powers that are exerted in the animal, can by no means be supposed to produce this great effect; nor, as the great and ingenious Dr. Cullen observes, can it be proved, that in such a number of animals, under the same temperature of heat, that their blood moves in all its circumstances in the same ratio, being directly corresponding.

If a person's blood moved 60 pulsations in a minute, the temperature being then at 96; upon the pulse being accelerated to 120, the temperature of heat will not rise in the same proportion. Or upon using the strongest exercise, when the blood's impetus is greatly quickened, the heat is not in the same gradation accelerated.

But I dare say, my reader will agree and conclude with me, that all these theories are vague and inconclusive; being neither grounded upon philosophy nor reason.

After

After combating the opinion of the greateſt maſters, juſtly celebrated for their medical and philoſophical abilities; a perſon ought to be extremely delicate in offering his ſentiments, upon ſuch myſterious and abſtruſe ſubjects, where ſo many have failed. But too great a modeſty is prejudicial to knowledge; for many a great man has ſlept in obſcurity, and many great points of knowledge by that timidity have been loſt; from having too great a falſe delicacy, which it certainly juſtly deſerves to be called.

No man ought, *à priori*, to ſay, I will account for ſuch a point of nature; but if a hint ſtrikes him; which, when examined, carries the fair authority of truth, he neither acquits himſelf with juſtice to the world, nor to his own merit, if, with a proper and delicate confidence, he does not offer it to the learned and candid public; there to be impartially canvaſſed, whether it is to live or die. But we ſee very often prejudice, reſulting from little low motives, refuſe juſtice to real merit and truth; while the next generation, not being cotemporaries with the author, therefore exempt from the rivalſhip, give him his due character.

To

To exemplify this opinion, nothing can do it more ſtrikingly, than the little low prejudiced ignorant cavillers, which the great Harvey met with, in oppoſition to his immortal diſcovery, the circulation of the blood. Tho' he demonſtrated it ſo clearly and evidently, that a child's reaſon might have ſeen into it, yet many of his cotemporaries, from envy, ignorance, malice, and other abject paſſions, barked with all their might and power; but all availed not, truth and juſtice triumphed. I believe there are many, whoſe reaſon is ſo choaked up and ſhackled, from old ſcholaſtic prejudices, being a baſis for many years practice; that at laſt they are as reconciled to their reaſon, as being as clear facts, as any demonſtration in Euclid. I have often met with theſe prejudiced old practitioners.

There is ſo much oppoſition in mankind when fame is the conteſt, reſulting from low pride, &c. that no one can ſteer in a public line exempt from it.

When the great Harvey demonſtrated his doctrine ſo glaringly, that the moſt prejudiced judgement could but aſſent to it; then they endeavoured to prove, that he was not the firſt diſcoverer; that Michael Servetus knew, and demonſtrated it to the world before him. Nay, they

they went ſo far back, as to quote Hippocrates's knowledge of it. But I think now all the candid world, without heſitation, gives it in favour of Harvey. Servetus, no doubt, was acquainted with the blood's circulation thro' the lungs, but he was an entire ſtranger to the general circulation of it thro' the whole body; fromthe heart by the arteries, to the extremeſt parts; and back again, by the veins, to its origin, the heart.

As the imagination is ſo fertile, and as men's judgements have been ſo long and ſtrenuouſly exerciſed upon the different points of philoſophy, that there is ſcarce a point, but what fifty vague opinions have been thrown out concerning it, founded merely upon wild ſuppoſition; but the honour of the diſcovery certainly belongs to him, who firſt demonſtrated it to the world, upon clear and evident principles; receiving ſome circumſtances, rejecting others.

But that I may not be thought to digreſs from my ſubject, what a happy knowledge it muſt be to the phyſician, to know upon what principles, that which he is the guardian of, namely life, conſiſts in; then he will be able to reaſon clearly, not to ſtumble in the dark; but to preſcribe with a confidency of judgement.

Boerhaave

Boerhaave was fully ſenſible of the great importance of the diſcovery; as being the great barrier to medical knowledge. After enlarging upon its importance, he concludes with ſaying, Happy will be the man who ſhall diſcover it. He only alluded to the diſcovery of the great cauſe of animal heat; but particularly a diſcovery of the general principles of life, muſt, I think, be the greateſt diſcovery that ever philoſophy has yet found out; as being the great key to healing diſeaſe.

It behoves every philoſopher, particularly the phyſical ones, anxiouſly to ſearch for it; for it is this great knowledge, that will ſhew the ſtrength and weakneſs of the different phyſical theories of diſeaſe, which has nurſed each man's practice: many of them, I am afraid, will appear very far from the truth, and ſimplicity of nature. Then may medicine be called, with propriety, a ſcience. Therefore, if it is in the reach of men's intellects, every man ought to ſearch diligently after it. But true merit and knowledge is ſo little attended to, that men are more deſirous to freight themſelves with ſuperficial accompliſhments, and political manœuvres, which principally ſtamp each man's character.

The

The diſcovery of the great principles of life would put a ſtop to the great variety of theories that have been eſtabliſhed; and others that would be eſtabliſhed. Every man then would be able to regulate his practice, upon ſolid and regular grounds; agreeably to that ſimplicity and uniformity of Nature, which we always find her cloathed in.

But let me premiſe a ſhort hiſtory of the animal.

There are two genera in nature, which make up the principal part of the creation upon the globe, being the animal and vegetable kingdoms: we evidently obſerve they both enjoy life; — life is a very vague term, when applied in this philoſophical ſenſe; but what I imply by it, is a body having a power of extenſion within itſelf, being produced from an ovum, by copulation of the ſexes; which generates to maturity, and being then capable of propagating its ſpecies.

Agreeable to this definition of life, both the animal and vegetable kingdoms enjoy life, but they differ exceedingly in the degree of vigour in that life. The animal, we obſerve, have ſtrong characteriſtics of life, which the vegetable have not.

 Firſt,

First, in respect to corporal functions, the animal has a strong degree of heat.

Secondly, a loco motive power.

In respect to the mental functions, viz. perception and sensibility; they differ still stronger; indeed the vegetable is disputed, whether it possesses any or not. But the animal is well known to enjoy a vigorated perception, with a great sensibility; nay, the human part of the creation enjoys a degree of intellectual faculties, capable of reasoning abstractedly, when the objects are not present; in short, of forming imaginary perceptions, supremely eminent; great in the investigation of the mysteries of nature; forming a comprehensive idea of God, the great author of all things.

As we have shewn so great a distinction between the animal and vegetable kingdoms, one would presume that the definition would be very easily made; but upon a close examination it will be found very difficult, for this reason; there is such a regular gradation, they so imperceptibly run into one another, that one cannot draw the line; there being many bodies in nature which partake of both the animal and vegetable kingdom; therefore our definition must be a general one, comprehending

ing the diſtinction of the two kingdoms in their perfect ſtate; as ſuch, we can give the definition of the animal.

Animal life is therefore marked by having a certain degree of temperature of heat, above the circumambient air; and having a locomotive power: for we obſerve when we apply the thermometer to this genus, that it generally ſtands at 96 degrees of Fahrenheit's:—a heat many degrees above the atmoſphere.

The animal kingdom conſiſts of two ſexes, the male and female; which together have the power of generating ova; and which ova, with the aſſiſtance of freſh air and food, either of the vegetable or animal kingdoms, grow and become mature, and have the ſame properties as their parents But without the conſtant and freſh application of pure air, they cannot live; but their life is apparently taken away in a few minutes: therefore the air is immediately neceſſary to their exiſtence; likewiſe the freſh ſupply of food, either of the animal or vegetable kingdom; but that is not ſo direct or immediate to their exiſtence as air; for without food, Life may be ſupported for ſome days; but, for their welfare, it is directly incumbent they ſhould have it in perfection. But the air is certainly more eſſential to animation, as an

imperfection in it, always ſenſibly affects the animal, conſiderably more ſo than imperfect food; which is ſufficiently demonſtrated in large cities; for, though the neceſſaries of ſubſiſtence, in reſpect to food and clothing, are in large towns in the higheſt ſtate of perfection, yet the people living there, neither enjoy longevity, nor even a degree of vigour of life, while they do exiſt. But the people in the country will live in the extremeſt poverty, both in reſpect to food and clothing, yet ſhall enjoy a degree of health and bloom, unknown to the Cit. It will be readily anſwered, that it is not ſo much owing to the air, as to the luxuries of life, which the Cit is accuſtomed to: but I anſwer, that in country towns, their exceſſes are greater than in large populous ones, particularly in that bane of animal life, dram-drinking. But to ſhew it more forcibly, let a child receive its exiſtence and nurture in London, and contraſt it to a child born and reared in the country, (their food and clothing being the ſame,) then contemplate upon their degree of animation. You ſee a country perſon immediately looſe that vigorated bloom upon his living in town. But Dr. Percival's calculations evidently evince it; a man, who deſerves the higheſt character for his aſſiduous enquiries: In a paper, which

he

he read to the Royal Society, he there evidently ſhews the baneful effects of large towns upon the lives of mankind. In the town of Liverpool, 1 in 27 die annually; in Mancheſter, 1 in 28; in Eaſtham, 1 in 35; in Choiſbent, 1 in 41; in Cokey, 1 in 44; in Ackworth, 1 in 47; in Rayton, 1 in 52; in Darwin, 1 in 56; in Edale, 1 in 59; in Harwich, 1 in 66; in Monſton, 1 in 68; and in Hale only, 1 in 69. What can be a more plain demonſtration of mortality being accelerated, by a number of people being crouded together, breathing the ſame atmoſphere? This table diminiſhing the bills of mortality, in the ſame accurate gradation, as the towns are leſs peopled; which proves how neceſſary and eſſential the air is to animal life, as being the moſt immediate to its life and vigour.

But in what manner the air diſpenſes this living principle to the animal, has never been ſatisfactorily ſhewn; nay, ſcarce a reaſon aſſigned about it. In what manner food nouriſhes, is ocular and demonſtrative; it being taken into the ſtomach in large quantities, and there digeſted into a liquor, called chyle; from thence thrown into the inteſtinal canal; after that it is abſorbed by ſmall veſſels, called lacteals, in which it circulates, and is there mixed with a liquor, called lymph; after which in-

corporation it is thrown into the blood, and there passes the essential circulation of the lungs; after that it is properly anamalized, and adapted to the nourishment and existence of the animal, producing all the vital functions, giving a temperature of animal heat of 96 degrees, of Farhenheit's thermometer, upon which the being of the animal depends; for, if this heat is extinguished, death ensues; or if there is a deviation, from the regular standard of 96 degrees, it implies disease: that standard being the physician's first guide, towards forming his judgement of disease. Then as food, either of the animal or vegetable body, and, air give and support life; and, as the first characteristic of animal life consists in animal heat, let us enquire, as the foundation of our knowledge, which of these bodies food or air, is the principal author of animal heat; likely both assist; but our enquiries shall be, which is the principle. Most physiologists have rested upon the supposition of food being the principal author; as the nourishment and support received by that quarter immediately struck their ocular senses; while the other source by the air, did not; for in that, they were only sensible of its being requisite for life; but whether it gave or received something, they were totally in the dark; it escaping their evident senses; while the aliment by

by the mouth, was formed of evident principles of ſolidity and diameter; firſt maſticated in the mouth, after that thrown into the ſtomach, and from thence its courſe accurately purſued into the blood. But in reſpect to the air, they could only purſue it into the lungs; and from thence it was immediately expired as air, diminiſhed only in ſome of its qualities; but whether that diminution of ſome of its qualities, ſprung from receiving an additional body, or from having a diminution of its parts, they could not tell; being not able to trace it into the blood: and from knowing very little of the analyſis of the air, they could not ſo ſtrongly argue for its animation: but then oppoſite to this, they were ſenſible it was immediately neceſſary to the being of the animal; as life was taken in five minutes, if deprived of it. But to inveſtigate this important queſtion, we muſt accurately diſſect the principles both of the air and food. Firſt then let us examine air; as from what we have already ſaid, its qualities are more immediate to animation: It is a body which has undergone little inveſtigation 'till lately, and now ſeems to be a philoſophical ſubject of enquiry univerſally.

Air, is an ætherial, ſubtle, and elaſtic fluid, univerſally diſperſed over the whole face of the earth,

earth, ſtrikingly repreſented by the down of the peach; for ſo does the air cover the ſurface of the globe, as the down does the peach; its weight is very conſiderable, but there can be no regular eſtimate of it; they form an idea of it by exhauſting the air out of a veſſel, and then calculating the force exerted by the atmoſphere to fill up the vacuum. It is the firſt element in nature, as animal and vegetable life depend upon it; it is a very difficult body to analize, as it never takes on any other form, but that of a light, ſubtle, elaſtic fluid; being the only fluid body in nature which reſiſts freezing; though philoſophers univerſally allow it is capable of it, if a certain degree of cold could be applied; or ſpeaking with greater propriety, if it could be robbed of its phlogiſton or heat, which it certainly manifeſtly poſſeſſes in a great degree; for cold is no poſitive body. As it ſo eminently poſſeſſes above all other bodies this property of fluidity, let us ſee what muſt be the reaſon of it, or upon what fluidity depends.

There are many bodies in nature, which have for their general ſtate fluidity, but upon cold coming on intenſely, take a ſolid form, ſuch as water, &c. indeed all fluids, excepting air, have been made ſolid; but let us enquire

enquire how this change is brought about; for illuſtration let us take water.

Water expoſed to a degree of heat above 32 of Fahrenheit's thermometer, will be found fluid, but below 32 ſolid; which expreſsly denotes that heat is the cauſe of fluidity; and a deprivation of it, ſolidity.

In ſhort, there are only two certain ſtates which all matter enjoys, viz. ſolidity and fluidity. The former, by the art of man, may be reduced into the latter; and it is univerſally allowed, that the latter might likewiſe be reduced into the former ſtate. There are only two bodies that I know of, which are exceptions to this rule, viz. earth and air: the former by the moſt intenſe heat of human ingenuity, cannot be made fluid; and the latter, by the moſt intenſe cold, cannot be made ſolid. The hardeſt bodies, metallick and others, may be made fluid, even gold, the firmeſt and heavieſt of metals: nay, we can go further than giving it that ſtate of fluidity ſimilar to water; we can evaporize it, give it a ſtate ſimilar to air, make it an aerial, elaſtic fluid; which has been performed by that famous burning mirror at Paris.

Upon

Upon the other hand, reducing fluid bodies to a ſtate of ſolidity, by the effect of cold in northern countries, is univerſally obſerved :— even ſpirits and mercury have been froze. By what principle are thoſe alterations induced? It is eaſily anſwered, by the preſence or abſence of phlogiſton. The moſt fluid bodies that reſiſt freezing the moſt, poſſeſs moſt of it; and thoſe bodies which ſooneſt freeze, poſſeſs the leaſt; as for inſtance the gradation, water, ſpirits, the ætherial ſpirit of chymiſts, and air.

As to water, it is univerſally allowed that it contains a certain degree of phlogiſtion, proved by expoſing it to the thermometer; and when exhauſted of a certain degree by the influence of the air, (being ſo low as at 32 deg. of Farenheit's thermometer) it immediately freezes; and if by art the phlogiſton is again added, which it before had loſt, it returns to its primitive ſtate of water again.

In reſpect to ſpirits poſſeſſing phlogiſton, it is ſo well known to every one, from their taſte, and inflammability, that I need not here labour to prove it. The ætherial ſpirit of chymiſts poſſeſſes it in a higher degree; ſenſibly proved from its having theſe qualities more conſpicuouſly, viz. the taſte and inflammability, &c. likewiſe a ſtrong vaporific quality, and a ſtill ſtronger power in reſiſting freezing. But in

reſpect

respect to air's containing it comparatively in a still higher degree, it will, as being a new assertion, require more assiduity and attention to prove it.

The first argument that I shall bring in favour of this assertion, is, we can make any body into an aerial elastic fluid, evidently having the same state of fluidity as common air; the same elasticity, expansibility, and fluidity; even metals may be put into this state of fluidity; but then, they require an immense quantity of phlogiston; therefore a strong argument that the air receives its fluidity from the same principle of phlogiston: for the bodies which are held soluted in the air, are fixed air and water; the latter is known to be originally earth, and the former is universally supposed to be formed from acids; two bodies which are of a very fixed quality. Therefore as metals evidently to our senses require such an immense quantity of phlogiston to evaporize them, we have a just right to presume the fixed air and water, which undoubtedly are soluted in the air, require likewise a great quantity of phlogiston; there being no body in nature that is capable of giving fluidity, but phlogiston; and those bodies that have the greatest tendency to it, possess sensibly the greatest share of phlogiston; exemplified by spirits, æther, &c. and that state of

times

fluidity agreeable to the air, requires twenty times more phlogiſton, than that ſtate agreeable to water: and likewiſe every body in nature, by phlogiſton may be made either into a fluid ſimilar to water, or an aerial one, ſimilar to the atmoſphere. What directly demonſtrates that theſe two ſtates of fluidity are owing to phlogiſton, is, if you return either of them to a ſolid ſtate, they give out their ſuper-abundant phlogiſton in amazing quantities.

There are three bodies which are always concomitant with atmoſpherical air; and which we can always mark and demonſtrate to be in it: Theſe are, phlogiſton, water, and fixed air.

That phlogiſton is conſtantly exiſting in it, is proved from almoſt every thing in nature. Water being robbed of its phlogiſton by artifice, ſoon ſaturates itſelf again from the air. All metallic bodies attract it, being found upon them in the form of a black greaſy covering; likewiſe glaſs does the ſame. Oils, when expoſed, become highly rancid from attracting phlogiſton.

But what expreſſes it as much as any thing, is the proceſs of animal putrefaction. Expoſe an animal body, bereft of life, (in hot countries where this phlogiſton abounds much) and it will in a few hours become almoſt an entire ſalt, from

from its great attraction for phlogiſton; and if the air be examined (to whoſe influence the animal was expoſed, it will be found to have loſt its phlogiſton; it being the ſame as expired air from an animal's lungs; the principles of which I have elſewhere explained. It is in this manner that ſalt-petre is made; expoſing animal and earthy bodies to atmoſpherical air, in hot countries, which decompounds the air, ſo as to attract phlogiſton from it in that abundance, as to become an entire neutral ſalt.

That fixed air abounds likewiſe in atmoſpherical air, is evidently proved, from the immenſe quantities which vegetables receive; proved by their giving it back again when under a ſtate of fermentation, which is well known to brewers; apples poſſeſs a large quantity of it; no one can reaſonably ſuppoſe they receive it all from the earth. Take a ſmall pot of earth, vulgarly called a flower-pot; plant a vegetable in it, analize the earth both before and after it has grown in it, and it will give the direct ſame chymical appearance, though it has nurtured a vegetable, conſiderably larger in diameter than itſelf; from whence then did this vegetable receive its matter or ſubſtance? there can only one anſwer be given, from the air: then, upon analizing this vegetable, it will

will be found to poſſeſs great quantities, both of phlogiſton, fixed air, and water; its poſſeſſing phlogiſton is proved from its inflammability, its volatile oils, &c. the fixed air from its diſcharging of it, when under the ſtate of fermentation. And its poſſeſſing water is ſeen ocularly, when in its recent ſtate, and from its leaving an earth, or *caput mortuum*, in diſtillation, which is ſimilar to water; for it is evidently proved, that water may be diſtilled into earth, and there is little doubt, that earth and water in both ſtates conſiderably abound in the air. All theſe bodies are proved then to enter the vegetable from the air; nay, that air indiſputably is the nouriſher, mother, and feeder, of vegetables, is proved by a ſallad, being raiſed by only the ſeed being laid in cotton, and ſprinkled with water, and there without any earth vegetated; this ſallad, nevertheleſs abounds with volatile oils and ſalts, and likewiſe fixed oils and ſalts; all which it received, undoubtedly, from the air.

It is the atmoſphere that gives thoſe aromatic vegetables, in the Eaſt, their ſpicy qualities. Carry European earth there; previouſly expoſing it to the influence of the air; after that plant an aromatic vegetable, and it will grow in the European earth: which vegetable analized, gives out an amazing quantity of

of phlogiſton, being ſaturated in the form of a hot, inflammable, and eſſential oil.

Lime water is compoſed of a quantity of lime, ſoluted in the water, agreeable to its point or power of ſolution; ſo that the water is quite *tranſparent*; but if you expoſe this lime water to the influence of fixed air, it will become turbid, a *decompoſition* of the ſolution taking place: the fixed air will nutralize itſelf with the phlogiſton of the water, which kept the lime *in ſolution*, having a greater attraction for it; and by that means the lime will be depoſited. Then if the lime water is expoſed to the common atmoſphere, it will attract fixed air from the atmoſphere, and depoſite its lime. The calcareous earths and alkaline ſalts, which contain a great deal of fixed air, if robbed of it by chymical proceſs, will, upon expoſure to the air, attract it again from the atmoſphere.

I hope I have ſatisfactorily proved, that phlogiſton and fixed air are abundant in the atmoſphere; there only now remains to prove the reſidence of water. Its preſence, I think no one can doubt, proved from the ſtrong attraction the fixed alkaline ſalt has to run into a fluid ſtate, what chymiſts call *per deliquium*;) by expoſure to the atmoſphere, that

that is, from a fixed ſolid body, becoming a watery fluid, attracting five times its bulk of water. The reſidence of water, in the compoſition of the air, is very ſtrikingly proved, from the immenſe evaporations of water, conſtantly taking place; ſee Dr. Hales's calculation, what an amazing quantity is conſtantly evaporating from the Mediterranean ſea. All this water is ſoluted in the air, entering and making part of its compoſition; for it is not diſcoverable till a decompoſition takes place; which, when it does comparatively, what an immenſe quantity of rain will fall. If you expoſe ever ſuch a large body of water to the air, if its ſurface of contract is extenſive, how ſoon it evaporates.

Now I hope I have ſatisfactorily proved that phlogiſton, fixed air, and water, exiſt in that fluid, called air, let us ſee if we can find the preſence of a fourth body: expoſe any body to the atmoſphere, with ever ſuch ſtrong principles or powers of attraction, and it will attract no other bodies than thoſe already mentioned; and we know that the air is a compound, moſt eaſily decompounded, being formed of bodies, which we have already mentioned; and which, in the table of attraction, have no ſtrong affinity with one another; therefore, if there were any other body, which entered into this compound atmoſpherical air, we ſhould ſoon detect

tect its presence. There is no doubt but you may detect compound bodies, the effluvia of both the vegetable and animal, but their presence will be fortuitous, and not always tending upon the air, in every incident and circumstance; they being the effluvia of different bodies, therefore only to be found when the bodies which emit them are present; but the three principles, which I have already described, are always to be found in every place, climate, and circumstance, where air exists; therefore we have an undoubted right to suppose they make up the composition of the air; but when I write expresly upon that subject, I shall be more explicit. One of the first principles of chymistry is the law of attraction; that is, the bodies which compose a compound one, may, by adding another body, be decompounded, or a separation of its components ensue: for example, gold, which is the purest of metals, resisting the destructive power of time, and the fire the most, its component parts being so firmly attached; nevertheless, by adding *aqua regia*, which is a strong acid, a decomposition of the metal will take place; hence then, if this pure firm metal can be decompounded, upon the principle of attraction, we need not be surprised that that simple compound air, can likewise be decompounded upon the same principle. Nay, it

will be found to be decompounded in the same gradation as the table of attractions: we know that acids have a strong attraction for phlogiston; expose the nitrous acid to the air, and you will observe how fast it attracts the air's phlogiston; strongly characterised by flying off with it in vapour, and giving it that strong smell, which chymists know is the body which phlogiston and an acid form.

Water likewise is strongly attracted from the atmosphere, by the fixed alkali; and the caustic alkali also greedily attracts fixed air till its point of saturation, from the atmosphere.

You see how general and beautiful Nature is in all her laws throughout.

In the first example or fact, just now given, of the air's being robbed of its phlogiston, we know very well that the nitrous acid has a stronger attraction for it, than either water or fixed air; which before it was engaged with, in making that compound atmospherical air.

In our second example, it is as equally well known that the fixed alkali has a stronger attraction for water than either fixed air or phlogiston, in the form it takes in atmospherical air.

As

As to the third example; it is equally as universally received and eſtabliſhed, that after the fixed alkali has been robbed of its proper ſaturation of fixed air, that it will attract it, againſt the united attracting powers of phlogiſton and water, which it before was compounded with; all which attractions are directly agreeable to the table.

That phlogiſton, water, and fixed air, may conſtantly, upon the principle of attraction, be received from the air, is an undoubted fact; and what does immediately demonſtrate, that a proper ſaturation of theſe three bodies make up that element, called the common air, or atmoſphere, is, if you receive any of thoſe three bodies in a large proportion, from a given quantity of air, it will take from its quality as pure air, being then unfit for its uſes and purpoſes. Another ſtrong argument in its favour is, that no other elementary body can be drawn from it: for, if you do detect any other body, you will find its preſence to be fortuitous, being a compound; and the body which it originated from, is near the place where it was detected, as moſt bodies are in ſome meaſure, evaporable. While the air keeps its compound ſtate, none of theſe three bodies are to be detected; being neutralized or ſaturated with one another.

There are two different states in which all bodies appear, either as solids or fluids; sometimes the same bodies appear alternately in both forms; as water, for example; in frosty weather, when the air is below 32 degrees of Farhenheit's thermometer, it freezes; but when it is warmer, it retains its fluidity. All bodies, by the power of phlogiston, may be made fluid, even the hardest and most refractory may be dissolved by phlogiston, artificially thrown into them, though their natural state be ever so solid and refractory. On the other hand, all bodies, whose natural state is fluidity, by an intense degree of cold, or by berefting them of their natural quantity of phlogiston, which they are saturated with, will freeze or become solid. It is universally believed that even air, the most fluid of all bodies, would freeze, if it could be bereft of phlogiston; which phlogiston all fluid bodies are naturally and constantly saturated with; upon which their state of fluidity depend, laying within them in a neutralized, dormant, or latent state; that is, it does not shew itself to the thermometer or senses.

Therefore, as we have sufficiently proved, (and which no philosopher, that knows the present doctrine of the day, will deny) that phlogiston is the author of fluidity; and those bodies,

bodies, which poſſeſs it moſt, are moſt fluid; for water, in its ſtate of fluidity, is ſaturated with a great deal of it; but, when put into that ſtate called vapour, it poſſeſſes twenty times the quantity; and that vapour which riſes thick and cloudy, requires an immenſe deal more to give it a *tranſparent* ſolution the ſame as air: therefore, as air poſſeſes this tranſparency and fluidity more *conſiderably* than any other fluid beſide, ſo we have all the philoſophical right and reaſon to ſay, it comparatively poſſeſſes more *phlogiſton* than any other body.

Air is the moſt elaſtic of all fluids.

Let us enquire upon what elaſticity depends. All fluids have this property in ſome degree; but it will be found, that thoſe which poſſeſs moſt phlogiſton have it moſt ſenſibly; ſpirituous fluids, for this reaſon, poſſeſs it more conſiderably than water; but even water, by giving it a large quantity of phlogiſton, can poſſeſs this quality in a very eminent degree; take a few drops of water, place them in vacuo, and throw into them a large quantity of phlogiſton, and their elaſticity will overcome the greateſt force. It is upon this principle, that that very uſeful machine, a fire-engine, is conſtructed, for raiſing bodies of a moſt im-

menſe weight: water, by the aſſiſtance of fire, is formed into ſteam; and from its influence and force, it lifts large quantities of water, being uſed in collieries, &c. That air poſſeſſes this property in a moſt eminent degree, I need not mention to my philoſophical readers; the diſſection of the air-gun or air-pump, both of which conſpicuouſly prove this property in the air: that phlogiſton is the author no one can doubt, from what has been ſaid, and from a little philoſophical fact, which I ſhall conclude my arguments with; take a bladder, nearly filled with air, place it near a fire, and it will immediately expand and burſt the bladder. Therefore, as phlogiſton is proved to be the author of elaſticity, and as the air poſſeſſes this quality more conſiderably than any other fluid, it conſequently contains moſt phlogiſton.

Air reſiſts freezing more than any other fluid.

What quality or property is it in fluids, that makes them reſiſt the congealing power of cold? water ſooneſt freezes, then ſpirituous liquors, after that ether, and laſt air; nay, air has never been froze, while all other bodies have. In this gradation of water, ſpirits, ether, air, I ſcarce need mention in the ſame gradation,

gradation, do they possess phlogiston; water the least of it, and therefore soonest freezes; but throw into water a deal of phlogiston, either in an active state, as fire; or in a saturated latent state, as common salt; and it will resist freezing. I hope I need not tire my reader with arguments, but that he is as well convinced as I am, that phlogiston is the principle which resists freezing, and that, speaking philosophically, freezing or cold, implies the absence of phlogiston; then, as air resists freezing more than any other bodies, it, in consequence, possesses most phlogiston.

Therefore as air is proved to be able to hold in solution the most fixed bodies, acids and water, or earth, which water is believed to be formed of; and as it possesses the properties of fluidity, elasticity, and resists freezing the most; we have the most undoubted justice, in asserting it possesses phlogiston, or is saturated with a larger portion comparatively, than almost any other body.

There are no bodies in nature, but when examined, are compounded; that is, made up by a mixture of other bodies; for all, when chymically analized, may be decompounded: all chymists are well assured of this fact. Even water may be distilled into earth; but only

the poor air they excluded, making her an alien in nature; so they did of water, 'till Godfrey proved it to the contrary by reducing it into earth, by the process of distillation. Indeed the ingenious Dr. Priestley hath made atmospherical air, which air is compounded; therefore that fact can be no longer disputed: but there is as great an error which still prevails respecting air; that this compound is not capable of being decompounded. There is universally throughout nature, principles or powers of attraction, which all bodies are subject to; and the knowledge of these attractions or affinities, is the chymist's first rudiments of his science; they having made a table of them. By the table of attractions you see the affinity which each body hath for another; that if the first body in the column and the third were joined together, by the interposition of the second body in the column, there would be a decomposition of the third body from the first; and in consequence an union would take place of the first and second body, forming a new one in quality and principle. Upon this great power of attraction, we can decompound all bodies, and form new ones. For example, take the vegetable salt of wormwood, which is an alkaline salt neutralized with a quantity of fixed air, by adding to it an acid, which is a body that the salt has a greater attraction

traction for than the fixed air; it will form an union with the acid, making a neutral ſalt, and let looſe the fixed air which it before was joined with; which fixed air, as being light, will riſe to the top of the fluid, and ſo eſcape; making an effervescence in the liquor. The moſt hard and refractory bodies in nature, metals for inſtance, are all eaſily decompounded by this power of attraction; in ſhort, every body in nature but poor air, the moſt ſimple fluid of all; chymiſts thought proper to debar it from this univerſal rule: but nature is ſimple and uniform in all her proceſſes; and we ſhall find in reality, the air is capable of being decompounded in the ſame ratio, as the table of attractions.

For example, atmoſpherical air is compounded of phlogiſton, fixed air, and water, as I have before proved; then if an acid be expoſed to it, (which you may ſee in the table has a greater attraction for phlogiſton than either fixed air or water) in conſequence there will be a decompoſition of the common air; and its phlogiſton will ſaturate the acid: which is really the caſe. Expoſe the nitrous acid to the air, and it will attract phlogiſton; and the air expoſed will be found to be much the ſame as expired air; the decompoſition being the ſame as if breathed

breathed out of the lungs. If the vegetable acid be exposed, it will lose its acidity, forming in time a bitter neutral salt;—expose a lemon for instance, and this will be the result.

The same if rich earth be exposed; as it has a greater attraction for phlogiston, than either its present companions, viz. fixed air and water; the common air will be decompounded, and a kind of nitre will be formed. It is upon this principle they make salt-petre; and from these two principles of attraction, that the blood decompounds the air; it being compounded of both an earth and an acid, (which the chyle is formed of) therefore they attract the air's phlogiston, which gives animation to the system or animal fabric. It is in this point that the great Dr. Priestley has been led into such an error, in imagining these processes of decomposition of the air, was owing to its having more phlogiston thrown into it; instead of that, the true processes of the blood upon the air, the calcination of metals, and the putrefaction of animal bodies, act by decompounding and attracting the phlogiston of the air; what he calls a phlogisticated process of the air, is properly a dephlogisticating process. But I shall give a candid and full review of his doctrine in another place.

Now,

Now, as I have before proved, that it requires ſuch a deal of phlogiſton to neutralize water in the form of vapour: how much more will it require to give it that tranſparent ſolution, which we obſerve actually to take place in the atmoſphere? Certainly, if the fluidity of the water required a certain degree, and vapour a degree conſiderably beyond that again, the tranſparent ſolution of the atmoſphere muſt require a proportion far ſuperior to either of them: and this is not formed entirely upon ſuppoſition, though it is a ſuppoſition ſo ſtrongly founded, as to be almoſt equal to certainty; yet we ſhall prove it by experiment.

* If water requires ſuch a deal to neutralize or ſaturate itſelf, the fixed air, which likewiſe abounds ſo copiouſly in the atmoſphere, will require even more to ſaturate it. This will appear obvious, if we conſider what a deal of fixed ſalt is required to ſaturate a ſmall quantity of fixed air; ſufficiently exemplified by making the cauſtic alkali, what a ſmall proportion of fixed air takes off the amazing activity of the ſalt.

People never thought of this chymical compound in the atmoſphere, from its giving no direct appearance of each ingredient; but we obſerve this combination in chymiſtry, con-

ſtantly

ſtantly taking off the quality of each ingredient ſeparately, and forming a compound of quite different principles. This is exemplified by all the ſalts, metals, earths, &c. Take the vitriolic acid; how cauſtic it is; ſo much ſo, that nothing but glaſs will retain it, corroding the moſt firm metals; and likewiſe the cauſtic alkali, which alſo is very active; that if either the vitriolic acid, or the alkali, be taken into the ſtomach ſeparately in the quantity of a few grains, they will kill; but chymically join them together, and they may be thrown into the human ſtomach in the quantity of a couple of ounces, and they will only operate as a gentle purge. The ſame alteration is induced upon mercury; in its metallic ſtate it is quite inactive, having not the leaſt operation upon the conſtitution; but decompound it, reduce it into a calx, by taking from it its proper ſaturation of phlogiſton, and it will have a very active effect upon the ſyſtem. The ſame of the atmoſphere, if either the phlogiſton, fixed air, or water, were breathed ſeparately, they would in five minutes extinguiſh life; yet the compound does no miſchief, nay is ſo compatible with animal life, that it cannot be ſupported without it: and ſo far from this compound in the atmoſphere being a ſingular circumſtance in nature; every body which we know of is a compounded one; that the air

air if it did not take on that form, would be an alien to the reſt of nature's works: but experiment declares, that it is compounded, and that it may be chymically decompounded, the ſame as all other bodies in nature. As chymiſtry gets enlightened, theſe compounds are detected: formerly there were many bodies which chymiſts called firſt principles; that is, bodies which they could not change by chymical art into other bodies, therefore called them the firſt principles, which formed all other bodies; but now the preſent doctrine has eraſed thoſe opinions of water, and other bodies which were ſuppoſed to be incapable of decompoſition, have been found to be a compoſition: the ingenious Godfrey having diſtilled water into earth. The air being one of the laſt fluids whoſe compound was detected; but this treatiſe will accurately diſcover its component parts, and ſhew that it is like all other bodies a compound. The weak imagination of man making the operations of nature quite complicated; but whenever ſhe is inveſtigated, ſhe will be found quite ſimple and uniform. What an amazing quantity of phlogiſton muſt be ſoluted in the atmoſphere, to neutralize that great quantity of fixed air and water: bodies that are naturally fixed, requiring an amazing quantity of phlogiſton to keep them in a tranſparent ſolution in the form of air. If the whole

whole atmosphere could be decompounded at once, the phlogiston that would be let loose, would be such an immense proportion, as to set the whole world on fire. We often see in summer, when there is too strong a solution of phlogiston in the atmosphere, that it purges itself by lightning; and in hot climates it will tear up trees, castles, nay rocks; for agreeable to the laws of nature, whenever there is an over proportion of phlogiston in the air, she takes that method to unload herself.

There being a proper pitch of saturation in every compound, and whenever any particular body of that compound predominates, so much of it as does predominate, beyond the proper pitch of saturation, will not enter into the composition of the compound, but be as it were, an alien, liable to be set loose upon every trifling circumstance. All compounds being united together by the great principle of attraction, that attraction being Nature's great law; and whenever there is an over saturation of any ingredient, that over saturation and proportion, having no body to attract it in the compound, is therefore expelled as an alien to the body. So phlogiston, which abounds so copiously in the atmosphere in the summer, so as to make an over saturation, will produce lightning, that being

being the atmosphere's method of purging herself from this over proportion; for, as I have just observed, agreeable to the laws of Nature, there is a proper pitch of saturation in every thing; and whenever the air is too much loaded with phlogiston, it takes the means of producing lightning for discharging of it. And you will in general observe a great torrent of rain follow the lightning, formed of that water which helped to solute in some measure the over proportion of phlogiston.

In hot weather, when the lightning generally happens, phlogiston greatly abounds; and before the lightning takes place, you may find the atmosphere sensibly loaded by your feelings, it being close and hot; and after the lightning, it gets to its usual temperature.

In summer there is always too great an abundancy of phlogiston in the atmosphere, and the air is constantly giving it to large collections of water; therefore, near the sea coast it is always considerably cooler than in the interiors of the continent. But in winter it is reversed, for then it is warmest near the sea, for the air is constantly receiving phlogiston from it; the air being a body which soon admits of the changes of temperament, soon heated and soon cooled; but the sea requires a longer

longer time to have its temperature changed; therefore, in the ſummer it is conſtantly receiving heat from the air, and in winter conſtantly imparting it to the air, which it before received from it. This is the reaſon that iſlands are ſo temperate (ours for inſtance). In the iſland of Great-Britain we never know the intemperance of ſeaſons comparatively, to what continents do.

That the air is ſtrongly ſoluted with phlogiſton, is likewiſe proved, from the atmoſphere's receiving it in great quantities from the earth; for, in the winter, you will find that the earth expoſed to the air, is a deal cooler than that part of it which is ſome depth from the ſurface; and therefore excluded from the air's influence. What gives it this ſtrong appetite for phlogiſton, and what comes of all that which it received from the ſun? Why, it forms water and fixed air into atmoſpherical air; which air is the immediate nouriſher of animal and vegetable life. That the atmoſphere is ſo compounded, there can be little doubt, if we conſider the arguments, which unqueſtionably proves the great quantity that both water and fixed air require for their ſolution, and the immenſe quantities of humid exhalations, which are conſtantly taking place, ſeen by Dr. Hale's calculation, and the real exiſtence of all the three

three bodies in the atmoſphere, proved by chymical analyſis.

I muſt not paſs tacitly over the opinion of the great Dr. Prieſtley, that ingenious inveſtigator of nature, who is deſervedly eſteemed the firſt philoſopher of his time, and whoſe opinions and experiments are anxiouſly ſought after by the whole world. But the greateſt men that have lived have been known to err; for Nature's operations are ſo myſterious, that man, in his reſearches for inveſtigating them, is often miſtaken. When I inform my readers, that Dr. Prieſtley has publiſhed to the world an opinion on reſpiration and uſe of the blood; which opinion is directly contradictory to mine, they will in conſequence be tenacious in their belief. But no man, let him be ever ſo eminent, ſhould be implicitly followed, but ſhould have an impartial canvaſs before that great judge, the public. For my part, no man's opinion ſhall ever with-hold my humble reſearches from exerciſing my judgement; therefore I ſhall here, as far as I am able, give a candid inveſtigation of this great queſtion, and let the world be umpire; for it is a queſtion of the firſt moment to mankind, and deſerves the moſt candid and ſerious conſideration; for it is certain that the nobleſt purſuit is ſearching into the grand arcana of Nature,

therein worſhipping and contemplating upon the omnipotence of God, the great author of all things; which purſuits will exalt our ſpecies above the reſt of animals, and make us feel our immortality.

Theſe opinions of mine, concerning the animal body, and the principles of the atmoſphere (as I now offer them to the public) were formed into this ſyſtem many years ago: my friends will very probably think me very dilatory in not giving them to the world before. The reaſon I aſſign was a delicacy, as Dr. Prieſtley's publications came out, and which differed from my principles, particularly in reſpect to the atmoſphere, though in many points we ſhall be found to agree. The ſubject being in ſuch able hands, I was determined that the Doctor ſhould finiſh his reſearches, thinking they would ultimately tend to agree with mine; but he ſtill adheres to ſome eſſential points of difference, which muſt be now inquired into. Though I have not had an opportunity to make ſo many different experiments, concerning the air, as he has had; yet I hope my mode of reaſoning and inveſtigation, concerning it, will be found valid; for, in my refutation, I ſhall be ſo candid, as to take the Doctor's experiments, and his own relation of them.

The

The Doctor's opinion, concerning respiration and use of the blood is, — he imputes the use of the blood and lungs to be the great instruments in exhaling phlogiston from the animal, by the menstruum atmospherical air; but I shall give you his own words.

What I then concluded to be the use of respiration in general, I have now, I think, proved to be effected by means of the blood, in consequence of its coming so nearly into contact with the air in the lungs; the blood appearing to be a fluid wonderfully formed to imbibe, and part with that principle which the chymists call phlogiston, and changing in colour in consequence of being charged with it, or being freed from it; and affecting air in the very same manner, both out of the body and in the lungs, and even notwithstanding the interposition of various substances, which prevent its coming into immediate contact with the air.

These then are the Doctor's own words upon the subject; he looks upon the act of respiration to be no more than the action of the air upon the blood, carrying off phlogiston; that the same effect and change is produced when the blood and air is in contact out of the body as well as in the animal viscus, the lungs. Let us

first enquire upon the known principles of animal life, if the evacuation of that phlogiston is so immediately necessary to the being of the animal, that an obstruction of it would kill in five minutes.

I hope Dr. Priestley will not deny, but that many bodies possess this phlogiston he here speaks of, and that great abundance of it is in the animal system. Its fat, red globules, which in hogs and whales make up the greatest bulk of the animal, is certainly principally phlogiston, as they are highly inflammable, yet here we find that, instead of the phlogiston killing the animal, it is the most essential part of the system, being the first moving power of animal life; for agreeable to the quantity of phlogiston contained in any living body, is the different gradations of life; from the first animated animal body, to the most weak impoverished vegetable: and the great arcana of animal life, is in functions for receiving this phlogiston, and giving it activity, when received; for agreeable to the power of these two circumstances, that each animal possesses, will be found the different gradations of animal life; which the different species of animals so manifestly enjoy. Therefore the first grand object in investigating the mysteries and prin-

principles of animal life, will be, in finding out in what way this phlogiſton is received, and not evacuated: for we might as well in our reſearches after animal life, how it was firſt received and ſupported, inquire only how life is exhauſted and extinguiſhed; therefore our great enquiries ſhould not be directed how the great feeder and animator of animal life, viz. phlogiſton, is evacuated out of the ſyſtem, but received into the ſyſtem; and unluckily for the Doctor, I hope I ſhall ſatisfactorily prove, that the very proceſs by which he ſays phlogiſton is evacuated out of the ſyſtem, is in reality received by it.

All phyſicians agree, that the lungs is the great viſcus by which animal life is ſupported, as ſtopping its function kills the animal in five minutes. But I ſhall prove, that is from the lungs office in ſecreting phlogiſton, the general received author of animal life, and not in diſcharging and evacuating it.

This immenſe quantity of phlogiſton which animals poſſeſs, is certainly for the greateſt purpoſes; being laid up as I obſerved before, in reſpect to animals in cold climates, as the grand reſervoir of animation, againſt the extreme cold in the winter; for we diſtinctly obſerve, all animals towards the poles, and all

animals which ſleep over the winter; in ſummer, when phlogiſton abounds in the air, receive an immenſe quantity; and which, in the courſe of the winter, is principally diſſipated or loſt, in order, no doubt, to keep up their vital heat. This ſhews us, that phlogiſton is of the firſt conſequence to animal life, being its great *primum mobile.* So far from Prieſtley's having that extended opinion of phlogiſton, and its great conſequence to animal life, places to its charge its being noxious and effete to the ſyſtem, and that the lungs' great office (that firſt of organs) is to diſcharge this phlogiſton: nay, agreeable to him, ſo neceſſary to life is the diſcharge of this poiſon, phlogiſton, that, if the lungs be obſtructed for five minutes, death is the conſequence; the evacuation of phlogiſton being by that means ſtopped.

There are two direct contradictions between the Doctor's opinions and mine, he ſuppoſing that the lungs' great office is to diſcharge phlogiſton, and that this phlogiſton is *ſo* very poiſonous and effete; while I ſuppoſe the great office of the lungs is to ſecrete phlogiſton into the ſyſtem, and that this phlogiſton is the firſt moving power; but let us enter more minutely into the inveſtigation of this great queſtion.

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We know that the ſtomach is conſiderably the moſt ſenſible viſcus of any in the whole animal, and that the lungs is one of the moſt inſenſible; but, nevertheleſs, one animal will ſwallow another when alive, throwing into his ſtomach all the effete and noxious fumes of phlogiſton, which the devoured animal poſſeſſed; yet it is ſo far from killing the devourer, that it is ſo immediate to its life, it could not live without it. I took a dog, and after making him very hungry, he ferocioufly devoured two quarts of blood, drawn warm from an ox, when thoſe poiſonous fumes, agreeable to the Doctor, were exhaling rapidly; yet he breathed them; and, inſtead of killing the dog, as from the Doctor's theory might be expected, they ſenſibly cheriſhed him, making him eat with greater glee and rapidity. In this fact, the noxious fumes and effete matter not only entered the ſtomach in immenſe quantity, but was likewiſe received by the lungs; yet, ſo far from taking life was the conſequence, it was the ſupport and feeder of life.

What muſt a butcher ſuffer, who is conſtantly expoſed to thoſe fumes? Why, with reflection, we ſhould ſay, he would not live five minutes; he being ſo immediately expoſed to the exhalations of the fluids of whole oxen;

yet, ſo far from killing him, it makes him thrive and grow fat. It is a juſt and univerſal obſervation, that butchers are fatter than the generality of mankind; thoſe fumes, which fly from warm blood, on expoſure to the air, being remarkably nutritious and invigorating.

I am ſo far from looking upon this effluvia being ſo directly oppoſite to the living principle of life, as to kill in five minutes if bereft of the opportunity of evacuating itſelf, by acceſs of air; that I look upon it as the eſſence of the animal, being the moſt nutritious and fineſt part of the blood; and it is owing to this nutritious quality of it, that makes men who are expoſed to its vapour ſo fat: that they are ſo, is an undoubted fact: then how can the Doctor reconcile this to his theory, that this effluvia is ſo very effete and noxious. In what manner muſt that butcher be ſituated, in thoſe ſlaughter-houſes for our royal navy, where hundreds of carcaſes are ſmoaking before him at once? Why, death to be ſure; but in reality, it makes him ſleek and fat.

Blood drawn from an animal, and expoſed to the immediate and general contact of the atmoſphere, muſt evaporate this phlogiſton extremely quicker than in the lungs; for in them

them there is only a certain quantity expoſed, and even that not directly to the blood itſelf, there being an intervening membrane. But the blood being expoſed out of the body, neither of theſe obſtacles take place: therefore with the juſteſt reaſoning we may ſay, the exhalation of this effluvia, muſt be ſtronger in blood expoſed to the air out of the lungs, than in the lungs. That is ocularly demonſtrable from the ſenſible evaporation which evidently takes place, from blood warm from the animal expoſed to the air.

So ſenſible of the ſolidity of my theory, and the fallacy of the Doctor's, I was determined to give it a fair trial, at the hazard of my health. Having got a large veſſel of bullock's blood, drawn warm from the animal, I introduced my head over it, and that my lungs might collect as much of the effluvia as poſſible, I incloſed my head within the mouth of the veſſel, with all the addreſs I was able; with a motive that the atmoſphere ſhould not ſteal the vapour from me. I argued from rational and philoſophical principles, *à priori*, that if this fume is ſo very noxious and effete, as the Doctor calls it, that it would kill me, from two reaſons; firſt, the deadly fumes flying from the blood, would be received by my lungs, and ſo deſtroy me; and ſecondly the air

air being already ſaturated, with the fumes of the ox's blood, could receive no part of thoſe fumes, or effete matter, which ſhould iſſue from mine; therefore agreeable to the Doctor's theory, my reſpiration and uſe of my blood would be counteracted and ſtopped, and I ſhould, in conſequence, be ſuffocated. But my reaſon ſo ſtrongly fought againſt the principles of ſuch a doctrine, that I tried the experiment without any dread; no body being along with me at the time, to drag me from thoſe pernicious fumes, in caſe I had been convulſed: but inſtead of its having that ſerious conſequence, I found not the leaſt bad effects from it; on the contrary, I found the living principle entertained by it, feeding its appetite: I held my head ſo long, giving the blood a rapid motion with a ſtick at the time, that I received ſo much of the fumes, as to ſenſibly ſtrike my palate in their paſſage into the lungs, and likewiſe to cover ſenſibly my face with their vapour, as to colour my ſkin. Here then is a ſtriking fact, where thoſe fumes were ſo immediately and generally imbibed by the lungs, without producing the leaſt ſymptom of diſeaſe, not ſo much as a ſingle cough; but nature ſeemed to be cheriſhed and invigorated by it. This then is a paradox to the Doctor's theory, that this effete matter which the Doctor acknowledges flies from blood, recently drawn

drawn from the animal, ſhould cheriſh inſtead of producing death, as from his opinion we had a right to expect.

I have ſince ordered conſumptive patients to attend ſlaughter-houſes, and to hang their heads over large collections of warm blood; and, that they might imbibe as much of the effluvia as poſſible, to give the blood motion with a ſtick; and their tender diſeaſed lungs have found the advantage of it. If there was any thing noxious in the vapour, certainly their irritable and diſeaſed lungs would ſuffer by it; but it appears an agreeable balſam to them.

I have not only proved that phlogiſton makes up the greateſt part of the animal, it being laid up as a reſervoir, in the form of fat, againſt an emergency of either want of food, or extreme cold; which I ſhould preſume no one will deny; but I have likewiſe proved that this phlogiſton, either in the form of fat, red globules, or any other, which the animal poſſeſſes, may be received into the ſtomach of another animal; and ſo far from being pernicious to the animal, is immediate to its life.

Take phlogiſton in any other form, and you may throw it into the animal ſyſtem, with ſa-

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lutary effects; either in an animal, vegetable, or mineral ſtate. All animal oils and ſalts are highly nutritive; vegetable oils or ſalts are likewiſe ſo; ſo are mineral ſalts and oils, common ſalt particularly ſo; all of which contain a deal of phlogiſton.

I do not know phlogiſton in any form, but what it may be received into the animal œconomy: inflammable air condenſed, may be thrown into the ſyſtem in large quantities with ſafety; what I mean by condenſation, it being in a ſolid or fluid form, either as ſalts, ſulphur, or oils; and why they cannot be received in an aerial ſtate into the lungs, I ſhall account for elſewhere.

If then phlogiſton is ſo inactive, and no way pernicious in its qualities, in every ſtate we know it; how can the Doctor make it ſo effete and poiſonous, from its circulation in the animal ſyſtem; ſo that the life of the animal ſhall demand its conſtant diſcharge; that if that diſcharge be but ſtopped for five minutes, death ſhall be the conſequence? What particular proceſs of the animal ſyſtem, makes it ſo effete; how is it conducted, and why ſo pernicious? What are its qualities, tendencies, and effects? The Doctor has not preſumed to give

give a ſingle illuſtration of one of theſe queſtions. It is very extraordinary we ſhould find it ſo in the animal ſyſtem, and not ſo in any other part of nature; we know that in moſt poiſons, it deſtroys their effect; particularly in the mineral ones, mercury, antimony, &c. I ſhould like that the Doctor would have given us ſome elucidation of its chymical properties in the animal ſyſtem, and how it acts upon, and affects animal life with ſuch ſerious conſequences.

But let us enquire into the motive which gave origin to this theory of the Doctor's.—He found that the putrefaction of bodies, the effervescence of iron filings and brimſtone, or the calcination of metals, affect air in the very ſame manner as animal reſpiration; diminiſhing the quantity of air in a certain proportion; leſſening its ſpecific gravity, and rendering it unfit for reſpiration, or inflammation, but leaving it in a ſtate capable of being reſtored to a tolerable degree of purity, by agitation in water. Having diſcovered this, he concluded that the uſe of the lungs is to carry off or to diſcharge this phlogiſton, which had been taken into the ſyſtem by the aliment, and was become as it were effete; the air that is reſpired ſerving as a menſtruum for that purpoſe.

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But I will give you his own words upon the subject.

"There is perhaps no subject in physiology, and few in philosophy in general, that has engaged more attention than that of the use of *respiration.* It is evident, that without breathing most animals would presently die; and it is also well known, that the same air will not long answer the purpose: for if it has been frequently respired, the breathing of it is as fatal as the total deprivation of air. But by what property it is, that air contributes to the support of animal life; and why air that has been much breathed, will no more answer the purpose, seems not to have been discovered by any of the many philosophers and physicians who have professedly written upon the subject; and that it might have continued to elude all *direct investigation,* when it discovered itself without any trouble or thought, in the course of my researches into the properties of different kinds of air, which had at first quite another object.

"In these experiments it clearly appeared, that respiration is a *phlogistic process,* affecting air in the very same manner as every other phlogistic process, (viz. putrefaction, the effervescence of iron filings and brimstone, or the calcination of metals, &c.) affects it; diminishing

nishing the quantity of it in a certain proportion, lessening its specific gravity, and rendering it unfit for respiration or inflammation, but leaving it in a state capable of being restored to a tolerable degree of purity, by agitation in water, &c. Having discovered this, I concluded, as may be seen in Phil. Trans. vol. LXII. p. 187. and of this work, vol. I. p. 78. 277. that the use of the lungs is to carry off a putrid effluvium, or to discharge that phlogiston, which had been taken into the system with the aliment, and was become as it were, effete; the air that is respired serving as a menstruum for that purpose.

"What I then concluded to be the use of respiration in general, I have now, I think, proved to be effected by means of the blood, in consequence of its coming so nearly into contact with the air in the lungs; the blood appearing to be a fluid wonderfully formed to imbibe and part with, that principle which the chymists call phlogiston, and changing its colour in consequence of being charged with it, or being freed from it; and affecting air in the very same manner, both out of the body, and in the lungs; and even notwithstanding the interposition of various substances, which prevent its coming into immediate contact with the air."

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I by all means agree with the Doctor, that all those processes of putrefaction, calcination, &c. are the same as the process which takes place in the lungs; that is, affecting air in the direct same manner; but in what manner that affection is conducted, I directly disagree with the learned Doctor; for, instead of its being a phlogisticating process to the air, I do affirm, it is a dephlogisticating one.

Let us, by way of elucidation of this essential piece of knowledge, take his first example, viz. putrefaction.

Putrefaction is a process (as we observed before) which affects the atmosphere in the same manner as animal respiration; what the Doctor calls phlogisticating air, but what I call dephlogisticating. Therefore, let us impartially and minutely canvass the process.

Take that part of the animal, which is most susceptible of putrefaction; viz. the animal mucous (as it is the most prone to putrefaction, therefore it is most adapted for an example) previous to its exposure to the air to putrify, examine it most accurately by the senses, its smell, taste, and colour; then by chymical process; in short, by every one that human ingenuity has invented, and see its qualities

qualities and properties, you will find it to be, comparatively, an insipid, inodorus, watery body; by chymical process you will find its component parts to be principally water, with a small quantity of gelatinous concrete, in none of which trials will you find it to possess little or none of phlogiston, but to be the opposite to it, in every quality and principle. Expose it to the air, and it will soon wonderfully change to the opposite extremes in all its qualities; it will become of a fetid cadaverous smell, its taste most pungent and noxious, its colour, from a limpid appearance, to a greenish one; nay, it will even become luminous, and shine in the dark: by chymical process, before only giving out a quantity of water, will now, after exposure to the air, give out strong volatile salts, and become highly inflammable; nay, so much phlogiston it now contains, as to be capable to be formed into inflammable air; shall actually, within its own powers, without any art to co-operate with it, constantly emit phlogiston, so as to become luminous. It will not only form itself into active volatile salts, but likewise into active volatile oils.

Here is a most pointed and wonderful fact; that an inactive, insipid, inodorous body should change its properties so rapidly, from expo-

ſure to the air, ſo as to become directly oppoſite from its former properties, will now have the moſt active qualities, moſt pungent to the taſte, and of the ſtrongeſt cadaverous ſmell, ſo as to taint the atmoſphere for a great ſpace around it. When bodies change their properties ſo amazingly, from one extremity to another, we may be certain ſome great and important proceſs in nature has taken place; then let us candidly inveſtigate, and ſee if we cannot find how this wonderful alteration is brought about; that, before expoſure to the air, if you had put the animal mucous into the fire, it would have extinguiſhed it, the ſame as water, but after expoſure, it would become inflammable and burn.

This great change then is all from expoſure to the air, which air, it has decompounded in the ſame manner as animal reſpiration would have done; there was no third body expoſed, or in the leaſt intervened at the time. Then I muſt again repeat in what manner was this wonderful change produced, that the animal mucous, which, from the ſtricteſt examination, poſſeſſed little or no phlogiſton, will now be a body containing nothing elſe comparatively; nay, ſhall even generate heat and light? and what is more extraordinary, that this mu-

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cous is not only turned to be an active phlogiſtic body, from the oppoſite quality, viz. a watery mucous one; yet the air (agreeable to Dr. Prieſtley) which produces all this change will have received a large proportion of phlogiſton from the mucous; as it was left in the ſame ſtate as if employed in animal reſpiration. I think it is incumbent on the Doctor to explain where this amazing abundancy of phlogiſton comes from, if it does not come from the air: but, I am afraid, the Doctor will find great difficulty in doing it. It is by this proceſs of expoſing animal and earthy matter to the air, that ſalt-petre is made, which body chymiſts know, or at leaſt ought to know, is principally phlogiſton. Where does all this phlogiſton come from? will any one be ſo ridicuouſly abſurd as to ſay it came from the animal mucous? — if there is any one ſo groſsly abſurd I pity him; being not deſirous, nor ſhall I offer, to refute him: but, as it is as clear as any demonſtration in Euclid, it could not come from the mucous, therefore, as there was no third body, it muſt have come from the air, by decompounding of it; in conſequence it is not phlogiſticating the air, but dephlogiſticating of it. So extremely active is the mucous, in decompounding the air, that it will not only attract phlogiſton,

ſufficient to ſaturate itſelf, but will become volatile, and fly off with it in vapour.

Therefore there can be no doubt but this phlogiſton was produced from the air, being decompounded by the mucous's ſuperior attraction for its phlogiſton; in conſequence there not only will be phlogiſton, but likewiſe fixed air and water generated; which is actually the fact; for, obſerve a cadeverous body, it is always extremely moiſt, and likewiſe, by chymical inveſtigation, fixed air will be found; all which originated from the air, and which three bodies, phlogiſton, fixed air, and water, make a compound, which formed the body, called air, and which decompoſition accounts for the air, expoſed to putrefaction, being diminiſhed in diameter, or the quantity of air in a certain proportion, leſſening its ſpecific gravity, and rendering it unfit for reſpiration and inflammation. The philoſophical reaſons, for which alterations, you will ſee fully explained in this tract.

That it is not merely gueſſing at the different phænomena of nature, but that each circumſtance and fact directly fall in and coincide with the general doctrine, and are its ſtrongeſt proofs; ſufficiently coroborating it, to the moſt ſceptic diſpoſition: all the theories

ries hitherto have been wild and vague conjectures, founded not on reason and solid judgement, but barely whim and guess work. How happy is it to pursue the works of God, with that simplicity and uniformity which we see them always clothed in; not the elaborate imaginary buildings of men's chimeras. I, by no means, make this application to the learned Doctor, whose works I am now refuting; his labours have been of the greatest service to mankind, and will be attended to till the latest period of time, being conducted by accurate and assiduous experiments, the true means of investigating Nature, and have been of the greatest utility; but the greatest of men, in pursuing the mysteries of philosophy, have erred. That Dr. Priestley is wrong, in his general doctrine of the air, is farther demonstrable.

The nitrous acid, in respect to its chymical principles and qualities, I need not here investigate, they being so well known: when it is exposed to the general atmosphere, it becomes volatile, flying off in a sensible vapour or smoke, which distinctly strikes the senses; from this exposure it becomes much weaker; a circumstance well known to chymists; therefore they confine it from the air's influence. From

its losing its active powers, as an acid, from exposure, (and which exposure is evidently attended with a vapour,) we would at first conclude that the active acid evaporated; but upon analizing this vapour, it is a mere nitrous sulphur not possessing in the least the properties of the acid; for, in breathing of it, your senses are confirmed in its being a nitrous sulphur, by its giving a suffocating sensation. It does not corrode metallic bodies, which the acid would do most rapidly; its taste confirms it a neutral body: in short, by the strictest chymical examination, it will be found a neutral body. This at first seems very wonderful, that the strong nitrous acid should evaporate an inactive neutral body; and, instead of that being stronger which remains, as we should naturally conclude, it is weaker, for the vapour is found to be phlogiston, united with the acid; and which phlogiston entirely destroys the activity of the acid; therefore it is a just conclusion to suppose, as the acid got quit of its phlogiston, that that which remained behind would be considerably more active. But instead of that being the case, which we certainly should have expected, *a priori*, it is in reality considerably weaker; it has likewise received a considerable saturation of phlogiston. Where did this amazing quantity of phlogiston come from, to neutralize the acid? the answer immediately

mediately introduces itſelf; — from the air, as there was no third body which intervened.

Then let us examine what alteration is induced upon the air, in conſequence of its loſing this great quantity of phlogiſton? Why, upon examining of it, it is in the ſame ſtate as air, which had been expoſed to animal reſpiration or putrefaction; it is what Prieſtley calls phlogiſticated, but what I call dephlogiſticated; that is, robbed of its proper ſaturation of phlogiſton, neceſſary to its being atmoſpherical air. The Doctor acknowledges that the nitrous acid phlogiſticates, as he calls it, the air, quicker than the influence of almoſt any other body; but will any one, after this examination, offer to aſſert that the acid produced this alteration upon the air, by giving it phlogiſton, which Dr. Prieſtley ſuppoſes? if they do, their reaſoning and chymiſtry are diametrically oppoſite to mine. For, only attend to the facts, the exhalation or vapour, which ſo conſpicuouſly flies from the acid, upon expoſure to the air, being a neutral body, from every examination, being phlogiſton neutralized with the nitrous acid; likewiſe that acid, which remains in the bottle, having received a great quantity of phlogiſton, proved from loſing its activity, and changing in colour, the ſame as if phlogiſton was artifi-

cially thrown into it: where did all this phlogiſton come from? Certainly from the air, otherwiſe the phænomena are not to be accounted for upon Prieſtley's principles. If the air, in this caſe, took phlogiſton from the nitrous acid, and phlogiſticated the air expoſed, in conſequence the acid would become far more active, as the great proceſs in making ſtrong concentrated nitrous acid, is to take as much phlogiſton from it as poſſible; but, inſtead of that being the caſe, the nitrous acid is impoveriſhed, and not ſtrengthened. There is a ſenſible vapour conſtantly flying from the acid, when expoſed to the atmoſpherical air; therefore, as this vapour moſt intimately blends itſelf with the common air, the changes induced upon it will moſt ſtrikingly expreſs the air's operation upon the acid: examine it, and you will find, that inſtead of its being the moſt active acid, from incorporating with the air, agreeable to Prieſtley, it is ſaturated with phlogiſton; therefore it is a phlogiſticating proceſs for the nitrous acid, and a dephlogiſticating one for the air; juſt the reverſe of what Dr. Prieſtley imagined. But only attend to what the Doctor ſays himſelf upon the ſubject,

"In order to compare the effects of the ſame ſpirit of nitre on common and on dephlogiſticated air, I once, for about a fortnight, expoſed

posed two half-ounce phials, nearly filled with the strongest brown spirit of nitre, one of them to a quantity of common air, and the other to about an equal quantity of dephlogisticated air; and I observed that the air in each of these cases was diminished in about the same proportion, and that the dephlogisticated air was considerably injured. The surface of the spirit of nitre in each of the phials was become much lighter-coloured than before, and the brown colour had, throughout, intirely disappeared; owing, no doubt, to its having parted with its phlogiston; and what I thought something remarkable, clouds of some whitish matter, not much unlike flowers of zinc, floated on the surface of the spirit of nitre, in both the phials. The quantity of acid was sensibly diminished in both; and carefully pouring off the upper and lighter-coloured part of the acid in both the phials, I found that they yielded nitrous air in nearly the same proportion, which was as *four* to *nine*, of what they had done before; while the stronger part of the acid, at the bottom of the phials, yielded nitrous air in the proportion of *seven* to *nine* of what they had done before."

You see in what manner the nitrous acid injured both common and dephlogisticated air, which

which the Doctor ſays (agreeable to his theory) was from imparting phlogiſton to them; but only attend to the circumſtances. He ſays the quantity of acid was ſenſibly diminiſhed in both phials; for that part of the acid, which was moſt expoſed to the air, was ſo weak as only to yield as four to nine of nitrous air of what they did before; and that part of the acid, which was the leaſt expoſed, to yield as ſeven to nine. And all this, agreeable to the Doctor, from imparting phlogiſton to the common and dephlogiſticated air. But he, and every chymiſt, muſt acknowledge, that phlogiſton neutralizes and weakens the nitrous acid, and the only means of making the concentrated acid, is to take phlogiſton from it; then, if it had imparted phlogiſton to the air, it muſt undoubtedly have grown ſtronger, and not weaker; but the direct ſame change was induced upon it as if phlogiſton was given it from any other ſource. But chymiſts are quite in a labyrinth, they even are unacquainted with this great, obvious, and important fact; that phlogiſton and acids are oppoſite bodies, neutralizing each other; forming neutral bodies, ſalts, &c. The clouds of ſome whitiſh matter, not unlike flowers of zinc, which floated on the ſurface of the ſpirit of nitre, in both phials, which the Doctor thought ſo remarkable, was only the earth decompounded, by being robbed of its phlogiſton; which,

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as I obſerved before, enters into the compoſition of common and dephlogiſticated air; but when I write expreſsly upon that ſubject, I will give a hiſtory of all the phænomena.

The lunar cauſtic is well known to be ſilver reduced into the ſtate of a calx, which calx, upon expoſure to the air, will have its metal revivified. The calx of metals is univerſally allowed to be the metal robbed of its phlogiſton; for, if you, by art, give it its proper ſaturation of phlogiſton again, it will re-aſſume its metallic properties.

I expoſed a quantity of the calx of ſilver to the air, from which expoſure its properties, as a cauſtic, were deſtroyed; it returned to its inactive metallic ſtate; therefore, from the allowed and eſtabliſhed principles of chymiſtry, it muſt have received its proper ſaturation of phlogiſton; there being no body to give it its proper ſaturation, but the air; therefore, as the air has here evidently parted with the phlogiſton, and not received, let us ſee what change has been induced upon it; why upon examination, it was found to be what the Doctor calls phlogiſticated, the ſame change produced as reſpiration or putrefaction, &c. therefore, no doubt, from the ſame cauſe; the air

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in both cases losing its phlogiston, and not receiving.

Oily bodies, as Dr. Priestley has himself proved, diminish, or, what he calls, phlogisticate the air; in consequence of that diminution of the air, they become more rancid and inflammable, evidently possessing a larger quantity of phlogiston; but, in consequence of receiving this addition of phlogstion, the air is decompounded.

The finest tallow or candle, from the most delicate white colour, will likewise, from exposure, become yellow and more inflammable, changing in every circumstance, in colour, taste, and inflammability; the same as when there is a quantity of actual fire thrown into it; either from melting the tallow with too strong a heat, (what the tallow-chandlers term scorching,) or likewise, that part of the candle, that is nearest the flame's influence, will take on that yellow colour and properties, from imbibing the fire from the flame.

I hope no caviller can dispute, but that these changes were produced by imbibing a greater proportion of phlogiston; therefore as the air is equally as capable of giving the change as the fire, in consequence, the air must have parted with

with its phlogiſton, and by that means become what I term dephlogiſticated.

As we have proved that this phlogiſton, which the Doctor ſpeaks of, would not have ſo pernicous an effect in the animal ſyſtem, as to kill the animal in five minutes; and as we have likewiſe proved, that the doctrine of phlogiſticated air (from which his theory of reſpiration and uſe of the blood originated) is not juſt, but directly reverſed; that it is not a phlogiſticated proceſs, but a dephlogiſticated proceſs: then let us examine the Doctor's experiments, for elucidating his theory; and ſee whether they ſupport him or not. Indeed, upon reading them, it a little ſurpriſed me that the Doctor ſhould bring them as proofs, as they appear (as far as my ſagacity carries me) to overthrow his doctrine, more than ſupport it. I ſhall, without producing my own experiments, confine myſelf entirely to his, and with his own deſcription of them, which I make no doubt will ſatisfy my reader with the fallacy of the Doctor's concluſion from them.

It is a univerſal received opinion, that the blood receives its red colour in the lungs. Hewſon, that ingenious philoſopher, directly proves it; Dr. Prieſtley likewiſe confirms it; we both agree in that point; but the great

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ſubject of controverſy is, the phyſical cauſe. The Doctor ſuppoſes it is from parting with its phlogiſton to the air, and I ſuppoſe it is from receiving phlogiſton from the air.

The Doctor, in elucidation of his opinion gives the following experiments.

He expoſed pieces of the ſame maſs of red blood, to inflammable air, fixed air, and what he terms phlogiſticated air, at the ſame time; they all became black, but what is a little wonderful, and what the Doctor cannot help telling, that the piece of blood, which was expoſed to the inflammable air, was the leaſt ſo; whilſt, agreeable to his theory, it ſhould have been conſiderably the moſt ſo; as he ſuppoſes that blood, by receiving phlogiſton, becomes blacker, and by parting with it becomes more red, and that is the proceſs which takes place in the lungs, the blood parting with phlogiſton to the air, and by that means becomes more red; but this very experiment is a ſingular fact to prove his doctrine, that fixed air ſhould turn blood blacker than inflammable air, when Dr. Prieſtley himſelf obſerves, that blood imbibes the latter's inflammability, and renders it in ſome degree wholeſome, but it produces no alteration upon fixed air; therefore could receive no phlo-

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giſton from it; for, if it had received any phlogiſton from the fixed air, it would have altered it, either in quality or quantity: then how is it poſſible that fixed air could ſupply it with a larger quantity of phlogiſton? a body which is the direct oppoſite to phlogiſton. The Doctor is obliged to this evaſive anſwer, that fixed air contains phlogiſton. It certainly does ſo; for I believe no air can be found without phlogiſton; but it does not contain one fiftieth degree of phlogiſton that inflammable air does; and that which it does contain, is ſo fixed by the acid, that it is not to be decompounded; for the blood makes no alteration upon fixed air, which it would do, if it took away its phlogiſton. The alteration it induces upon inflammatory air is, to imbibe ſo large a quantity of its phlogiſton, as to make it, in ſome degree, wholeſome; nay, almoſt entirely ſo; but, nevertheleſs, its imbibing ſuch a deal of its phlogiſton, it does not turn blood ſo black as fixed air, which gives it no phlogiſton; it may be argued on the other hand, why does it turn it in the leaſt black, as my doctrine ſays phlogiſton makes it more red. The reaſon is, that the phlogiſton, in inflammable air, is united with another fixed body, which hinders it from reflecting that red colour; for inſtance, blood that is black by agitation will become red; from this cauſe, breaking the union of the

the phlogiſton to the particles of the fibrous or glutinous part of the blood, and ſo ſetting it looſe. But in inflammable air its phlogiſton cannot be decompounded, by the attraction of the lymph or gluten, but is received into the blood in its compound ſtate; which is ſo fixed a ſtate, that it does not reflect the rays of light ſo ſtrongly as to give it that florid appearance. This is proved from the blood which was expoſed to inflammable air, though not ſo black as that which was expoſed to fixed air yet the former never became red again, when open to the influence of the atmoſphere, while the latter did: for the blood which was expoſed to the inflammable air, had got its ſaturation of phlogiſton, though in a ſtate that it could not reflect that florid colour; while that, expoſed to the fixed air, had imbibed no phlogiſton, but had parted with the looſe part of its own, which gives that florid colour, therefore it attracted the air's phlogiſton when expoſed to it.

That this is really the caſe is demonſtrable: take phlogiſton in a very fixed ſtate, as oil, which is much the ſame body as inflammable air, mix it with the blood, and it will turn it darker; but take phlogiſton united to a glutinous, animal, or earthy matter, either in the ſtate of ſalt petre, the urinary ſalts, or in the urine

urine itſelf; and it will turn it red the ſame as the atmoſpherical air will do.

Another fact which is impoſſible for the Doctor to ſurmount. When blood is recently drawn from the animal, it is very florid, but it ſhall very quickly and ſenſibly looſe that floridneſs, though at the ſame time it is imparting a very diſtinct vapour to the air, conſiderably a ſtronger one than could iſſue from the lungs; as there, the membrane of the lungs oppoſed its paſſage. As the Doctor ſays expreſsly that the air acts by carrying off the blood's phlogiſton, and that the ſame change is brought about out of the lungs as in the lungs; we ſhould, agreeable to that theory, expect the blood to grow more red, inſtead of more black, but it is reverſed; it appearing very florid when firſt drawn, but ſoon turns to a dingy black, owing to a diſtinct and ſenſible vapour, which iſſues from it, and which vapour is that fine florid phlogiſtic red part of the blood.

It may be ſaid, that the blood's turning black when recently drawn from the animal, is from its looſing its heat; but if the heat be artificially preſerved, ſo that it may ſtill retain the ſame degree, the change will equally take place.

If the vapour be condenſed, it will be found to be the fine animating phlogiſtic part of the blood, and it is that animating nutritious exhalation, that makes butchers fat; and likewiſe the looſing of that makes the blood turn more black, and not more red, as the Doctor ſuppoſes.

There is no doubt, that after the blood has loſt this eſſential phlogiſton or living principle, the part of the blood's ſurface which has been for a long time expoſed, will regain its florid red colour, by decompounding the air. But this ſenſible vapour or exhalation, which flies from recent blood in a diſtinct ſmoke, injures not the air; as I proved before, it is the attraction of phlogiſton from the air, after it has loſt its own, not the giving it to the air, which injures it; for that vapour enters not into the compound of the air, being only ſuſpended in it, as an extraneous or heterogeneous body.

There is another fact, which is directly contradictory to the Doctor's theory, and demonſtrable in favour of mine, which he himſelf takes notice of, being related by father Beccaria. That blood became black in *vacuo*, where it could not, as the Doctor himſelf acknowledges, have imbibed phlogiſton, and it could not,

not, as the Doctor would insinuate, be from an internal principle within itself of putrefaction; as afterwards, upon exposure to the air, it regained its florid colour again, which it never would do, should it's blackness be the result of its own internal putrefaction; besides, its transition to a black colour was too immediate for the least supposition of that kind.

But the Doctor is under a necessity (for all his prejudice) to acknowledge that the blood receives phlogiston from the air. His words are these:

"Since, however, a solution of nitre does produce this effect upon blood, instantly making the very blackest of a beautiful florid red; though this effect is not peculiar to nitre, (for a solution of common salt does nearly the same thing,) I own I am inclined to ascribe this effect to the air."

What can be more demonstrable, than that the florid red appearance, which blood puts on from exposure to the air, is owing to its absorbing part of the compound of the air, as nitre produces the direct same effect, when mixed with the blood, and Dr. Priestley says, that nitre may be formed into air, and of a very pure kind of air, we likewise know

that nitre is originally formed from the air; exposing animal mucous and other bodies to the air, in hot countries, where phlogiston greatly abounds, forms nitre.

That nitre is principally compounded of phlogiston, is demonstrable from many circumstances; to wit, its being produced more pure, and in far greater abundance, in those hot countries only, where phlogiston greatly abounds. Its high state of inflammability, is proved from its being the basis of gunpowder, its being to be formed into inflammable air; and, if it is exposed long enough to the air, it will turn into a volatile salt, proved by Hoffman.

In short, no doubt can remain about it; but that the air, when exposed to animal respiration, the putrefaction, or calcination of bodies, loses by that means its proper saturation of phlogiston, so that it is no longer fit for the uses and purposes of atmospherical air.

If phlogiston is thrown artificially into the blood, (that is, in the form of nitre,) it produces the direct same florid appearance as the air gives it. Can there be a doubt but it is from the same cause? And to put it beyond dispute, actual fire, thrown into the blood, affects

fects it in the direct same manner. We know very well that phlogiston is the most volatile of any body in nature; in short, we have before proved it is the great author of volatility in all bodies; for, agreeable to the quantity of phlogiston that bodies contain, they are more or less volatile, as in the regular gradation of water, spirits, æther, &c. their inflammability and volatility bearing an equal proportion; in short, we can, by heat, drive phlogiston from any body, even from metals, where it is most fixed, if they are capable of standing the proper degree of heat,

In meat, we are very sensible we can do it, either by roasting or boiling; by either of these processes we can dissipate every appearance of phlogiston from the muscular part of the animal, so as only to leave a lymph behind, making it a mere white glutinous matter, of an insipid taste, taking from it that red colour and pungent high relishing taste which w meat has; and you may accurately obser e, as the phlogiston leaves the meat, a regular gradation, from a fine florid red to a perfect white; its first growing blacker and blacker, then whiter and whiter. If the blackness was owing to its having a greater proportion of phlogiston, agreeable to Priestley, then certainly, without doubt, it would, as the fire dissipated the phlo-

giſton, grow redder and redder; but it is reverſed, it grows black from a fine florid red. That fire always acts, by diſſipating phlogiſton, is indiſputable, from making ſalts and oils, that are expoſed to its influence, into inflammable air. — That the air is the great author of giving phlogiſton to bodies is clear and demonſtrable. Let that ſimple homogeneous, inodorous body, viz. pure water, be expoſed to the air in a veſſel, and it will turn highly putrid and decompound, or, as Prieſtley calls it, phlogiſticate the air. If the putrid water be examined, it contains an immenſe quantity of phlogiſton, ſo much ſo as to be capable of emitting of it, and becoming luminous. Can Prieſtley, or any philoſopher, argue with a grave countenance, that the water contained all this phlogiſton before it was putrified, and that it likewiſe gave ſuch an immenſe quantity to the air as to phlogiſticate it? I hope the ſuppoſition appears ſo erroneous, that I have no occaſion to queſtion, or argue upon it; if others do, their reaſon and mine are diametrically opſite, but I hope they agree.

Lewenhoec ſays, " *inſpecting ſome freſh* and pure rain water, he could at firſt diſtinguiſh nothing therein; but after ſtanding a few days, expoſed to the air, the water grew foul and turbid, and in it appeared an infinite number of

of little fish of various kinds. Among these animalcules there was one, consisting of thirty joints, perfectly turning and winding itself about, and at last deposited a great number of eggs, from whence arose more animalcules like the first."

Can Priestley, or his advocates, suppose that these animalcules, or little fish, were generated from the air's taking phlogiston from the water? If that were the case, our general sentiments of animation (and all the philosophers hitherto) have been erroneous, for they supposed phlogiston is the great author. We observe, when the sun returns to us, how it animates the whole face of the earth; but agreeable to Priestley, it must be by taking phlogiston from the earth; this is rather a singular doctrine. Just the same in respect to vegetation, water exposed will produce vegetation; that likewise must be from taking away the water's phlogiston. But the sun vegetates the whole face of the earth, and animates it. If any one wants to be sensible of the change taking place in blood and meat from the volatilizing power of the fire, let him only observe his spit or pot. In the change it produces upon blood, he may observe his cook in her cu-

linary proceſs, where he will ſenſibly ſee the change.

But let us obſerve, for farther ſatisfaction to the more tenacious of our readers, if the phlogiſton of the living animal will not make this change, viz. turn blood redder, inſtead of blacker.

In urine there is a deal of animal phlogiſton, which keeps an animal mucous diſſolved; that it is ſo, is proved from its pungent ſmell and volatility, from its hot pungent taſte, and from its volatile ammoniac ſalts; and you will always obſerve, when the phlogiſton or heat of the ſyſtem abounds moſt, in conſequence theſe properties in the urine are moſt conſiderable; as this is an evident proof, that urine poſſeſſes a deal of animal phlogiſton, being ſo ſtrongly ſaturated with it; — let us ſee what changes it produces upon blood. Take the blackeſt blood, and immediately, upon putting it into urine, it changes its colour to a fine florid red, juſt ſuch a change as the lungs or nitre produces on blood.

Phlogiſton, in whatever form we apply it to the blood, either in a fixed or looſe ſtate, has this evident and ſenſible property, of turning the blood immediately, and ſtriking-

ly,

ly, red. Acid, (which every chymiſt knows, or ſhould know, is the direct oppoſite to phlogiſton, the one being an alkali, the other an acid,) in whatever form it is applied to the blood, either as fixed air, vinegar, or any other form, will turn it immediately and ſtrikingly black; neutralizing and decompounding the red globules inſtantaneouſly, the ſame as if they were alkaline ſalts. But we are ſuch ſtrangers to every part of nature that is in the leaſt concealed, that to this day the difference is not diſcovered between phlogiſton and fixed air, many ſuppoſing them the ſame, (nitrous and every other air being in the ſame predicament); but, when I write expreſsly on the ſubject, I will ſhew there is the ſame diſtinction between phlogiſton and fixed air, as there is, between alkalies and acids.

The Doctor has certainly not attended with that perſpicuity that the ſubject requires, otherwiſe he certainly would have canvaſſed his doctrine a little more accurately: how this effete matter was generated; and how it was ſo deadly to the ſyſtem. We know very well, that there is an immenſe quantity of phlogiſton conſtantly iſſuing from the ſyſtem, but this phlogiſton paſſes off in an actual ſtate, forming the animal heat, on which the very being of the animal depends: and this heat iſſues univerſally out of the whole

ſyſtem,

and not from any particular organ: the lungs do not evacuate or possess more heat than any other part of the system; then, as this effete phlogiston, which the Doctor speaks of, is not discharged in an active state, in what state is it then discharged? If in a condensed state, and not an actual one, (as those two states, or the only two that I know of, that phlogiston appears in,) whether is it a volatile salt, or an oil, or what other? The Doctor, certainly, should have analized it, and given us some information; and not left us so entirely in the dark.

But I will conclude with this great and general remark, which alone carries conviction with it; that what Dr. Priestley calls phlogisticated air, extinguishes flame; this then, when maturely considered, is a very droll supposition, that fire should extinguish fire; it is an irrational one, and is not so in nature; for inflammable air, which we know beyond contradiction abounds with a larger proportion of phlogiston, (and therefore is properly called phlogisticated,) instead of extinguishing flame, makes it burn with greater rapidity; nay, take phlogiston, and let it be evaporated into common air, such as oils, particularly volatile oils, or any phlogistic body, and it will produce flame with the utmost avidity. It is from this impregnation

impregnation that the air, in mines, takes fire; therefore it is very extraordinary and contradictory, that air being phlogisticated should extinguish flame.

That air is the great body which animates and carries the great principle of phlogiston to all bodies, is demonstrable; for, in summer, when the air is replete with phlogiston, what a deal of inanimate matter is given life to; what millions of millions of animals have their beginning and period with the summer's heat; sometimes it will make the face of a country all animated, with reptiles and insects, so as to destroy the whole vegetable kingdom. We have proved that the great distinction between the vegetable and animal kingdoms consists principally in one being a phlogisticated body, the other almost bereft of phlogiston; then, without doubt, it is here proved, that the air is the great and sole animator, it being the great agent which gives phlogiston to bodies; not as Priestley would have it, that its great uses and purposes were to take phlogiston from bodies, that being, agreeable to him, the office of the lungs; — inconsistent!

It is a universal received opinion, amongst all physiologists, that the animal system receives and gives out something to the air in inspiration

respiration and expiration, tho' they were totally in the dark, what it is, or how it is conducted. Indeed, the opinion could but strike them, seeing that animal life could not be supported, even the space of five minutes without it; it is the living principle of nature; for neither animal, vegetable, or any living body, could exist without it; nay, even the dissolution of bodies cannot take place without it; for animal and vegetable bodies, when deprived of their life, their putrefaction, necessary for the nurture of other bodies, is stopped, without having access to this great and necessary body, the air: that we see the course of nature stopped in all its processes, without that great and necessary agent, the atmosphere. Therefore, no wonder it struck physiologists with the importance of the enquiry, and with its essential qualities, and various hypothesis have been the result, principally founded on mere whim, no part of the fabric resulting from facts in nature. But we will pass by saying any thing farther upon the different hypothesis, and take notice of what was chymically proved to take place.

The ingenious Dr. Black formed a very pretty experiment with a syphon, in which he placed a quantity of lime-water, and which he expired through, placing one end of the syphon

to

to his mouth, and forcing the air, which came from his lungs, to paſs through the lime water: upon examining the water he found it turbid; the lime, which before was ſoluted in the water, as to entirely eſcape the eye, now became viſible and diſtinct, forming a milky fluid; which alteration was produced from a quality the air had received from the lungs; for he inſpired the atmoſphere through the lime-water, but it produced no effect, until the air, tainted with the lungs, was expired. And, as it is directly proved, the air, which came from the lungs, was only capable of giving this milkineſs to lime water; for the air, which was inſpired, could not give it. Then let us conſider what is the chymical principle which will give this milkineſs to lime water. Why we know of none, but fixed air, that could poſſibly have come from the expired air; therefore, with propriety and juſtice, he ſet it down as reſulting from fixed air, which he preſumed came from the lungs; and that one great office of theirs, was to diſcharge fixed air from the ſyſtem. But we ſhall endeavour to prove the generation of this air from another cauſe.

But to come to a minute enquiry, how this grand proceſs of ſanguification and animal heat is conducted, let us take, by way of illuſtration, the animal principles of a ſheep.

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I truſt no one will offer to deny but its living principle is conducted by the ſame cauſes as ours.

A ſheep is an animal body, with the ſame degree of heat as our ſyſtem; and likewiſe its powers of ſanguification are the ſame, both the ſolids and fluids partaking of the ſame qualities and colours. Its exiſtence depends upon food received and maſticated by the mouth, and farther prepared by the ſtomach and other organs; likewiſe it requires freſh air; for, if debarred of it, the ſame phænomenon takes place as with our ſyſtem, it is killed in a few minutes. Then, as food and air are the two grand reſources of its exiſtence, let us examine what they conſiſt of; the latter has already undergone an inveſtigation, therefore let us accurately attend to the food.

The food of a ſheep every one knows to be the ſpontaneous product of the earth; which is vulgarly called graſs; the moſt inſipid and watery of all vegetables, giving no particular flavour to the mouth, but of a humid, inſipid taſte, and quite inodorous: when chymically analized, it principally conſiſts of water, little or none of the volatile ſalts or oils, abounding chiefly with a watery acid, which it expreſſes ſenſibly in the acetous fermentation; in ſhort, having

having very little in its compoſition that indicates phlogiſton. It may be argued, that if properly fermented, it will give out a ſpirit; therefore it implies the reſidence of phlogiſton; but I contradict that analyſis, as not being fair; for no ſuch fermentation goes on in the ſyſtem; the great author of fermentation, the air, is wanting; and if ſuch a proceſs did go forward, the fixed air would deſtroy the ſyſtem. And likewiſe the graſs, which animals feed upon, is, of all vegetables, the pooreſt to give this ſpirit; having little or none of the ſaccharine quality, which is the principal author of that ſpiritous fermentation: that I diſpute, whether any may be received from it; if there is, it will be ſmall in quantity, and not of any ſignification in the ſyſtem.

This vegetable food or graſs then, is maſticated with a deal of water, received by the animal in the ſame manner as the graſs was, viz. into the ſtomach; and there this food, formed of the aceſcent watery vegetable, with a quantity of common water, is ſoluted with a ſtrong liquor, which the ſtomach throws out, as its principal author of digeſtion; and which incorporation forms a chyle, having every ſtrong mark of acidity, which will turn the violet infuſion red, will break milk, and, in ſhort, if chymically analiſed, will give every

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indication of a ſtrong acid. It is ſo ſtrongly aceſcent, that nature is under a neceſſity of throwing into it a large quantity of ſtrong phlogiſtic juice, and a thick mucous liquor, in order to blunt its acidity; otherwiſe it would greatly corrode and irritate the tender veſſels of the ſyſtem.

That this is really the caſe, is demonſtrable. This vegetable aceſcent food, being firſt maſticated with a mucous liquor, viz. the ſaliva, which greatly ſoftens the acidity of the food, after which, in its paſſage out of the ſtomach into the duodenum, it meets with one of the higheſt elaborated phlogiſtic fluids in the whole ſyſtem, viz. the bile, which has an amazing effect in neutralizing the acidity of the chyle; and which is demonſtrable by the great alteration there is, if the chyle is accurately examined, before and after it meets with this high phlogiſtic fluid: not only that, but there is a large ſalivary gland, called the pancreatic gland, which likewiſe pours out a liquor for blunting the acrimony of the chyle; in ſhort, the whole inteſtinal tube is formed of little glands, which ſecrete a liquor for this purpoſe; but nevertheleſs the great aceſcency of the chyle, being ſo directly oppoſite to the phlogiſtic principles of the ſyſtem, is ſtill too aceſcent; that nature of her great ingenuity, hath framed another great and eſſen-

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tial mixture to take place, before it is thrown into the grand circulatory ſyſtem, viz. the mixture of the rich mucous lymph; which mixture is formed in the receptaculum of the chyle: yet nevertheleſs, though the vegetable food of the ſheep is mixed with all theſe rich animal liquors, it ſhall ſtill be ſtrongly aceſcent; for, if the chyle be examined before it is thrown into the blood, it will have a tendency to acidity: yet, wonderful! phyſiologiſts would have this ſtrong aceſcent vegetable liquor, (ſo aceſcent as even ſtill to predominate, though it is ſo highly elaborated with animal juices,) to be the great reſervour and author of the phlogiſton to the ſyſtem, to give the great proportion of phlogiſton that the red globules and fat evidently poſſeſſes; nay, ſhall give animal heat, a heat of ninety-ſix degrees, which is conſtantly kept up; yet, more ſurpriſing and wonderful than all this, it imparts ſuch an immenſe deal of phlogiſton to the ſyſtem, phyſiologiſts ſay, that the lungs, that eſſential organ, is formed, merely to act as a great ventilator to diſcharge this amazing quantity of phlogiſton; that, if this great ventilator be but ſtopped for five minutes, death is the conſequence. How wonderful a doctrine is this, there being two direct oppoſite bodies in nature, ſo oppoſite in every chymical principle, that, by circulating

in a tube for a few minutes, will turn from one extremity to another; two bodies or principles in nature, that are so directly opposite to each other; yet merely, by a slow circulation, in a tube of a few yards in length, the one body would lose every principle of itself, and form the other. A very ingenious doctrine indeed; no man, in his far-fetched laboured theories, is obliged to reconcile these contradictions; but Nature is simple and uniform when investigated, shewing the greatest simplicity and uniformity. This chyle, which, from analysis, expresses not the least indication of phlogiston, will, after it has passed the lungs, change its properties exceedingly; before quite insipid to the taste, bordering strongly of an acid, is now, after being thrown into the circulation, of a strong alkalescent salty taste; of a high red colour, highly anamalized, going rapidly into the putrefactive fermentation, not shewing the least tendency to the acetous, but giving out a deal of volatile salt, peculiar to animal putrefaction.

What a great change is here? how much must the lungs have altered its properties; there being every distinction that takes place between the vegetable and animal kingdoms? viz. being first of a strong acid, watery taste, running into the acetous fermentation; its salts, which are small in quantity, are fixed; but, after

after being thrown into the general circulation, the scene will be quite changed: it will partake of the animal principles, viz. have a strong, saltish, high-relishing taste, only capable of the putrefactive fermentation, which it most immediately runs into, tho' before it was capable of the acetous fermentation, and requiring a long time before it would produce that. In its vegetable state very little salts we e found in it, and they of a fixed nature; but now, after being anamalized, its salts are in great abundance, and of a volatile nature. How diametrically opposite! what an amazing change is produced! that the food, being of the most simple vegetable taste, shall, after being circulated in the animal, become highly anamalized, throwing off every chymical properties of its vegetable state, and take on the opposite chymical properties of the animal. What could produce this great change? The animal must have some great phlogistic reservoir; it has only two resources, food and air; we have proved that the food is the direct opposite to this. There is an old philosophical axiom, something cannot be generated out of nothing; therefore it must get all these phlogistic powers from the air; which is demonstrable, as it has no other resource; the food, being so far from the author of it, that it is the direct opposite element; nay, take food from the sheep, and it will become one high vola-

tile ſalt; therefore the food, inſtead of being the author of it, is, in reality, Nature's great aid, in counteracting phlogiſton; for, if it is bereft of it, the animal is killed, turning to a high volatile ſalt comparatively. There is a remarkable fact of ſheep having been found under ſnow, where they had been confined for months, and yet ſupported life, though bereft of food; having only water, which they got from licking the ſnow; which ſnow, or water, ſupported life, by reſiſting putrefaction; the water having this great power, as phlogiſton was generated, it abſorbed it, and waſhed it out of the ſyſtem; yet in time it would be generated ſo faſt, that the poor animal would die, becauſe it had not its vegetable food, to neutralize its generating phlogiſton.

Take the ſheep in its moſt infant ſtate; it has nothing to feed on, but thoſe watery aceſcent vegetables; yet, from that food, the embryo ſhall become mature, enjoying a thouſand times more phlogiſton than it did in its infant ſtate; nay, ſhall conſtantly be giving out the amazing proportion of phlogiſton, as to produce a heat of ninety-ſix of Farenheit's thermometer; having no reſources from its food, that being of a quality juſt the contrary, having a power to neutralize or counteract phlogiſton. The only other reſource by which it can

poſſibly

possibly generate phlogiston then is air; that this is the grand reservoir of phlogiston, we shall, I hope, prove as clear as any demonstration in Euclid, only allowing a little for what cannot be mathematically demonstrated. Agreeable to the old hypothesis; it is impossible to reconcile such contradictions, so directly opposite, that a philosopher might with the same confidency and gravity, endeavour to prove that black is white, and white is black.

Only reflect upon the difference of temperature of these two kingdoms; the animal kingdom having a strong heat of ninety-six of Farenheit's; while the other, the vegetable, only partakes of the general temperature of inanimate bodies; but all this great change is brought about; that is, the vegetable kingdom becoming the animal kingdom, from the great and important viscera the lungs; for the food is not fit for animal life till it has passed that necessary circulation through the lungs, and with the qualities it receives then it is then fit for animal life; but before it has undergone that circulation, its animal properties have not taken place, still retaining its vegetable principles; and after it has once possessed the great animal properties, which it receives from its circulation through the lungs, it will only do for one circulation through the system, which circulation is performed in a

few minutes; for it must again pass through the lungs before it can be qualified for another circulation through the system, requiring the anamalizing power of the lungs to be renewed. Nay, this organ is so immediate to the being of the animal, that not a single drop of blood is sent to any part of the system, without receiving its influence; the heart itself being supplied with blood from the aorta, it being that vessel which receives the blood, in order to distribute it through the system, after having passed the lungs.

Leuenhoec, who was a man the most eminent for his microscopical observations, having illustrated by that means, many parts of the human system, says, that the farinaceous substances, malt liquors, wine, bread, &c. do consist, both before and after their formation into chyle, of small, lax, white bodies; which mixing with the blood, are often discerned floating in it for a little time after the meal; but, in twenty-four hours after, no such bodies are discernable in the vessels, but they are all converted into large red bodies, or yellow ones.

Then it is demonstrable, agreeable to Leuenhoec, that they receive this great change of animalization in the grand circulation. That they receive their principal anamalization in the lungs is highly presumptive, from this argument

gument alone; no blood paſſing to any part of the body, till it has firſt paſſed the lungs, from its requiring ſo conſtant a repetition of this circulation through the lungs, and from the animal's being killed in the trifling time of five minutes, when bereft of it; but I ſhall ſpeak more fully of this afterwards.

Boerhaave who, of all men, hath moſt philoſophically ſtudied medicine, ſays, that this anamilization is certainly formed in the lungs, though he was wrong in his opinion in what manner it was conducted.

The red colour of the blood, which is certainly a ſtrong characteriſtic of anamilization, is formed in the lungs; for, it is evident to ocular demonſtration, that the blood after having paſſed the lungs, is conſiderably redder, ſeen diſtinctly by viewing the blood in the pulmonary vein and artery, what an amazing difference there is in the colour; that in the vein being very red, while that in the artery is not ſo. That this redneſs is not the conſequence of the agitation that the blood meets with in the lungs, for I have before proved, that that agitation is very trifling, and by no means ſo conſiderable as Boerhaave thought. If agitation did it, the blood would return to the heart, conſiderably redder than it left it, as the

agitation it meets with there is a hundred times more considerable than it meets with in the lungs; but force and agitation has just the reverse effect in the general circulation; for it returns considerably blacker, requiring another circulation through the lungs before it regains its usual redness; therefore, without doubt, the red colour of the blood is formed in the lungs, and not from the principle of agitation; as we find, where agitation is most considerably conducted in the general circulation, it has a contrary effect, turning the blood blacker. This red colour of the blood, which is formed in the lungs, is, without doubt, the strongest mark of anamilization; for no living bodies in nature have their fluids red, but animals, and, agreeable to their degree of animation, the quantity and colour bear a proportion; that is, the more animated, the more red their fluids, and in greater quantity; so *vice versa*. There are many kinds of reptiles, fish, and other animals, which enjoy a trifling degree of animal life, some not much above the principle of vegetation, which have no red blood; and you may accurately trace every animal's vigour by its degree of colour and quantity of blood, from the most savage and wild animals, to the most poor reptiles. Nay, every one, I hope, will allow, that animal heat is the strongest characteristic of animal life, as no bodies in nature

nature poſſeſs it but animals: and you will find, that you may trace a regular gradation, between the redneſs of the blood, the degree of animation, and the degree of animal heat; nay, in the human ſyſtem, if a convaleſcent perſon's blood be examined, whoſe powers of nature are only half actuated, you will find a material difference betwixt it and a perſon's blood in full health; the former having by no means that rich animated appearance as the latter.

That the lungs are the great animators, giving animal heat and red colour to the blood, is demonſtrable; for, directly agreeable to animals having their lungs perfect, or in a high degree; in the ſame direct gradation, have they theſe qualities; viz. animal heat, and their blood of a rich red colour. Therefore, as theſe gradations ſo directly correſpond with each other, it implies their immediate connection. The moſt vigorous and animated animals, the tiger and others, which have conſiderably the greateſt energy and animation, have comparatively the moſt copious and large cheſts. What an immenſe breadth the lion's lungs occupy. On the other hand, animals which have no lungs, have ſcarce a degree of animation or heat above the vegetable ſyſtem; for inſtance, the ſnail, &c. in thoſe animals their ſenſibility, their powers of motion,

tion, are not many degrees above the vegetable kingdom; while those, that have large chests, have all those animated powers and perceptions which mark a strong degree of animal life.

Therefore, as we have proved that there is such an intimate relation between red blood, animal life, and animal heat attending upon that life, the organ, where this colour is made, certainly produces the principle of life and heat. This question is easily solved, the lungs make the blood red, is evidently demonstrable; for, if the blood be examined, which has passed the lungs, with that which has not passed them, you will find the former some degrees of shades stronger than the latter; and this additional colouring is received by the blood's being in contact with the air, which is inspired into the lungs; for, if the blood out of the lungs be exposed to the atmosphere, it will equally colour it, turning it from a heavy black hue to a bright red. To bring this explanation to a nicer minutia, take a determined quantity of blood out of the vena cava, the same quantity out of the vena portæ; then put each of them seperately into ten times their bulk of water, and you will find the latter to tinge the water sensibly stronger, than the former.

This

This is a very material queſtion, and deſerves the moſt ſerious attention; for, as I have juſt obſerved, that animal heat is the ſtrongeſt characteriſtic of animal life; therefore, that organ, which principally conduces to form it, is certainly the moſt eſſential to the animal. Boerhaave ſays, that the lungs form it, to prove which, he expreſsly ſays, that the thermometer ſhewed a ſtronger degree of heat to exiſt, when put into the vena portæ, than when put into the vena cava, of the ſame animal. This is a little ſtrange, and deſerves the moſt ſerious attention; that the atmoſphere, which is ſo many degrees below the temperature of the blood (in froſty weather for inſtance) ſhould, inſtead of almoſt congealing the blood (which we might ſuppoſe, *a priori)* make it conſiderably warmer: this is ſtill more extraordinary, when we reflect how wonderfully nature has conſtructed the lungs, to expoſe ſo large a ſurface of the blood to the air. Boerhaave ſays, that the ſurface, expoſed in the lungs, is larger than the whole external diameter of the animal; yet, wonderful to relate, this great expoſure to an atmoſphere, which is congealing every other fluid, in Iceland. &c. will have a quite contrary effect upon the blood, turning it conſiderably hotter; yet the air, which has been expoſed and expired, will have imbibed a deal of heat, being of the temperature of the blood.

blood. Here is a paradox, and inexplicable upon the old doctrine; that two bodies, one of the temperature of ninety-ſix of Farenheit's, and the other conſiderably below the freezing point, ſhould, by being expoſed together, have both their temperatures ſo raiſed, that the body, which was conſiderably below thirty-two degrees, ſhall mount up to ninety-ſix: yet, nevertheleſs, inſtead of ſtealing this additional temperature from the other, it gives it an additional degree. Upon the old doctrine, this is truly a paradox; tho', when it is fairly canvaſſed, it is by no means ſtrange, but what is chymically taking place conſtantly in other bodies. Take, for inſtance, common oil, and mix it with a ſtrong acid, and immediately a ſtrong heat is produced, from a decompoſition of the oil taking place, its phlogiſton is ſet looſe; juſt ſo the air, which likewiſe is a compound, ſtrongly abounding with phlogiſton, ſhall, by being expoſed to the blood, which has (the ſame as the acid with the oil) a ſtronger attraction for its phlogiſton; therefore, a decompoſition and re-union take place, and the phlogiſton, in paſſing from one body to the other, will produce heat: in the one example, every chymiſt could argue philoſophically about it, and account for it rationally; but the other ſtill remained in the dark. There is certainly ſome great and important proceſs

taking

taking place in the lungs, as life cannot be supported for five minutes without this essential change taking place. Let us consider farther what this great change consists of, being so very necessary to animal life: it certainly consists of phlogiston, from two great reasons: first, its great tendency to run into the alkalescent putrefactive fermentation, foreign to its source, vegetable matter; and likewise, what is more demonstrable, is its animal heat, which expressly denotes both to the thermometer and senses, the actual existence of phlogiston.

When we see a moist body retain a heat of ninety-six degrees, what an immense quantity of phlogiston will it require to support that heat, under the great exhausting power of evaporation. Dr. Black, upon his ingenious doctrine of latent heat, hath proved, what an immense deal of phlogiston is required for evaporating fluids, the vapour having a particular appetite for absorbing actual phlogiston, and then making it latent; that is, laying concealed, either to our feelings or thermometer; but when the vapour is condensed into its primitive state of fluidity, it gives out its latent phlogiston into actual again. And it is really amazing, what a quantity of phlogiston lies dormant in vapour, seen by condensing the vapour in a common still, how soon the water in

in the worm veſſel is heated. Black's computation of the heat received is immenſe.

After eſtabliſhing this philoſophical fact, of the great abſorbing power of vapour upon phlogiſton, what an amazing quantity of phlogiſton will be required, to keep up that conſtant vapour, that is always flying of from our ſyſtem, vulgarly termed perſpiration. Only reflect upon an adult of our ſpecies, what a conſiderable external ſurface is expoſed to the atmoſphere, beſides that conſiderable one of his lungs, which, Boerhaave ſays, is equal to the whole external ſurface; what an amazing quantity of vapour muſt be conſtantly taking place; a moiſt ſurface, under the conſtant influence of a heat of ninety-ſix degrees, aided by ſo conſiderable a motion as his circulation; that diſcharge from the lungs being ſo particularly replete with vapour.

Then only ſum up all theſe circumſtances together; firſt, the great abſorption of phlogiſton required to produce vapour; ſecondly, the conſtant moiſture of the ſurface; thirdly, the drying power of the atmoſphere, particularly upon fluid bodies, of which the animal ſyſtem may certainly be called one; fourthly, the quick motion of the fluids, from their rapid circulation, which every body knows greatly

greatly aids evaporation; and, fifthly, the conſtant heat of ninety-ſix degrees, which the fluids are conſtantly expoſed to: maturely weigh all theſe circumſtances together, and then candidly reflect, what a deal of phlogiſton muſt be required to ſupport the animal functions. In general, philoſophers never thought of this great evaporizing appetite; they only attended to the actual heat, which the thermometer ſhewed exiſted; but, if the other is philoſophically weighed, it will open another extenſive idea, of its requiring a great reſervoir of phlogiſton.

It is from this principle, of vapour requiring ſuch a deal of phlogiſton, that people catch cold from being wet; there are many bodies, which are actually more cold than water, and which may be applied with impunity to the ſyſtem; but water has a particular influence in giving cold, which all convaleſcents are aware of. It is from the great natural tendency that water has to evaporate, but before it can evaporate, it requires a large quantity of phlogiſton, which it will ſteal from the bodies contiguous to it; therefore, if the water is applied to the animal ſyſtem, it will rob it of its animal heat or phlogiſton; ſo much ſo, in convaleſcent people, as to produce diſeaſe.

Therefore,

Therefore, Dr. Heberden is wrong in ſuppoſing that moiſture does no harm, and that a perſon may lie in a damp bed with impunity. A perſon lying in a damp bed, with all his ſurface immediately expoſed to it, particularly when aſleep, (being a time moſt ſuſceptible of cold, as the animal heat of his ſyſtem at that time is moſt languid, therefore ſooneſt exhauſted,) muſt certainly catch cold, without he has a moſt robuſt conſtitution indeed. It is ſuch a trial as few conſtitutions are able to cope with, and has been the death of thouſands.

We have already analized the food, and we have ſhewn, that not the leaſt appearance of phlogiſton exiſts there comparatively, either to the thermometer, ſenſes, or chymical proceſs; therefore this animal heat could not draw its ſource from thence; and I hope I need not endeavour to prove here, as I mean to write expreſsly upon the ſubject, that heat is a pure element, ſeperate from any other, always exiſting in that ſtate, never taking any other form; though, when it is neutralized with other bodies, it lies dormant; yet, upon being ſet looſe, it takes on its primitive form.

If the vegetable food of the animal, contained the phlogiſton which the animal poſſeſſes, we certainly, without the leaſt doubt, ſhould

ſhould detect its preſence in the vegetable, by chymical analyſis; for, by this analyſis we can detect it in all other bodies which poſſeſs it, why then ſhould we be foiled in the analyſing of a ſimple vegetable, which holds its component parts ſo extremely looſe. The hardeſt metals we can decompound with the greateſt eaſe, and evince to our ſenſes the phlogiſton they contain. All bodies in nature we can decompound, and rob them of their phlogiſton; nay, vegetables with the greateſt eaſe; and, when we analize the ſpontaneous graſs, which many animals live upon, we find its component parts to be of qualities oppoſite to phlogiſton; principally a watery acid, which neutralizes or blunts the activity of phlogiſton, inſtead of feeding of it; nay, not ſo much as aiding of it, but of the direct oppoſite quality. How then is it poſſible to reconcile this contradiction, that it can be the great author of it in animals? If men's philoſophy is obliged to reconcile ſuch paradoxes, it certainly ſtands on a flimſy foundation.

As we have analized the vegetable food of animals, and found little or no phlogiſton in them, let us analize the animals which have fed upon the vegetable, and ſee their chymical principles.

First, then, the taste of animals.

Upon tasting, you find a rich, salty, pungent flavour, similar to what phlogiston gives, when in the form of oil or salt; while the grass, which the animal fed upon, gives a watery, insipid, acid taste.

Secondly, in respect to the animal's fermentation.

Its fermentation is almost immediate in warm weather; sometimes, in a few minutes, it will run into a strong alkalescent fermentation or putrefaction, giving the sensible existence of a deal of phlogiston, and being covered with a volatile salt; while the vegetable will lay some weeks under the same degree of heat, without any change; and, when it does ferment, it requires the mixture of a deal of water, and even then it is only the acetous fermentation.

Thirdly, its chymical analysis by distillation.

Animal matter distilled, gives out a strong volatile empyreumatic oil and volatile salt, leaving a fixed earth behind; while the grass, distilled,

distilled, gives out a large proportion of water, with an earth and fixed salt, little or no oil.

Fourthly, their natural degree of heat.

In this great point they differ most essentially, for the living vegetable has no heat above the surrounding bodies, while the living animal has a temperature, generated within itself, by its own organs, many degrees above the surrounding inanimate bodies.

Then how diametrically different are these two bodies, just the direct opposites; therefore it is impossible the grass could have been the entire existence of the animal, as their properties are so diametrically opposite; one having a large proportion of phlogiston, while the other appears to have none, and it must have entered the system by a different source; therefore let us examine its other sources of existence, for it is utterly impossible that human reason can suppose it originated from the grass, as their elements and principles are so directly opposite, that, instead of one being the author of the other, they are direct opponents in qualities, counteracting each other; for, by being joined together, they rob one another of each of their principles, forming a third neutral body, the same as alkalies and acids:

all chymists will acknowledge the different properties of these two bodies, and if they will maturely weigh the animal and the vegetable kingdoms, they will find the same opposition. No chymist would endeavour to argue, that the alkaline salt could be made into one of the acids, by receiving a trifling degree of motion, the same as the grass in the animal receives, from the circulation.

As we have proved the extreme fallacy of the supposition, that the food can be the great author of animal heat, we must then have recourse to the other means of support, which the animal receives; which is air, that great and essential element to animal life, that even the being bereft of it, for the space of five minutes, death will be the consequence. Then how much more immediate is it to the existence of the animal than the food; therefore something essential is imparted from it; and, as phlogiston abounds so much in the animal, in consequence it must have some great channel by which it receives it; and, as we have just now proved, it cannot be received by the food, therefore it must be by the air, as these are its only two sources. We have already dissected the air, and in which we have proved the existence of an immense quantity of phlogiston, which solutes water and fixed air into atmospherical

atmoſpherical air; and that the quantity required to make the fixed air and water into that tranſparent ſolution, which really exiſts in atmoſpherical air, is immenſe: that this is not merely romance, I have chymically analized the air, and proved the exiſtence of this phlogiſton; that it is neutralized with fixed air and water, which compound forms atmoſpherical air; and it will not give the leaſt indication of each ingredient ſeparately, but the whole making a body of quite different principles; which I elucidated was very general in nature, exemplified by acids and alkalies. But thoſe three ingredients are ſo connected together, that if a fourth body be expoſed to the influence of the atmoſphere, which has a ſtronger attraction for any of the three ingredients than they have for one another; this fourth body will make a decompoſition of the atmoſpherical air, taking from it its powers and qualities as air; which is by no means ſingular, but a univerſal law in nature, known to all chymiſts. This is exemplified by lightning; when there is too large a proportion of phlogiſton ſoluted in the atmoſphere, this great univerſal power and law of nature will rob it of its over proportion, by the act of lightning; and there generally falls an immenſe quantity of rain immediately after it, which is the water that helped to ſolute this over-proportion

of phlogiſton: and likewiſe when there is an over proportion of water in the atmoſphere, it will diſcharge itſelf by rain; and, after and before a ſevere ſhower of rain, you may find the atmoſphere ſenſibly warmer, both to the thermometer and ſenſes; which is owing to the phlogiſton's being ſet looſe, which helped to ſolute the over-proportion of water, which the atmoſphere was burthened with. Likewiſe the moſt intenſe froſts will often take place immediately after a fog is cleared up, proved by many obſervations and calendars of the weather; which is owing to the phlogiſton of the atmoſphere being employed in neutralizing the humid vapours which formed the fog; but on the froſt's taking place, there is a ſenſible decreaſe both of phlogiſton or heat, and moiſture, which is evidently ſhewn by the thermometer. From whence ariſes this decreaſe? It is certainly owing to the water and phlogiſton neutralizing one another into atmoſpherical air; and ſo, by that means, taking from both of them their ſenſible qualities, which the thermometer and ſenſes prove the loſs of. Which addition to the atmoſphere, of this extraordinary water and phlogiſton, will make it heavier; which is really the caſe, proved by the barometer; it is owing to this great power in nature of ſoluting, neutralizing, and decompounding the atmoſphere, which

makes

makes all the changes which the thermometer and barometer expreſs, and which our feelings likewiſe make us ſenſible of; but more of this hereafter, when I ſhall write expreſsly upon the ſubject. Though this doctrine of the air being a compound may appear new, differing from the old eſtabliſhed opinion, yet it is proved demonſtrably to be juſt; as Dr. Prieſtley, in his ingenious experiments, found that many bodies, by the aſſiſtance of heat, could be formed into atmoſpherical air; bodies, that had no property or principle before ſimilar to air. Yet by the application of heat, that great author of all fluidity, they could be formed into different kinds of air, and ſome partaking of every property and principle of common air. Nay further, ſolids cannot only be formed into that tranſparent fluid called air, but likewiſe the different kinds of air may be condenſed, and form ſolids. Here then is a union and ſimilarity between air and ſolid bodies, which chemiſtry before dreamt not of.

The lungs being an organ the moſt eſſential in the whole ſyſtem, as upon its health the whole animal frame ſympathiſes: for in conſumptions, where the lungs are the ſeat of the diſeaſe, we obſerve a ſlow and corroding diſorder, the conſequence baffling the phyſician's art; for with-

out the ulcerations of the lungs are healed, it will terminate fatally, and when once injured, it is seldom they are radically cured, but a hectic and consuming disorder takes place. This great organ is not only fatal in its diseased state to the animal, but even if its function is stopped for five minutes, death is the consequence; which is the case with no other organ, their functions being not so immediate to the life of the animal.

This organ then being of the utmost and most immediate consequence to the system, let us consider its situation and structure.—It is situated in a large cavity called the thorax, enclosed by the ribs, and divided by the diaphragm from the stomach, liver, and the rest of the viscera. It is so framed as to take in a large quantity of the common atmosphere, which it is constantly inhaling and exhaling every moment, as the immediate life of the animal rests upon it. It takes in this large quantity of air, and applies it in a most dextrous manner to a large exposed surface of blood, (they being only separated by a thin membrane, agreeable to Boerhaave, ten times thinner than writing paper) expressing this obvious construction in nature to form as large a surface of blood and air together, as can take place in a cavity of their size; which surface,

ſurface, though contained in ſo ſmall a cavity as the thorax, is conſiderably larger than the ſurface of the whole body, the lungs being wonderfully conſtructed for this great and obvious purpoſe, to form as large a ſurface of blood and air together, it being the greateſt and moſt eſſential cauſe of animal life. This intention of expoſing the blood and air together, being ſo very obvious, let us obſerve what change is produced, both upon the blood and air, to ſee if we can by that means trace the great and important function of the lungs in animal life.

The blood, as we have before taken notice, is diſtinctly redder and more fluid, and agreeable to Boerhaave, warmer; all which changes take place, in conſequence of the blood paſſing the lungs, and all of which we have demonſtrated before. Let us firſt conſider its being redder from paſſing the lungs.

One of the greateſt marks of animation is the red colour of the blood, for we obſerve an accurate gradation of each animal's degree of life, agreeable to the redneſs of their fluids; from the tiger, and thoſe animals which are endowed with the ſtrongeſt marks of animal life, to ſnails and other reptiles, which ſcarce have any animation; we may accurately trace the

the different gradations, from the former having the highest marks of redness in their fluids, till the latter, who express not the least marks of red colour in theirs: therefore the organ which forms this red colour of the blood must be an important one to animal life. Upon examining chemically those red globules, we find that they principally consist of phlogiston, being highly inflammable, having a repulsive power to water, swimming in fluids with a flat surface like a shilling, the same as oil and other phlogistic fluids; in short, upon a chemical analysis, giving all the marks of phlogiston. Then, as they consist so strongly of phlogiston, where they are formed, there must be a phlogistic process; we have proved that they are formed in the lungs, for the blood, by passing the lungs, all anatomists agree, becomes redder, and it is equally as well ascertained, that the red colour of the blood is entirely owing to the red globules; therefore, without doubt, the lungs is the great author of forming animal blood.

The next mark of the blood's change in passing the lungs, is its being more fluid.

All bodies enjoy two states, viz. fluidity or solidity; we say, from peculiarity of climate, such a thing is naturally fluid or solid; while, in altering the climate, their natural state

ſtate of fluidity and ſolidity differ: in England, we ſay the natural ſtate of water is fluidity; in Greenland, it is ſolidity: then what is the author of theſe changes? It is eaſily anſwered, the preſence and abſence of phlogiſton; for all bodies, it is univerally allowed, may be made either ſolid or fluid, by the abſence or preſence of phlogiſton. Every philoſopher knows the fact, and the ingenious Dr. Black hath philoſophically explained how it is conducted. Then as it is univerſal throughout nature, that fluidity and ſolidity are owing to the preſence and abſence of phlogiſton, therefore, without doubt, by the blood's becoming more fluid in the lungs, is owing to the ſame cauſe, without phyſiologiſts would make it an alien: indeed there are ſuch ſtrange hypotheſes ſupported, with ſo much partiality, that it is amazing.

The laſt obſervation we ſhall make of its changes in paſſing the lungs is, that it is warmer. Boerhaave diſcovered this, by placing a thermometer in the blood of the right auricle, it did not ſtand ſo high as when placed in the left auricle of the ſame animal; therefore, without doubt, the blood muſt have received this additional heat by its circulation through the lungs. I need not enlarge upon this additional

additional warmth, being an indication of a greater degree of phlogiston or heat.

Let us take a general view of the changes brought upon the blood by its circulation through the lungs, being more red, more fluid, and, agreeable to Boerhaave, warmer. I hope no one will dispute after what has been said, that these changes are owing to its receiving phlogiston; if any one is so tenacious and sceptic, take phlogiston either in a fixed state, or in a loose state, viz. as nitre (which is principally phlogiston) or as actual fire, and those direct changes will be brought upon the blood. If the air did not carry phlogiston to the lungs, in Greenland every inspiration, agreeable to the common action of hot and cold bodies upon one another, the blood would be quite congealed; but instead of that taking place, it is amazingly redder, more fluid, and actually warmer. What can have produced all these changes? Why a child's reason would say, from receiving heat; not as Priestley supposes from his chemical observations, that the lungs great office is not to receive phlogiston or heat, but only to evacuate it. Maturely reflect, with common sense alone, upon these changes, and they directly contradict such suppositions. But upon a just chemical review, it shall be found equally as repugnant

repugnant and fallacious, for we can prove it chemically, that the lungs great office is to receive phlogiſton, and not to evacuate it.

After attending to the changes produced upon the blood by the act of inſpiration, let us next conſider the changes produced upon the air by the ſame function.

Atmoſpherical air, breathed into the lungs, is there wonderfully put in contact with the ſurface of the blood (at leaſt there is only a thin membrane intervenes, agreeable to Dr. Hales ſo thin as the thouſandth part of an inch) and there ſtaying expoſed to its influence for a few ſeconds of time, after which it is thrown out, as being unfit for further expoſure: this operation is ſo eſſential to the life of the animal, that it muſt be immediately renewed again with freſh air. Therefore it is natural to ſuppoſe, as life ſo directly depends upon it, ſome great change muſt there have taken place. But let us examine the expired air, and ſee what alteration it has undergone, as it has loſt its great property of feeding life, for it will not do for a ſecond inſpiration.

Firſt, we obſerve one great and remarkable change, it has loſt its elaſticity; ſecondly, it is

is lighter; thirdly, it contains fixed air; and fourthly, it contains a deal of water. All these remarkable changes take place by being exposed to the blood; let us enquire how it is brought about; whether it has lost some of its principles, or got something heterogeneous from the blood.

First then let us enquire concerning its elasticity. Quicksilver, every one knows, has this property in a very eminent degree, and particularly all inflammable liquors. But what bodies have this elastic property most considerably, are those formed into vapour; the most considerable of all is the common atmosphere.

As all fluids then have this property of being evaporable, let us enquire what is the cause of it. Indeed all fluids, particularly spirituous ones, nay even the heaviest and most fixed of all fluids, the mineral acids, particularly the nitrous acid. Nay, solids are equally as evaporable, if their density and gravity be ever so strong, they are capable of ascending; in short, every body in nature. We know there is an universal principle in nature, a power of gravitation, which every body manifestly possesses, agreeable to their specific gravity. The great physical cause why bodies do

do gravitate we know not, only we are well assured it is an universal law in nature. It was upon this great and general principle that Sir Isaac Newton founded his great system of philosophy. It is equally as general a principle in nature, that bodies, if ever so specifically heavy, do sometimes (either from the effects of Nature's own operations, or from art) counteract this great gravitating principle; and, instead of falling to the earth, the great center of gravity, they ascend. As this gravitating principle then is so great and general a law in nature, whatever counteracts it, must be a very great and powerful principle indeed.

Let us enquire what body or principle it is that causes this great deviation of Nature's gravitating law? It is easily answered, phlogiston. The physical reason why it has this great effect so powerfully is, as I answered the question of Nature's gravitating law, we are totally in the dark; only we are certain of the fact, as being general and universal; and I need not elucidate it, by enlarging on the effects of evaporation, distillation, and other chymical processes, from the effects of fire, they being fully investigated by Dr. Black's doctrine, wherein he proves that fluidity and evaporation are conducted by the principle of phlogiston entering in a latent state, as he calls it,

into

into the body evaporated; but it is a saturated state, the same as an alkali or an acid, and neutralized in the direct same state as phlogiston is with earth, making those bodies called salts, &c.

Then I make it a general rule, that no body in nature can resist the gravitating power of the earth's center, upon any other principle than receiving a more than ordinary proportion of phlogiston; otherwise they cannot become specifically lighter than the atmosphere, which they must do, if they ascend into it from their own levity, having no mechanical or external impulse. I form this ascension of bodies into a general rule, as resulting entirely from the power of phlogiston. Let us examine bodies in their evaporable state, if they really possess it more considerably than in their natural state.

Then let us take gold, for example, as being a body which resists the ascending power of phlogiston the most. By throwing into a piece of gold an immense quantity of phlogiston, collected by the focus of a burning glass, from the rays of the sun, it became lighter than the atmosphere, and evaporated, flying off with an immense quantity of phlogiston. That it was phlogiston alone that evaporated it, it is certain,

tain, as nothing but pure phlogiſton, collected from the great reſervoir, the ſun, was applied to it, or influenced it; and that it abſorbed or ſaturated itſelf with a ſtrong proportion of this phlogiſton, is likewiſe as evidently proved; for, when this gold vapour was condenſed, it gave out all its immenſe heat or phlogiſton to the body which condenſed it; and another pretty fact it proves, that as long as it exiſted as vapour, it fixed the active power of the phlogiſton, ſo that it neither ſhewed itſelf to the ſenſes nor to the thermometer: but as ſoon as ever it was let looſe, by the gold's being condenſed, then it ſhewed itſelf by all its active properties.

Here is a clear example of the aſcenſion of bodies, or a counteraction of the power of gravitation, being entirely owing to phlogiſton; for no other body or principle in nature could evaporate the gold but phlogiſton. Now the air is, in its natural ſtate, the lighteſt body of any in their natural ſtate, reſiſting moſt, of any entire bodies, the gravitating power of the earth's center; and, as we have ſhewn that bodies do that from containing a large quantity of phlogiſton, therefore we have a right to ſuppoſe, it contains proportionably the largeſt ſaturation of any other body in its natural ſtate; particularly as we can prove that

it is compounded of heavy gravitating bodies, viz. fixed air and water; which I shall demonstrate to be the case. Fixed air, which philosophers believe is originally the same as the heavy acids, the most heavy gravitating fluids of any in nature; and water, every one is acquainted with its ponderous quality. Then, as I proved before, that nothing could make heavy bodies resist the power of gravity but phlogiston; and likewise that phlogiston, to bodies so specifically heavy, must be a large proportion indeed, to give them this great and wonderful property.

Another property which the air possesses, it is more elastic; then let us enquire upon what its elasticity depends; and by that means trace why it has lost its elasticity by being breathed?

Upon what does elasticity depend? That question is easily solved; it is known to be heat. This principle or body can give this elastic property to every part of nature; likewise can increase the property in those bodies which have it naturally; nay, what is surprising, the most dense and compact of all metals, it can form into an elastic vapour, which two states, metallic and vapour, differ in specific gravity so far as from one extremity to the

the other; exemplified by gold, which the famous burning mirror at Paris can turn into vapour; most wonderful that that heavy ponderous metal should be made lighter than the common air! Water, and many other fluids, can with a small degree of heat be evaporized; nay, with the common heat of the atmosphere, all bodies have a natural tendency to ascend. But to demonstrate by experiment, how heat can evaporate, and give bodies the power of elasticity, I shall prove in a very sensible degree: take a few drops of water, place them in *vacuo*, in a large globe, made of metal; expose the globe to an intense heat, and you will burst the vessel. Spirits, and other inflammable liquors, have this great elastic property in a more considerable degree.

But air of all bodies is most sensible to elasticity, the least degree of heat acts most immediately and most considerably upon it. This is seen very sensibly in a bladder partly exhausted of air, but if applied to a very small degree of heat, it immediately fully distends the bladder, and if still increased will soon burst it; nay, I do not suppose any force can withstand this wonderful elastic property of heat. We see, in nature, earthquakes produced by it, where the earth is shaken for some

hundreds of miles. Nay, heat not only appears evidently to give this elastic property; but, what demonstrates it fully, if you take heat from any body, you destroy its elasticity; seen strikingly by robbing the vapour of water of its heat, you immediately condense it again. This is prettily proved by a common still, the water in which is turned into vapour by the fire, which ascends into the receiver or head of the still; from which a large canal called the worm, is fixed; and which being exposed to a large body of cold water; so that, when the vapour reaches it, it shall be condensed; but in the condensation, it gives out an amazing degree of heat, ten times more considerable than that degree which is contained in boiling water; which is proved by heating the cold water in the worm-tub so fast, and principally at the top, being that end next the head of the still. No one, I think, can doubt of heat being the principle in nature which is the author of elasticity; nay, it is the author of distillation, which chymists use to evaporate bodies. Solids are not free from its powers, for they all increase and decrease in specific gravity by heat. Take a piece of iron, mould it to a certain diameter, by passing it through a ring; then heat it to a red heat, and you will find it will not pass again through the ring.

As

As heat, then, is indiſputably proved to be the author of elaſticity throughout all nature, ſhewn experimentally to be the author of the air's elaſticity; it is very wonderful, that when the air; at thirty-two degrees, agreeable to Farenheit's thermometer, ſhall be expoſed to a heat of ninety-ſix in the thorax; yet that heat, inſtead of increaſing its elaſticity, will amazingly decreaſe it; particularly as heat, in every other caſe, increaſes its elaſticity. Therefore this argument would greatly denounce that the blood robbed it of its phlogiſton; and this agrees with the obſervations of the alterations in the blood; that, by receiving the air's phlogiſton, it has ſenſibly become more red, more fluid, and warmer, agreeable to Boerhaave. As to the two latter alterations, I think I need not endeavour to prove that if it receives phlogiſton, it will produce a greater heat and fluidity; as heat, every one knows, makes the hardeſt bodies fluid. As to making it more red, that likewiſe will be the natural conſequence of heat; if you expoſe blood to a ſtrong degree of heat, where it cannot evaporate, you may ſenſibly obſerve it to turn more red.

The next material change that we obſerve in expired air, is its being lighter.

Philosophers have calculated the atmosphere to have a very sensible and considerable degree of weight; what bodies are they which give this weight to the atmosphere? Bodies which we can prove the atmosphere evidently to possess, and which are specifically heavy: viz. water and fixed air; the weight of water every one knows, and the weight of fixed air, likewise all chymists are sensible that it is a great deal heavier than the common air. I have before proved that water and fixed air make up a great part of the common air, having shewn it by the experiment of lime water, and likewise the caustic salts, attracting fix d air in great quantitites from the common air; and I likewise proved that the fixed salts (sal tart. per deliquium for instance) readily attracted water from the air; therefore, as I have proved their existence in the air, I shall hereafter evidently prove that the blood in the lungs decompounds the air, and that these two bodies, water and fixed air are seperated from it; and, in consequence, must make it specifically lighter.

That it abounds with fixed air is very evidently proved by the most ingenious Dr. Black, by whom I had the honour and happiness to be taught chymistry.

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He took a glaſs ſyphon, wherein he placed a quantity of lime water, and both inſpired and expired through the ſyphon; the firſt operation affected not the leaſt the lime-water, but the latter made the water become ſenſibly turbid. Therefore he preſumed, agreeable to an incontrovertable rule in chymiſtry, that the expired air contained fixed air, and that it only ſhewed its poſſeſſion of it from being breathed by the lungs.

That it likewiſe poſſeſſes water, is ocularly proved by breathing upon a cold glaſs, which condenſes the breath, and depoſits a clear water, which is ſo univerſally known, that I need not enlarge upon it.

Here we evidently ſee, that the lungs have a power in decompounding the air; let us enquire upon what principle this power is conducted, and how it operates.

Firſt, then, we have proved, that the atmoſphere is a compound body, formed of fixed air and water, neutralized with an immenſe quantity of phlogiſton; which has the power of giving all bodies a fluidity ſimilar to air, but particularly fixed air and water; and, as long as this neutral ſolution exiſts, it will form atmoſpherical air; but, when a decompoſition

takes place, being robbed of the most essential body of the composition, viz. phlogiston, that then there will be a seperation of each ingredient. This is exactly the case of the expired air; it shews the evident mark of these two bodies; viz. fixed air and water, which are obvious. We evidently observe the two bodies, which give the specific gravity to the air, seperated from it in great abundance, by the act of respiration; no wonder then it should be lighter than the pure air, and fly upwards; which is the case of expired air; it always rises above the pure atmospherical air. And that it should be more moist, will naturally be the consequence, from its being robbed of its phlogiston, by the blood's superior attraction for it, which kept the water soluted.

Here then we have rationally and philosophically accounted for every change which really takes place in the air from being breathed; and we have given the same rational account, for the changes induced upon the blood by respiration; now let us prove what comes of the phlogiston, as its presence has deserted the air.

As the air has been in particular contact with the blood, let us examine it and see if we can detect the air's phlogiston there. The blood

blood has become ſenſibly redder, more fluid, and warmer agreeable to Boerhaave; all of which have been proved expreſsly to denote the reſidence of phlogiſton.

But let us elucidate our theory by following regularly an animal's ſuſtenance, from its vegetable food to its animalizing and diſcharging it out of the ſyſtem: then ſhall we have a more clear and ſtriking view how it is conducted. — We ſhall ſtill take the ſame ſpecies of animal as before for our ſubject, viz. a ſheep, which, as I obſerved, enjoys the ſame principles of animal heat and ſanguiſication as our ſpecies do.

Its food, as I obſerved before, is of the vegetable kingdom, that ſpontaneous production of it vulgarly called graſs, which is received by the animal into its mouth, and is maſticated by the teeth, which are adapted for grinding bodies aſunder, and from thence anatomiſts have ſtiled them Dentes Molares: at the time of this maſtication of the food, there is a mucous liquor called the ſaliva, which enters copiouſly into its compoſition, forming with it a kind of ball, which is thrown into the ſtomach, and there meets with a gaſtric liquor, which ſoon reduces its integrant parts into a fluid called chyle. After

undergoing

undergoing this chemical change, from the secreted juices of the stomach, assisted by the animal heat and the muscular action of the stomach, it is thrown out of the stomach into a tube or gut, called duodenum, and it there meets with a very essential fluid necessary to its further preparation, called the bile; likewise a liquor called the pancreatic juice; after which it has a long continued course for some yards, in which, the parts necessary for the body are received by small capillary vessels, minutely and intimately dispersed every where along the surface of the canal; and that which is excrementitious is thrown out of the body at the termination of the canal, by the gut called the rectum; while that received by the lacteals, or capillary vessels, unite in one general receptacle, called *receptaculum chyli*, where, meeting with a liquor called lymph, they both together are thrown into the circulation of red blood, just previous to its passage through the lungs.

In this circulation of the food, it takes on every property of the vegetable, its animalization not being made by any process hitherto; its taste, colour, and chymical properties, are all still strongly acescent. But after its circulation through the lungs, it undergoes that great animal change; its ve-

vegetable properties are all vanifhed, no vegetable chyle being to be detected in the blood, after its paffage through the lungs. The great Lewenhoec obferved, that the farinaceous fubftances, malt liqnors, wine, and bread, do confift, both before and after their formation into chyle, of fmall lax and white fpherules, eafily divifible, which, mixing with the blood, are often difcerned floating in it, for a little time after a meal; but in twenty-four hours no fuch fpherules are difcernible in the veffels, but they are all converted into large red ones, or fmaller yellow ones And we likewife know, from the experiments of Lower, that the chyle, which floated vifibly in the blood a few hours after a meal, does, in the fpace of twenty-four hours afterwards, entirely difappear. If you throw chyle into a vein, its properties of chyle may be accurately diftinguifhed even in the pulmonary artery; but if the pulmonary vein be examined, though fuch a large quantity of chyle has been thrown into it by the *receptaculum chyli*, you will not difcover any; for the latter having paffed the lungs, its properties were there animalized: before, being of a milky, mild, acefcent watery nature, it now becomes of a red, florid colour, of a ftrong animal effluvia, eafily running into the putrefactive fermentation, and not capable of the acetous; (though before

fore in a great meaſure it was only capable of the acetous) of a ſtrong animal heat, and of a more fluid texture, all denoting the reception of a large quantity of phlogiſton. Dr. Lower ſays, that he has diſtinctly obſerved milk along with the blood in the right ventricle, but he never could obſerve it in the left ventricle, after the blood had paſſed the lungs. What a rapid and great change is here made by ſo ſhort an intercourſe with the air! only a few ſeconds, to change its properties ſo exceedingly; which when chymically examined in the ſtate of chyle, partook not in the leaſt of phlogiſton, but now has every property denoting it in a very eminent degree. It is not a little wonderful how this great change can be brought about, from a vegetable aceſcent body, being compounded principally of water, earth, and a weak acid, ſhould, by the intercourſe of the air, take on quite different properties, different both to the ſenſes and chymical analyſis; that it ſhall now have a volatile, alkaline, ſaltiſh taſte; before, a watery, aceſcent one; that it ſhall now be highly inflammable, forming red globules, which, if examined, bear all the properties of phlogiſton or oil, have an oily repulſive action in water, ſwimming in it with flat ſurfaces like a ſhilling the ſame as oil, eaſily admiſſible with oil, but not with water; when burned, give a ſtrong and bright flame;

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in ſhort, have every property in common with oil. The great Dr. Prieſtley has accurately inveſtigated the properties of oil; he can, by a proceſs, expand it into inflammable air; and the chymical proceſs every one is acquainted with, which proves its being phlogiſton and earth that form it — both of which proceſſes evidently declare it to be principally phlogiſton; therefore as the red globules are nearly the ſame, only the oil is a ſtronger impregnation of phlogiſton, there being no property in common which they do not both poſſeſs, being both formed of a great quantity of fixed phlogiſton: the chyle poſſeſſed no properties of this nature, it being formed of watery, aceſcent vegetables, therefore it muſt have been received in the ſyſtem; where it is received, we can accurately prove, for, examine the blood of the ſame animal in the vena cava and vena portæ, and you will find that the latter poſſeſſes conſiderably more of red globules than the former, therefore, demonſtrably, the lungs muſt have formed them. Nay, to bring this beyond all diſpute, expoſe the blood out of the ſyſtem, and you will find the ſame preciſe proceſs takes place there; it will from a black hue turn to a fine florid red: take a given quantity of each, waſh from both all their red globules in water, then evaporate the water, and you will find that you will get more from a

given

given quantity of the blood that has been exposed to the air, than that which has not; and likewise that they will burn with a more brisk flame. Nay, take blood, and wash from it all its red globules, and you will accurately observe that, as it loses its globules, it will turn blacker and blacker. This process of stealing phlogiston from the air is by no means singular; it is conducted by many bodies. The process of making salt-petre very strikingly shews it, where animal, or earthy matter, form a fixed salt; but I intend writing a treatise, wherein I will demonstrate many processes of nature, of which mankind, as yet, are totally in the dark. All metals, and leather, indeed most bodies considerderably attract phlogiston, seen by a black, dingy covering which they contract, and which, if examined, will be found phlogiston; as it is universally allowed to be so, I shall not here prove it.

I hope my reader is now satisfied that the lungs is the great animalizing viscera, exposing the blood to a large surface of the air, with a motive of receiving phlogiston from it. And, as it naturally will strike his curiosity to know how it is conducted, I hope I shall be able to inform him upon rational and philosophical principles.

First

First then, it is an universal and established doctrine, that any compound body may be decompounded, if you will expose another body, which has a stronger attraction, for some one of the compound, that in consequence there will be a decomposition and fresh union; but let us illustrate it by example. — If the fixed alkali (which every one knows is joined with a deal of fixed air) be exposed to an acid, it will immediately leave the air, and form a strong union with the acid; making a neutral salt, partaking of neither of the properties of its components separately.

Again; take the tart. per deliquium, which is the fixed alkali mixed with water, (and which it has a strong attraction for) upon the interposition of an acid, it will drop the water, forming a neutral salt at the bottom of the vessel. Upon this principle of attraction or affinity does the chyle attract phlogiston in the lungs; and it will, upon investigation, be found, to be agreeable to the table of attractions.

Of all bodies in nature, phlogiston and acids have the strongest attraction for one another; then let us enquire what the chyle consists of: it consists of a watery, acescent, and vegetable mucous; and the air is formed of phlogiston, fixed air, and water: now it is well known, that when fixed air is absorbed

into

into bodies, it will there become fixed, (from which it has derived its name of fixed air) that is, it lies there contracted into an exceeding ſmaller bulk, and gives out its qualities to the body by an acid taſte, that in this latent or fixed ſtate, it is highly concentrated, and has an amazing ſtronger attraction for phlogiſton, than it had when fixed air; and it is likewiſe to be conſidered, that one body will give an over proportion of ſaturation of phlogiſton to another, which has not ſo ſtrong an attraction for it; which is proved by many proceſſes, well known to chymiſts. Therefore in this vegetable, fixed ſtate, it muſt exceed the attracting powers of the atmoſpherical fixed air and water for their phlogiſton, robbing them of it: nay, this proceſs in the body is not ſo very ſingular, for if the chyle be expoſed out of it, to the influence of the air, it will be found to do the ſame, contracting a better alkaline ſtate.

I have already, I think, ſatisfactorily proved, that the air principally conſiſts of phlogiſton, ſoluting a great quantity of fixed air and water, which I believe few philoſophers will deny; and I have likewiſe demonſtrated, that the food of animals, taken by the mouth, is nothing but the moſt, ſimple, watery, and aceſcent vegetables, being the ſpontaneous product

product of the earth, without agriculture, vulgarly called grass.

That this is the real process of nature, we have the most undoubted proofs of: first, the air's being charged with such a deal of phlogiston, otherwise it could not neutralize, or keep such a quantity of fixed air and water soluted. Secondly, the chyle's superior attraction for it, if exposed to it; proved by the table of chymical attractions, and likewise by the direct proofs of such a process taking place out of the system. Thirdly, by analysing the blood, where it will be found self-evident and convictive to the most tenacious disposition, of its possessing it in an exceeding large degree; marked by its putrefactive tendency, its taste, but most of all, its animal heat; will any one be so ridiculously absurd as to say, that it could possess these, without possessing phlogiston? To such philosophers I will answer not. Nay, by every chymical and philosophical observation, the animal possesses an amazing quantity of phlogiston, at least those bodies which we know are phlogiston in its latent state, such as fat, oil, and volatile salts, sometimes better half of the animal being pure fat; nay, it is constantly giving out, in its actual state, a degree of heat, sometimes a hundred degrees above the surrounding bodies.—Where

does it get all these properties? Let the shrewdest sceptic analise the chyle, and find the bare appearance of a reason of its originating from it, if he can.

Fourth. If you examine the expired air, it will be found strikingly to corroborate our theory, by having lost its phlogiston, proved by the water and fixed air, which it before kept soluted, being now decompounded, shewing themselves both to the senses and chymical analysis; for, as I before proved, that both these bodies, fixed air, and water, were to be got sensibly from the expired air.

That this process of stealing phlogiston from the air, is not peculiar to the animal kingdom, all bodies in nature do it in some degree. It is from this process of the air being decompounded by such a variety of circumstances in large towns, that makes vegetation thrive better within a certain district of them. Vegetables being formed of bodies, which have considerably less power of decompounding the air than animals, therefore do it more slowly; that when it is decompounded from other circumstances which are constantly taking place in large towns, it will make vegetables grow and thrive quicker, that is, receive the decompounded phlogiston, fixed air, and water,

all

all which are neceſſary to their life: vegetables receiving by far the greateſt part of their nutriment from the air by their ſurface.

What will be an extraordinary fact to philoſophers is, that fire exiſts by it. It is univerſally known that fire cannot exiſt without the free intercourſe of the air, no more than the human ſyſtem, that their being equally depends upon it; and another equally as well eſtabliſhed fact is, that they both leave the air in the ſame ſtate, that it neither will do for the farther purpoſes of animal life, or the life of fire; its having by both proceſſes undergone the direct ſame change. If accurately examined in both caſes, there will be found a ſenſible exiſtence of both fixed air and water; we have already endeavoured to prove the change brought upon the ſyſtem, by the air, was by receiving phlogiſton; and the change brought on fire, by the air, will be found to be equally the ſame.

Examine a lighted candle, and you will ſee a conſiderable flame and heat come from it; and that flame and heat will bear a direct proportion to the pure air deſtroyed by it; by feeding it with a conſtant freſh ſtream of pure air it will give ten times the flame it would have done if it was pent up in a cloſe, confined at-

moſphere. In the art of ſoldering metals, the workmen take a blow-pipe, and throw a great current of air through the flame of a candle, which produces ten times a ſtronger heat, than the flame of the candle would have done without the aid of the current of air. The conſumption of the tallow does not, by any means, bear a proportion to the flame; for, in the caſe of its burning with ten times the flame, it did not conſume the tallow in the ſame ratio; therefore this phlogiſton muſt have been ſupplied from ſome place; it is proved, the tallow did not give it, therefore the air muſt have given it: indeed, upon analyſis, it will be found ſo; for it is amazing the quantity of air a candle conſumes; what I mean by conſumption here, is decompounding it, by taking away its phlogiſton. How could a perſon rationally conclude, that in a grain of tallow, there could lay latent ſuch a deal of phlogiſton, ſo as to give conſiderable light and heat for ſome minutes? No; it is the air which principally furniſhes it. In forming that grain of tallow into inflammable air, it would be very inconſiderable, by no means equal to the flame it would emit if burned in the open air; and, if burned in the ſtate of inflammable air, it will, I preſume, make conſiderably leſs flame, than if burned as tallow in the open air.

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If my reader is ſtill not contented with my doctrine, as innovations into the ſchool of philoſophy ought to be critically examined, particularly when it overturns old ſyſtems, I ſhall give him another fact, plain, obvious, and indiſputable.

Every one knows that the proceſs of animal putrefaction deſtroys air in the direct ſame manner as animal reſpiration and artificial fire; that it leaves the air in the direct ſame ſtate, therefore indiſputably, that the ſame proceſs is equally conducted in the three. That animal putrefaction receives phlogiſton from the air is evident to our ſenſes and chymical knowledge; for it is this proceſs by which they make ſalt-petre, in expoſing animal and earthy bodies in hot countries, where there is a deal of phlogiſton in the air; that theſe bodies, having a ſuperior attraction for the air's phlogiſton, decompounds the air, leaving it in the direct ſame ſtate as fire or reſpiration.

Take a piece of freſh meat, analize it by all the chymical proceſſes invented, and then calculate the degree of phlogiſton it poſſeſſes; take the direct ſame bulk of meat of the ſame animal, let it highly putrefy, and then analize it, and you will find an immenſe difference in the quantity of phlogiſton; being in the latter caſe fifty times more conſiderable,

though in all its putrefactive process it was giving phlogiston to the air, characterized by its putrid smell, and inflammable air it was generating.

That in this process of receiving it from the air in its latent or dormant state, and then giving it back again to the air in its actual state, it directly agrees with both the animal kingdom and actual fire; for they both likewise give it back again in its actual state, characterized by animal heat and actual fire; nay, if you observe a putrid body, in the night, you will actually see fire surrround it. Will any philosopher say, that the meat possessed all this phlogiston before exposure to the air? If he does, I will not offer to contradict him. Vegetables conduct their life upon the same principles; that is, by receiving phlogiston from the air; nay, when I write expressly on that subject, I shall prove that they receive by far the greatest part of their nourishment by the surface; they decompound the air, and by that means receive both phlogiston, fixed air, and water from it; all of which bodies, by circulating in vegetables, are evacuated by them in the state of air; so that the air is the great author of life; and, by dispensing that life, it receives its own; and by that means there is an alternate dependence of one part of the creation upon the other. Water has

has the ſame power in decompounding and forming air; but more of this afterwards.

Let animal mucous be expoſed, which, if analiſed, poſſeſſes little or no phlogiſton, and it will turn ſtrongly putrid and give out phlogiſton to the air, and likewiſe turn into an active ſalt; which chymiſts know, or will know, is nothing but phlogiſton, fixed by earthy and acid ſubſtances; and which is demonſtrated by analizing the ſalt, as it will be found to be compounded of an amazing quantity of phlogiſton; what expreſſes its being compounded of phlogiſton is, its being capable of being turned into inflammable air. Then, if this mucous matter, (which is really the caſe) by expoſure to the air, will become a ſalt, whoſe principal compoſition is phlogiſton; nevertheleſs, though it retains ſuch an immenſe deal, yet, in the proceſs of putrefaction, which made it, it would be conſtantly iſſuing out phlogiſton, both as volatile ſalt and inflammable air, nay, in actual fire; which is often really the caſe, (putrid ſubſtances emitting light in the dark:) nevertheleſs, though it is giving out ſuch an amazing quantity of phlogiſton in all forms, yet it will retain enough to make it a pure ſalt. It is a ſimilar proceſs to this, by which they make that inflammable ſalt, ſalt-petre; by expoſing animal

matter and rich earth to the air in hot countries, where phlogiſton greatly abounds; bodies that poſſeſs little or no phlogiſton comparatively before expoſure. But in the making of this ſalt, if the air be examined, it will be found to be decompounded, the ſame as animal reſpiration decompounds it: then, if the air is acted upon in this proceſs, the ſame as in reſpiration, will Dr. Prieſtley, or any other philoſopher, ſay it is by receiving phlogiſton from the animal matter or earth expoſed? certainly not, the receiving has been with the animal and earthy bodies, which at firſt poſſeſſed little or no phlogiſton, but is now totally compounded of it. Should any one be inconſiderate and ridiculous enough to argue, that the animal and earthy matter poſſeſt all the phlogiſton before expoſure, ſuch doctrine deſerves no refutation. If men will cavil upon ſuch trifling grounds, they may cavil, I ſhall not intereſt myſelf to contradict them; but certainly, maturely canvaſſing the doctrine, after this candid and fair ſtate of it, conviction moſt in courſe follow.

It is wonderful how dark the world has been almoſt to every proceſs of the human ſyſtem; things that were a little concealed have laid ſo long in obſcurity. There is a very ſtriking inſtance of this in animal moiſture. If it had been maturely conſidered, the world could not have

have been under ſuch ignorance concerning it; but let us candidly inveſtigate it. An animal, whoſe fluids make the better half of its bulk and compoſition, ſhall ſupport a conſtant heat of ninety-ſix degrees of Farenheit's thermometer, and whoſe fluids are always open to it, and which have a ſtrong vaporific tendency, their baſis being water. Then only reflect upon ſuch an immenſe quantity of fluids being expoſed with ſo large a ſurface, to the drying power of the air, aided by the immenſe heat of ninety-ſix degrees, along with a quick circulation of thoſe fluids; that, all acting together, muſt produce an amazing evaporation: then reflect what a quantity of freſh fluids will it require to repleniſh the evaporation, and keep the ſkin in that conſtant ſtate of moiſture which it always poſſeſſes. A heat ſo very conſiderable as ninety-ſix degrees, always acting upon the animal moiſture; a moiſture which has ſuch a vaporific tendency, and expoſed to ſo large a ſurface, as the whole external ſurface of the animal; beſides the lungs, whoſe ſurface, agreeable to Boerhaave, is equal to the whole external diameter; not only that, but likewiſe the ſurfaces of the whole viſcera; that, though they are not immediately expoſed to the air, yet they are open to the circulation and motion requiſite to their functions; that every vital fibre and particle in the whole body is not only expoſed to this conſiderable animal heat, but likewiſe

likewise to the motion from the rapid circulation which is constantly taking place in the system.

Then sum up all these circumstances together, under the intense scorching heat of the air at the Equator. Only consider the quantity which must be evaporated in twenty-four hours. I speak within bounds when I say, the same bulk of water, heated to ninety-six degrees, and exposed to as large a surface of air, as the external surface and lungs of the human system, that more than one half of the water would be evaporated in the twenty-four hours. It may be argued, that the skin and other coverings hinder, in some measure, evaporation; but when we reflect, that the moisture can transpire through the skin, and that likewise the skin is always moist, therefore the air, the animal heat, and the circulation, all act upon the skin; and if its moisture is to be supplied from the system, it is almost the same as if there was no covering, in respect to retarding evaporation.

Only reflect upon what a considerable and constant supply of moisture there must be thrown upon the skin, otherwise it would become parched; therefore the air has that moisture constantly to act upon; yet, notwithstanding so large a surface being exposed to the intense vaporific heat that prevails in the East-Indies,

Indies, aided by the animal heat, with the great powers of the circulation likewiſe impelling the fluids upon the ſkin; that I am certain, with comprehending all theſe circumcumſtances in their full force, that in an adult of our ſpecies it would require forty pounds of moiſture in the day, to keep him in his ſtate of pliability and moiſture.

To bring this to our ſenſes more clearly and demonſtrably, take the ſkin of any animal, fill it with water, and give it the motion ſimilar to what the fluids had, in the animal that it belonged to, and likewiſe the animal heat of 96 degrees, and obſerve in the 24 hours what conſumption there will be. If the ſkin is kept as moiſt as it was, when upon the animal, I will pronounce that above half of its fluids will be conſumed.

Only conſider the immenſe diſcharges, which are conſtantly iſſuing out of the human ſyſtem. Its inſenſible perſpiration, which is conſtantly evaporating, the great diſcharges by the lungs, which, if condenſed by breathing upon a cold glaſs, will be ſeen to be very conſiderable; then likewiſe the evacuations by urine, ſaliva, &c. are to be taken to account. That can any man, if he maturely weighs all theſe circumſtances, be ſo abſurd as to ſuppoſe they are ſupplied by the mouth?

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In a winter's day, I have often examined that evacuation of mine by urine, and it has exceeded in quantity the moisture taken by the mouth into the system; then where did this overplus come from, and what supported the other evacuations of fluids in my system, when the one by urine exceeded the moisture that was received by the mouth? particularly that of perspiration, (which is so much more considerable than the urine, and with all the rest of the great variety, there are in the system;) likewise comprehending that extensive idea of every minute particle and fibre being so very moist, soft, and pliable, than the strong animal heat, and the drying power of the air; and likewise take to account the great and general circulation every atom undergoes, by the great and impelling circulatory powers of the heart and arteries; not only that, but the great mechanical power of motion, in the muscles; then with comprehending both these powers of motion upon the animal fluids, aided by 96 degrees of heat, and the great evaporating power of the air in hot climates; what a considerable quantity of fluids will it require, to keep the animal system in that moist, limber state it possesses, particularly as the animal fluids are very evaporable, that is, have a strong tendency to be evaporated. If physiologists had maturely weighed all these arguments,

ments, they could not have been ſatisfied with the trifling cauſes which have been aſſigned for it.

But what puts my argument beyond all doubt is, that in many countries where the air is greatly ſoluted with water, that animals will ſupport themſelves for ſome weeks, without any inconveniency, and without taking any fluids by the mouth. The human ſpecies will ſubſiſt themſelves for a long time, without ever drinking, nevertheleſs they will keep up their diſcharges by perſpiration, urine, &c. the ſame as if they had drank fluids, and will keep their ſkin moiſt, though of a heat of 96 degrees. Theſe facts are quite extraordinary and inexplicable upon the old doctrine, there is ſome other great cauſe which the world is a ſtranger to: for it is impoſſible, after canvaſſing each circumſtance, to ſuppoſe that the trifling cauſes which were before aſſigned for it, could be adequate to ſuch effects; we can only reconcile that mankind being ſatisfied with them was owing to this cauſe, viz. being under ſuch obſcurity, and there is a principle in human nature to always aſſign ſome cauſe and reaſon to the extent of their knowledge for every point of philoſophy; and be ſatisfied till a better can be given; but I truſt this cauſe, viz. the decompoſition of the air, will ſufficiently

ficiently account, in the fullest manner, for all this great quantity of moisture necessary for animal life, and we shall be no longer strangers to the phenomenon.

It is this great cause of the decomposition of the air, which will sufficiently account for it. But let us enter minutely upon the explication how it is conducted, that is, how the air is decompounded so as to part with its water, and how the animal receives it.

I hope I have already proved satisfactorily, that phlogiston is attracted considerably from the air, by animals breathing of it, by the actual combustion of inflammable bodies, and by animal putrefaction. From my theory of these processes, and of the composition of the air, there will be a deal of water decompounded from the air, from the state of solution which it before enjoyed in the air; but let us see if it is really so in nature. I have already proved, that the air is compounded of fixed air and water, soluted with phlogiston; and likewise that the animal is formed of earth and acid bodies, &c. which have a stronger attraction for the air's phlogiston, than the bodies which are already joined with it; that in consequence of their being exposed to the influence of each other, there will be a decomposition

compoſition and freſh union; that the air's phlogiſton will leave its preſent companions, and form an union with the animal, which will produce a condenſation, both of the water and fixed air; which will therefore ſhew themſelves to the ſenſes, and the water will join with the body contiguous to it, which is the animal's ſurface, and which great circumſtance is the great author of keeping our bodies moiſt and pliable, otherwiſe we ſhould be ſcorched and burnt up.

Apply a cold body, a piece of glaſs for inſtance, to the animal breath, and ſee if there will be any condenſation of water? Yes, there will be a very conſiderable condenſation of water, ſo as ſenſibly to run in currents down the glaſs.

By ſleeping all night in a room, when the air is in a freezing ſtate, there will be ice found upon the windows; being nothing more than the water condenſed from the breath, and froze by the external cold air without the chamber. This fact is univerſally known and received.

After maturely weighing my doctrine of the compoſition of the air, and its capability of being decompounded, by animals breathing it.

it, &c. and as I looked upon the burning of fire, and animal putrefaction to be the direct same process, therefore I argued, *a priori*, that there must be the same condensation from the burning a candle in a room, as if an animal had breathed in it. I took a lighted candle, and placed it one frosty night in a room, where no living animal had access to it; the next morning, upon examining the windows, there was the same icy crust upon them as if an animal had slept there. As I observed before, that the burning an inflammable body in the common atmosphere decompounds the air, for it is universally known that pure air is as essential to the life of fire as it is to animal life, and that both processes leave the air in the same state. For the inflammable body being ignited, acts upon the atmosphere by stealing from it its phlogiston, which before laid dormant, being neutralized with fixed air and water. The first cause of this burning of the inflammable body, is actual phlogiston being applied to it from without, which immediately acts upon the dormant phlogiston which the inflammable body possesses, and forms it into actual phlogiston, in the escape of which, (as actual phlogiston, it has the most rapid motion in expanding itself,) acting upon the atmosphere by decompounding it, and putting its neutralized

or dormant phlogiſton into actual; the great quantity of which phlogiſton is the principal author of the fire which is produced from the body's being in flame, and not immediately from the body itſelf, which was before generally believed. It is amazing, the power of the ignited body in decompounding the air! what an amazing quantity of freſh air is conſtantly required to feed it! all of which it decompounds, and ſets looſe its dormant phlogiſton, which is immenſe! No perſon, that I ever heard of, dreamt, that when phlogiſton is ſet looſe from any body in a ſtate of ignition, that in its eſcape it decompounds the atmoſphere, ſetting free its phlogiſton, and both together iſſue out from the burning body in a livid flame; but this livid flame owes by far its principal exiſtence to the phlogiſton of the atmoſphere, the moſt conſiderable part of it coming immediately from the air. Therefore that animal life and flame will be found to have the ſame exiſtence from the air, and that their action upon the air ſhall be directly conſonant, decompounding the air, and taking from it its phlohiſton, and ſo leave the fixed air and water, which the phlogiſton was neutralized with, in their ſenſible ſtate, ſo as to be evident to the ſenſes, and which is really the caſe. Who dreamt before of this ſimple conduct of nature? Philoſophy has long ſtopped

at a very great bar, but I hope this treatise will surmount it, opening to us some of the first points of knowledge, which before being not known, made our researches vague indeed. Every one knew how necessary the atmosphere was in nature, being the great medium to animal, vegetable, and mineral life, but not the least surmise was formed in what manner it dispensed that life.

That there is a strong solution of water in the atmosphere, I believe no one will dispute; seen in the great rains that fall, in the vegetables receiving most of their nourishment by their surface: in moist countries, the inhabitants drinking very little, or none at all.

In hot countries, where the heat is so extremely intense, that scarce animal life can be supported, there are animals, which can support their animal life and moisture, even in the deserts of Arabia (where the reflection from the barren sands make the heat so very acute) even for the space of many days without ever drinking; the camel, for instance, which travellers make use of as an animal of burthen. Then upon what principle did the camel keep up its animal moisture? having the extreme heat of the sun, with the strong reflection from the sands, when the earth is so parched up by it,

it, that it can produce no water; add to this the natural temperature of animal heat, which the camel possessed in itself: it has not only the intense burning heat of the climate, and reflection from the sands to encounter with, but likewise it has to travel long journies with an immense load of provisions, as they are made use of upon those journies as beasts of burthen: then under all these circumstances, where the air is hotter than in any part of the globe, what must keep its animal system from being parched and burnt up? All its blood and juices, which have such a natural tendency to evaporation, and likewise its tender nerves and fibres, which have such a sensibility to being irritated and parched by heat, always requiring to be kept relaxed, moist, and pliable; comprehend all these circumstances together, then only think how soon its fluids must be exhausted, if there was not some great latent principle in the animal, of receiving moisture; if it was upon the mere mechanism of evaporation and drinking by the mouth, why its animal life and moisture would not be supported for twelve hours; its skin would become as dry as a piece of parchment, and its solids as dry as a burnt stick.

Then how would physiologists say that it received this moisture? All their arguments

hitherto, that ever I heard of, are vague and inconclusive. I have proved, that there is a large quantity of water in the atmosphere, and that the body which solutes it is phlogiston; therefore when the atmosphere is robbed of its phlogiston, which I shall prove to be the case in the lungs, it must deposit its moisture, which it held soluted, in the state of water; which is really the case; proved by condensing the air after expiration; which condensation is distinctly seen by breathing upon a cold glass, the moisture of which will stand upon the glass in large drops; and, if examined, shall have every property in common with pure water, and which must have come from the atmosphere, for many reasons: first, all the discharges which come immediately from the animal, are highly alkalescent, of a urinous or cadaverous smell, and, if each be examined, will be found highly so, either that by urine, or perspiration, and all others of lesser note; the discharges from the internal parts, when exposed to the air, have all a strong animal effluvia. Upon examining the lungs anatomically, we do not observe any organ to secrete this expired moisture, or any such simple fluid, immediately in any of the glandular or other organs; all the fluids which the animal secretes, without exception, are highly animalized and alkalescent. The fluid which

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we obſerve the glands of the lungs to ſecrete, is a ſtrong animal mucous, the ſame which other expoſed ſurfaces of the body do, of a fixed nature, free from evaporation, in order to keep the parts moiſt and dry, from the heating and inflammable power of the air. If it was not of a fixed, greaſy, and mucous quality, but of that ſimple, watery, and evaporable quality of water, why the animal heat of the body, aſſiſted by that freſh and ſtrong current of air, would exhauſt it immediately, and the parts would inſtantly become dry, and, in conſequence, inflamed. Nay farther, to repleniſh the expired air with that immenſe quantity of water, which it is always ſoluted with, would ſoon exhauſt the ſyſtem of all moiſture; it would not be able to ſupply it for a ſingle day. But the ſyſtem cannot be the reſervoir for it; for, upon examining the animal juices, we do not find any ſuch ſimple juice. The ſerum, which is the moſt ſimple in the animal, is highly alkaleſcent; a ſtrong volatile ſalt and animal mucous being ſoluted in it. I do inſiſt upon it, that in a given time, there are ten times more moiſture in the expired air than the animal received by its mouth; for only conſider the ſmall quantity of moiſture that animals will ſubſiſt upon; ſome animals, under ſome particular circumſtances, from climate, &c. although they will ſcarce ever receive any moiſture by the mouth, yet they

will ſupport a heat of 96 degrees, and every vital function will go on with that degree of moiſture that other animals poſſeſs; their ſkin, and every organ will have the ſame moiſt appearance and pliability with animals that drink a great deal; nay, not only that, but ſhall actually keep up all their moiſt diſcharges and evacuations, viz. perſpiration, urine, &c. &c. theſe conſtantly going on regularly, though they had not received the leaſt moiſture by the mouth. Then, from whence did theſe moiſt evacuations originate? We have proved poſitively that they did not enter the ſyſtem by the mouth.

Nay, even to allow the argument, that the animal's lungs did ſecrete this water; I do aſſert, that the air inſpired would not evaporate ſuch a quantity of water, even if it was ſecreted in the lungs, as the air of animal reſpiration is fraught with. Take water, and expoſe it to the heat of the animal ſyſtem, with as large a ſurface as the lungs, and give the air the ſame motion to act upon it, as it has in the lungs, and you will find that it will not make ſuch a moiſt depoſition, when condenſed, as the expired air from the lungs. But what immediately proves, without further conviction, that this moiſture does not come from the animal is, that when chymically examined,

mined, it is the ſame ſimple watery fluid as rain; if, after this, any one can ſuppoſe it to come from the animal, all of whoſe juices and diſcharges are ſo highly alkaleſcent, ſuch prejudiced ignorance is not worth refuting. But, inſtead of looking upon this as a wonderful phenomenon, ſuch a quantity of water being depoſited upon the lungs and the ſkin, we have a right to preſume it would be ſo, *a priori*, after knowing the compoſition of the air, being compounded of phlogiſton, water, and fixed air; and likewiſe that the blood does attract the phlogiſton of the air: therefore, from the principle of chymical combinations, when the great ſoluting principle, phlogiſton, is taken away, the other two bodies, viz. water and fixed air, will reaſſume their wonted forms and qualities, and the water will be condenſed, and ſhew itſelf in the form of water, which is really the caſe.

How eaſily and ſimply this is expounding a doctrine which uſed to be ſo very abſtruſe; which indeed, could never have been diſcovered, till ſuch times as the general principles of animal life and of the air were known. With what elegant ſimplicity does Nature conduct all her operations, that one link hangs ſo eaſy upon the other, forming that great, beautiful, and heavenly chain of nature, pronouncing the attri-

butes of the great Deity that first formed it, and who keeps it still perfect? What happiness there is in investigating that chain, and to observe it constructed with all that beauty and simplicity? not agreeable to the forced gigantic structure of men's imaginations, in which manner they are often describing this chain to be formed.

That the atmosphere is not only necessary to animal life, in giving it its great living principle, viz. phlogiston; but likewise it gives the moisture to the system, which is so requisite in supporting life, for to keep it in that cool, soft, and pliable state, and to give it that moisture which is not only so necessary to the support of its functions, but likewise to its discharges.

Therefore as the animal lungs decompounds the air, the water which is deposited in consequence must keep them very moist and soft; and likewise the expired air must be fraught with a deal of water, which is really the case in both instances. That the expired air is so very moist, is sufficiently proved from condensing it upon a cold glass, and that it is this moisture, which it is fraught with, that keeps the œsophagus and bronchia moist, is likewise proved, by exposing any body, either animate or inanimate, to its influence, as it will make them equally

equally moiſt: put your finger into your mouth, ſo that it ſhall not touch any part of the mouth, but only be expoſed to the free current of the expired air, and which, upon being examined, you will find it to have contracted a moiſture, the ſame as if an inanimate body had been placed there of equal temperature.

This moiſture was univerſally ſuppoſed to proceed from the lungs, being diſcharged and ſecreted from thence by ſome glandular organs, conſtructed for that great purpoſe; but I never heard of any anatomiſt that could demonſtrate them; and, if there were a ſet of glands, which ſecreted this immenſe quantity of water, which is conſtantly diſcharged by the expired air, the organs neceſſary to ſecrete ſuch a a large quantity, would ſoon evidently appear upon diſſection: but anatomiſts, by the aſſiſtance of the fineſt miroſcopic glaſſes, have not yet found them. We obſerve a number of mucous glands all along the trachea; but what they ſecrete is a diſtinct animal mucous, the ſame as is placed in all cavities of the animal ſyſtem, which are expoſed to the air's influence; diſcharging a fine rich thick mucous, with this obvious quality, to defend the parts from the great irritating and heating quality of the atmoſpherical air. But, if this moiſture, which the

the expired air is fraught with, be examined, it differs essentially from all animal excretions, as it does not in the least partake of any animal properties, it being pure rain water. We observe no such fluid in the blood, either in its excretions or in itself, they being as different as black is to white; the one being a high alkalescent animal fluid, running into a high state of animal putrefaction; the other being that simple homogeneous fluid, called rain-water, and which air is so strongly impregnated with, being one of its great combining principles.

That it is this simple fluid, called water, and not partaking in the least of animal principles (which it undoubtedly would do, if it came from the animal fluids) is its freezing immediately, when exposed to a degree of cold below the freezing point; which we know the animal fluids will not do, as they have a particular power in resisting freezing; and likewise upon chymical analysis, and to the taste, it expresses no quality, but that simple water, which the air is fraught with. We observe no such fluid in the blood as this simple water, either in its secretions or excretions, or in the body itself, they being as different from it, as black is to white; and no man's reasoning can suppose this moisture originated from the animal, as all animal juices contain a great quantity of phlogiston, a body that has such a tendency to evaporate,

evaporate, (it being indiſputably as I have before proved, the great author of evaporation;) that, if the animal's fluids were diſcharged, they would certainly be ſtrongly impregnated with phlogiſton, as all diſcharges of the animal ſtrongly are, they all being highly impregnated: therefore it is irrational to ſuppoſe that from the lungs there ſhould be ſo different an evacuation, viz. pure water; nay, moreover, that the lungs ſhould diſcharge more water than the animal had received by the mouth: abſurd! the idea being inexplicable, and cramped with difficulties.

But, to confirm any prejudiced reader, that may ſtill be a ſceptic, and adhere to old ſcholaſtic prejudices, I will, I think, make him a proſelyte. After I had digeſted my general theory, concerning the compoſition of the atmoſphere, and how it ſupported animal life, flame, and putrefaction, I argued, *a priori*, that, in feeding flame, the air would be left in a ſtate of moiſture, the ſame as in animal reſpiration; as all chymiſts, Prieſtley, &c. agree, that the ſame change in both proceſſes is produced upon the air.

An examination of this kind, previous to my doing it, I acknowledge, agitated me a great deal, as arguing, *a priori*, it in a great meaſure

measure, either eſtabliſhed or overthrew my general doctrine; but nevertheleſs, giving a ſufficient allowance for the evaporating and diſſipating power of the flame or fire, I found it demonſtrated, agreeable to my moſt ſanguine expectation: for, in a common ſtreet lamp, which burnt one night in the open air, the air being below the freezing point, which was neceſſary to condenſe the vapour, upon examiniag the lamp, in the morning, I found a quantity of water at the bottom of it, near two or three ounces.

Here was a clear, evident, and ſatisfactory fact, that water had been decompounded from the air, by the act of combuſtion; the depoſition was ſo conſiderable, that even the diſſipating power of the flame, pent up in that cloſe confined ſpace, could not diſſipate it; but when the coldneſs of the night favours the condenſation, then there will be ſo conſiderable a depoſition. No one can form the vagueſt argument that it came from any body but the atmoſpherical air, as the air, the oil, and the wick, were the only bodies employed; therefore, I am ſure, neither the oil, nor the wick, could poſſibly have produced the water, parcularly as the water was the ſame as rain-water, only allowing a little for the impregnation of the ſmoke, which muſt neceſſarily have

tainted

tainted it, but no more than pure water would have been under the ſame circumſtances.

After thoſe clear froſty nights, when the breath is moſt ſenſibly and diſtinctly condenſed in the form of a moiſt cloud, the lamps will always have a depoſition of water; and, if this water be examined, it will be found to be the direct ſame as that detected in the animal breath, when expired.

Here then was no animal to ſecrete it in the lamp, and, till phyſiologiſts prove, that an animal had inſinuated itſelf by inviſible inſpiration into the lamp, we muſt be directly forced into the preſent hypotheſis and doctrine.

Nay, after this, can any one deſire a more ſtriking fact how fire decompounds the air, and that both animal reſpiration and flame act upon the air, and are equally ſupported by it; they both being the ſame proceſs. Take a common ſtreet lamp, expoſe it when burning to a froſty air, and you will obſerve ſometimes upwards of four ounces of clear water, equally as pure as rain-water, collected at the bottom of the lamp. How forcibly does this fact then, prove that ſo much water ſhould be generated againſt the ſtrong evaporating powers from the heat

heat of the lamp, the flame of which, dispersing its phlogiston in so small a space as the diameter of the glass, must greatly heat the air and glass around it, and evaporate an immense deal; yet, nevertheless, such is the decompounding quality of the flame, three ounces of water will be found at the bottom of the lamp; therefore the deposition of the water is most considerable, when the air is the coldest, counteracting the heat of the lamp, and cooling its sides so considerably as to condense the moisture of the air, which had been decompounded by feeding the flame of the lamp. That there might be no deceit in which way the water got there, I took all caution to provide against; as the lamp was under cover, so that not the least rain could get to it, nor was it a night that the natural moisture of the air could have deposited it; for it was a remarkably clear, dry, frosty night; which is a night most favourable for the experiment's answering; for in those damp nights the experiment will not answer so well; nay, I believe not at all; but my experiments have not been so general as to give a full history; my enquiry went only so far as to ascertain the fact: upon my asking men, whose business were to attend the lamps, they gave me the most undoubted assurance of the fact.

Nay,

Nay, this depoſition of water, from animal breath and flame, is not peculiar to them alone, but whatever decompounds the air; the ſame will be obſerved from animal putrefaction; put a putrid body into a room, and you will obſerve the ſame moiſt depoſition upon the windows, as an animal lying in the room, or a candle burning in it, produces, and from the very ſame cauſe, viz. the air's being decompounded. It is for this reaſon you will always obſerve a putrid animal body's ſurface to be very moiſt. And in new-built houſes the lime upon the walls, will always appear moiſt, from the lime's having a great appetite to decompound the air, by attracting its phlogiſton; and which likewiſe makes the houſes ſo unhealthy.

And, as the lime, by attracting this phlogiſton, becomes hard from the moſt ſoft texture, forming the moſt hard aud durable mortar; it is a ſtrong argument that the great and uniting principle in nature is owing to phlogiſton, and not to fixed air, as Dr. Macbride would inſinuate; for, in the moſt general ſenſe, phlogiſton is the great living principle in nature; it animates the animal kingdom, vegetates the vegetable kingdom, and mineralizes the mineral kingdom; it being the great agent, by which nature conducts all her operations.

rations. It is the *medicatrices naturæ* of physicians, the universal æther of philosophers, and the *pabulum vitæ* of chemists; in short, it is the great living principle throughout nature.

The water or moisture detected in the atmosphere, after all these processes, will be found in every property to be the same; there will be sometimes found something heterogeneous, which will have insinuated itself into it, but that is accidental, and not always the same: as for instance, in moisture generated from the air by putrefaction, you will often find it to partake of the putrid particles of the body, but that is from the constant exhalation of those particles, which the putrid body is always emitting; that if rain water was as equally exposed, it would imbibe the same putrid impregnation.

I hope no one will dispute, but be sufficiently satisfied with the arguments accounting for the moisture of the animal organs, employed in respiration, and the moisture of the expired air; yet there is the moisture of the general surface still to account for.

That the lungs are the principal organs for receiving the animalizing phlogiston of the system,

ſyſtem, there is no doubt, yet it is not the only way by which phlogiſton enters the ſyſtem, there is a great deal enters by the general ſurface of the body, viz. by the ſkin, analogous to the vegetable world, which principally receives their phlogiſton by this means; nay, many animals have no lungs, and receive all theirs by their general ſurface: the ſkin, which covers the blood from the air in the lungs, is the ſame membrane which covers the blood from the air upon the general ſurface, therefore the phlogiſton of the air will paſs through the one as well as the other; but, nevertheleſs, there is five hundred times a greater quantity of blood expoſed in the lungs to the influence of the air than there is upon the general ſurface: therefore there muſt be the ſame gradation, in reſpect to the decompoſition and moiſture generated; yet, nevertheleſs, there is a ſufficient decompoſition of phlogiſton and water, ſo as to keep the ſkin conſtantly moiſt. And this moiſture upon the ſurface will always be found in that ratio, agreeable to the quantity of phlogiſton received; for in thoſe animals which receive all their phlogiſton by the ſurface, and which have no lungs, their ſkin covering their ſurface, will be found ſo much the more moiſt, viz. worms, ſnails, &c.

I shall enlarge upon the worm as an example, as it not only elucidates my doctrine of accounting for the general moisture of the animal system, but likewise for the doctrine of receiving phlogiston from the air. It is an animal which has no lungs, therefore it must receive the phlogiston necessary to animalize it by the surface; the necessary consequence of the decomposition and attraction of phlogiston, is in making the animal matter which attracts it, redder, and moister; which is very demonstrable upon the surface of a worm; every one knows that its surface is very moist, and likewise of a bright red, which differs directly from animals which have lungs, as their redness is in the internal parts, those contained within the skin; therefore their external surface is not red, while their internal surface is of a strong bright red. Just the opposite in the worm, whose surface is red, while its internal parts are of a pale colour.

How strikingly does this corroborate the general system of my theory! that in animals, which have lungs, their fluids will be thrown upon them in order to attract phlogiston; that in animals, which have no lungs, their fluids will be thrown upon their surface, as being the only means of their getting in contact with the

the atmosphere; and that that contact, or exposure, shall make their fluids red, a colour which the other fluids of their system have not; that, in consequence of the general surface of the body being made the lungs, this surface shall have the superabundant moisture and red colour, which other animals have upon their lungs, the same marks taking place with both: does not then this imply, that the same great office belongs to them both, as they both possess the two peculiarities, viz. a superabundant red colour and moisture; and likewise that these peculiarities are the consequence of that office or function? For the worm having no lungs, its blood is thrown in greater proportion upon its skin, and therefore decompounds the air proportionably more by its surface; and, in consequence of that greater decomposition of the air, its skin is more moist, which is really the case.

But I will give you a history of the worm: as to their external structure, it is so generally known, that I think it quite unnecessary to say any thing about it. Its peculiarities are, it has no lungs, therefore the blood instead of circulating through them, which is the case in most animals, has its fluids thrown upon its surface; as every animal shews this evident intention to have its fluids exposed to the air, that being the great author

of animal life. Its two large trunks of vessels run upon its surface, the one upon its back, the other upon its belly, where they dextrously form considerable ramifications with the greatest address, and with this evident intention to expose as large a surface of blood as possible, and which, by being exposed, has its fluids wonderfully changed, turning a fine florid red. This fine animated colour could by no means proceed from the food, for when it is examined, it is merely earth. If philosophers with any gravity could suppose, that the food of the sheep, the spontaneous production of the earth, could produce its phlogistic juices, certainly they cannot be led into the ridiculous supposition, that this bare earth produced this fine, florid, animated blood of the worm. Mankind, when they establish a theory, will force their reason to many contradictions; but this is too palpable and glaring a one. Upon examining its surface, it has every circumstance which confirms my doctrine, viz. a moist surface, and florid blood; but the supposition that dry earth produces these phænomena, is vague doctrine indeed; for in dry weather, worms can subsist amongst the driest earth; therefore can it rationally be supposed, that this dry earth could produce this fine, florid blood, and this considerable moisture which its fluids and surface evidently possess,

poſſeſs, unphiloſphical! no, the phænomena are only to be expounded upon the principles of my theory: the earth, which is its food, having a power from the table of attractions of decompounding the air, and attracting its phlogiſton; for the earth which it receives into its ſtomach, and is there mixed with its animal juices, the moſt excrementitious and impure part of it being thrown out of the worm's ſyſtem; therefore that which remains, paſſing the digeſtive organs, and mixing with its animal liquors; both there, and in the general circulation, receives an appetite for attracting phlogiſton, both from the air and from the common earth around it; phlogiſton being the great author of animal life, whether it is received by air the general way by which it is conveyed, or by water or earth; all of which diſpenſe it to ſupport life, agreeable to the nature of the animal. If phyſiologiſts will but candidly and minutely attend to theſe facts of the peculiarities of the worm, they will of themſelves carry the ſtrongeſt conviction of the truth of my doctrine; that by expoſing animal fluids to the air, they become red and moiſt, and that this redneſs and moiſture is ſo eſſentially neceſſary to animal life, that if animals have no lungs, (the common organ by which the great, neceſſary, and animating phlogiſtic proceſs is made) they expoſe their

fluids upon their surface; which method receives enough of phlogiston requisite for the extent which nature has ordained them, for their animal powers; and that exposure will be attended with the same phænomenon as the process by the lungs, but only in a less degree.

How rationally and philosophically is this accounting for the moisture of the system, which before laid under such obscurity and error, so as to be totally in the dark! — Some physiologists, no doubt, did assert, there was moisture absorbed by the surface from the air. The fact of animals living so long without drinking, forced them into that supposition, but they thought it was an act, conducted by the absorbents upon the surface, being totally ignorant of the real process. That there may be an absorption by that means, of the water that is decompounded by the air's being robbed of its phlogiston, is very consonant to reason, which moisture is circulated into the system; but these absorbents have nothing to do with the moisture of the lungs and the general surface; and they are only capable of *receiving* this *moisture*, which they circulate or carry within the system, by the air's being decompounded by the blood and juices.

For

For it is very rational to ſuppoſe, that, as both water and fixed air are decompounded by the ſuperior attraction of the blood and juices for phlogiſton, in conſequence they may be both abſorbed into the ſyſtem, and be received there, as being eſſentially neceſſary to the welfare and health of the animal; as we are well aſſured from our medicinal and anatomical knowledge of the animal ſyſtem, and likewiſe from our chemical knowledge of the properties of theſe two bodies, viz. water and fixed air, that their being abſorbed and circulated in the ſyſtem, would be entirely conſonant to the health of the animal, as its juices, particularly the chyle, are principally formed of theſe two bodies; and, as we can likewiſe argue ſtrenuouſly from analogy, vegetables receiving the greateſt part of their ſuſtenance by that means; therefore we have the ſtrongeſt right to believe, that not only the great animator, the firſt living principle, viz. phlogiſton, is received by this means into the animal, but likewiſe fixed air and water, the great attractors and dilutors of phlogiſton: ſo that the air not only furniſhes us with phlogiſton, but likewiſe food, viz. fixed air and water, the ſame as the chyle which is received by the mouth, in order to attract, neutralize, and dilute. — Here is another extenſive idea opened to us, an idea formed agreeable

to all that ſimplicity and uniformity with the reſt of our doctrine, and an idea that exalts our opinion of that great agent the atmoſphere, how neceſſary it is to animal life. Therefore how incumbent it is in us to breathe it in perfection, and likewiſe to have the lungs, that great and important organ, in its full health and perfection, to receive and decompound the air; for the air and the lungs are the two great agents which are ſo eſſential to animal life, as upon their welfare the health of the animal immediately depends, it alſo ſhewing how incumbent it is upon individuals to pay ſuch a regard and attention to them.

I think now, after eſtabliſhing this great doctrine in this plain, obvious, and conciſe relation, which we have in this book laid down, that it will open to us the great arcana of nature, which all philoſophers have been aiming at, and which has been ſo long ſo great a bar to ſcience; having eluded the reſearches of ſuch a number of learned ages; and yet, before this publication, having been almoſt as far from being diſcovered as ever; ſome of the late doctrines tending rather to obſcure it.

By way of illuſtration of my doctrine, I will give you the heads of a very ingenious theory of Dr. Black's, a very eminent profeſſor of chemiſtry,

chemiſtry, in Edinburgh. He has proved that the fluidity of all bodies depend upon heat, but not in the manner depending upon actual heat, as was univerſally underſtood, but from a quantity of heat being abſorbed with the body, and, by that abſorption loſing its actual properties, becoming latent. Though this ſtate of phlogiſton being latent, appears ſo extraordinary to the ingenious Doctor and the world, yet, if conſidered, it is general in nature. We ſee alkalies and acids unite, and loſe their actual qualities; and, as to phlogiſton's doing this, we ſee it very univerſally.

In the proceſs of making ſalt-petre, if it is maturely enquired into, and the ſalt analized, it will be found to be phlogiſton neutralized with another body; for, if the ſalt is burned, it gives out its phlogiſton in its actual ſtate again. There is a very noble invention, viz. the making of gun-powder, whoſe principal baſis is ſalt-petre, being mixed along with two other combuſtible bodies, ſo that upon the leaſt ſpark of actual fire approaching, it immediately breaks its bond of union with the body that it is neutralized with, and goes off in actual fire, with amazing power and force.

That

That phlogiſton, lying latent in the air, to many may appear introducing a new doctrine, but it is by no means peculiar to air; it is univerſal with all bodies. I know of no body in nature that does not poſſeſs it in its latent ſtate; nay, the life and exiſtence of all bodies depend upon it; and, agreeable to their ſaturation with it, all bodies take on that great variety of appearances which we ſee in nature; for all bodies would have one and the ſame appearance, if it was not for their different neutralizations of latent phlogiſton and ſaturations of actual phlogiſton.

Salt-petre is a body which neutralizes phlogiſton in a very conſiderable degree; the proceſs of making it, is by expoſing rich earthy bodies to the air in the hot countries, the Eaſt-Indies for inſtance, where the air has a great proportion of phlogiſton. That this body, rich earthy matter neutralizes itſelf with a great proportion of phlogiſton, and its phlogiſton lying latent till it is decompounded by a third body upon the principle of attraction, or ſet looſe by actual fire. That ſo great ſaturation of phlogiſton is not peculiar to ſalt-petre, all ſalts having an abundant ſaturation, but to be ſure none ſo great a neutralization as ſalt-petre: as I obſerved before, if it be mixed with charcoal and brimſtone,

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and exposed to actual fire, it will in a moment give out its actual phlogiston, and disperse itself in the open air: nay, some bodies have this neutralization of phlogiston so loosely, that the air itself is capable of decompounding it, or setting it loose as actual phlogiston, viz. the variety of phosphorus's made from animal matter; therefore we should never be surprised at its appetite either for neutralization with bodies, or its escape from them.

It is from this great principle in it, that life is conducted through the whole world; every body exists by receiving it, neutralizing it, and discharging it; which circulation is their principle of life, therefore we should by no means be surprized in the variety of forms we see it in, nor in its quick transitions either upon the principle of attraction, or actual flame, or of its different states of neutralization or saturation. There is not a body in nature but what possesses phlogiston, either in one state or another, (it is compatible with matter); but then they differ exceedingly in their point of saturation; some bodies attract an hundred times the quantity that others do, but each body has its particular point of saturation, that is, attracting it

it to a particular degree, and then being what the chemists call saturated.

Nay, such is its divisibility and universality of distribution with matter, that there is not a body in the creation, I believe, which does not possess it in all its different states, viz. neutralization, actual, &c. the different points of saturation of each of these states make up the great variety of forms which we see matter appear in, upon this globe; nay, the same body puts on different appearances, agreeable to the quantity it possesses of it; that is, all bodies in point of saturation differ exceedingly agreeable to their different states, viz. solidity, fluidity, vapour, and air.

Take any solid body, the metals for instance, or indeed any other, but for example let us take iron. In its natural state it is solid, being compounded of earth, neutralized and saturated with a quantity of phlogiston, which all chemists know. If you throw a large proportion of phlogiston into it, it will turn it fluid; if yet a larger proportion, it will turn it into vapour; and, if still a larger proportion, it will turn it into a transparent solution, the same as air; but all these different states require phlogiston to a certain degree; for, without you come to that certain proportion, the changes will not take place; and, as soon as you

you come to that proportion the changes immediately take place. But all chemists were of opinion, that the phlogiston which was thrown in to produce these different states of fluidity, acted altogether in a sensible form, being only phlogiston in its actual state: but the ingenious Dr. Black has proved, that fluidity and vapour depend upon phlogiston, being absorbed into the body in a latent state, as he calls it; but what I call a neutralized state, the same as acids and alkalies, or as phlogiston in any other body; viz. salt-petre, metals, &c. &c. But that the actual phlogiston has no power to produce these changes, till such time as it is absorbed and neutralized with the body. He having ingeniously proved, that ice requires one hundred and forty-seven degrees of actual heat to be neutralized, before it will form water; that sperma-ceti absorbed from one hundred and forty-one to one hundred and forty-eight degrees of heat, before it became fluid; bees-wax one hundred and seventy five; but the quantity required to turn bodies into vapour is immensely more considerable, proved by a common still; what a considerable heat is received by the water in the worm-tub, which is employed to condense the vapour; or, if you apply a thermometer to the vapour, how considerably it will affect it; or, by exposing your finger, what a sensible

ſible heat will be received from it; far more conſiderable than from the boiling water.

But, to form a true idea; let a veſſel of water be placed upon a very hot fire, and increaſe the fire to the greateſt pitch of human power, you never can raiſe the temperature of the water above the boiling point; then what comes of this extraordinary quantity of fire, which the water in the veſſel is conſtantly receiving? why it is all diſcharged by that part of the water which flies off in vapour; for if the vapour is condenſed, it will give out this extraordinary quantity of fire. Then, in this experiment, only reflect upon what a quantity of actual phlogiſton muſt be conſtantly flowing into the water, being expoſed to ſo intenſe a fire, without raiſing the temperature of the water: what comes of it all? why it paſſes off in vapour; for, if that vapour is kept from flying off, the water will retain all its heat that it received from the fire; as in Papin's Digeſter, where the confined water was found ſo hot as even to diſſolve bones: and when the vapour was ſet at liberty to fly off, it diſcharged itſelf with ſuch prodigious force, as to ſenſibly ſtrike the ceiling of the room where the experiment was made, and appeared luminous.

Only

Only consider what an immense degree of heat the fire is constantly giving to the water, and what a small quantity of water is employed in saturating it, seen by condensing the vapour: if the vapour be examined as long as it retains its properties as vapour, this extraordinary degree of heat which it is fraught with, will lie dormant; but if, by applying a cold body, you condense the water; that is, bring it into its original fluid state, then it will give into actual heat, the great degree of phlogiston which laid dormant in it: so the air, as long as it continues atmospherical air, its great saturation of heat or phlogiston will lie latent; but as soon as it is decompounded, the three bodies of which it is formed will be set loose, and express evidently to the senses their three different qualities. As soon as phlogiston is taken from the air, the two bodies with which it is compounded, will be condensed from their transparent solution of air, and shew themselves evidently to chemical investigation, the same as the water in the still, which was kept soluted by phlogiston; for as soon as it was robbed of its great and abundant saturation of phlogiston, it became water again.

Philosophers have not contemplated upon the amazing appetite which phlogiston in its actual

actual ſtate, has to neutralize itſelf with other bodies, particularly water; exemplified in the proceſs of diſtillation. That the immenſe quantity of phlogiſton, in our late example, went into the water from the fire; that it, with amazing avidity, ſeized upon the water, and flew off with it in its latent ſtate; but when the water was confined from paſſing off with it, as in Papin's Digeſter, it did not make its eſcape itſelf, but ſtaid along with the water, till it formed with it a degree of heat even to digeſt bones; and, when the water was allowed to eſcape with it, it flew from the veſſel many yards, in a bright flame. There is an amazing attraction between phlogiſton and all bodies; as ſoon as it is let looſe from one body, it immediately is attracted by another, particularly all evaporable bodies; and that they poſſeſs this power of evaporation from phlogiſton is certain; for, without its aid, nobody would have power to evaporate; and, agreeable to that power of evaporation is their appetite for attracting phlogiſton.

There is an old vulgar fact, that the bottom of a tea-kettle is comparatively by no means ſo hot, as other parts of the kettle, though it is ſo immediately expoſed, being in actual contact with the fire. This ſeems to be a paradox; but it is actually ſo; many philoſo-

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phers will not admit of it, particularly Dr. Black, who ſays there is a deception in the experiment; but facts of that kind, when they have ſtood the ſenſe of ſuch a number of ages, will generally be found to be juſt; and philoſophers are always tenacious in receiving them, when their philoſophy cannot account for them. I have repeatedly examined the experiment myſelf, and always found my feelings ſenſibly confirmed in it; and likewiſe have got others to do the ſame, and they all were equally ſatisfied. But inſtead of looking upon it as ſo extraordinary a fact, we had a right, *a priori*, to expect it; it only confirms to us the amazing appetite which phlogiſton has for water; ſeen evidently in a hot poker's heat being ſo ſoon extinguiſhed, when put into water.

That the explanation of the fact was upon this amazing appetite which phlogiſton has for water, I ſatisfied myſelf. A tea-kettle full of water, that was boiling upon the fire, immediately upon taking it from the fire, I put my finger to the bottom of it, and found it (clear to the ſenſes) ſenſibly not ſo hot as the top of the kettle: after being confirmed in the fact, I argued, that the reaſon of it muſt be from the water's immediately imbibing the heat, as it was received by the bottom of the kettle, and ſo paſſing it into vapour; upon the

principle of which doctrine, I argued, *a priori*, that if the vapour was increased, the bottom would be still less hot. Upon this, I took off the lid of the kettle, and put the kettle again upon the fire, and the bottom was sensibly and evidently still less hot to the finger which I tried the experiment with. Here then is a direct proof that this sudden transition of heat through metal, to saturate itself with water, is owing to the great appetite which phlogiston and water has for each other; and knowing the general fact, we might argue, *a priori*, though the bottom is so immediately exposed, yet it possesses very little heat, so that the finger may be held with impunity to it for a long time. It is so evident to the senses, that it is impossible to mistake the fact.

No philosopher ever dreamed of this great and extensive appetite which phlogiston has to neutralize itself with bodies, and fly off with them in vapour. Dr. Black, when he had mentioned that simple fact of water, æther, &c. absorbed heat, which laid latent, as he calls it, in them, and so evaporated, without extending in the least the idea upon the general principle in nature, surprised the learned world, so that many could not give their assent to it. But if they would but consider, neither Dr. Black nor any one need think it an extra-

ordinary

ordinary fact, but what is as universal a law in nature (viz. phlogiston's attraction for bodies) as gravitation itself; and that this process is not to be supposed singular, and have the confined name of being latent in a body, but being neutralized; just upon the same principle as phlogiston is in salts, or any other body; but I will give you a general history of the affinity between phlogiston and matter elsewhere. Matter is a vague term, but I have no other to substitute.

As phlgiston is proved then to have so strong an appetite for water, either in its actual state, as fire, or latent state, as saltpetre, &c. having fifty times a stronger appetite for it than air has; demonstrable in every process. Then, after establishing this undoubted fact, we cannot see, if Dr. Priestley's theory was just (that the use of respiration was to discharge phlogiston from the system) but that water would have answered considerably better to have breathed than air, as it would have discharged this effete phlogiston, (which Priestley speaks of) with so much more ease and propriety; as we can vouch for a fact, that its appetite is considerably stronger for phlogiston than air; proved evidently to the senses, by putting any part of the body, that is overheated, into water, how fast it receives the phlogiston from the part, and cools it;

but if you were to try the experiment upon the lungs, suffocation would instantaneously take place.

Again, in respect to putrefaction, which is the same process in its effect upon the air as respiration; if the air's action, upon a putrid body, was in stealing its phlogiston, after being set loose by putrefaction, I do, with the greatest confidency of chemical knowledge declare, that the water would steal its phlogiston fifty times quicker than the atmosphere; and, in consequence, hasten, in the same ratio, its putrefaction. But, instead of that being the fact in nature, unluckily for the Doctor it is just the reverse; for water has a power of preserving bodies from putrefying; it being a common practice to bury wood and other bodies in water, to preserve them from putrefaction: nay, water has a power, after bodies are putrefied, to sweeten them again. The method by which it does that, is by its strong appetite for receiving phlogiston; and by that appetite it steals from the putrid body the phlogiston it had generated in the air, and no doubt from the air; it being so obvious, that a child's reason must assent to it; for, if the air acted upon the putrid body, from its power in receiving, and not giving phlogiston, certainly the water would hasten the putrefaction fifty times

times quicker than air; but the reverſe is the truth; for water is a body that amazingly retards putrefaction in others; nay, it will actually ſweeten bodies that are putrefied.

Then in what manner are we to reconcile theſe contradictions of modern philoſophers? they may as well, as far as my reaſoning goes, endeavour to prove to me that black is white, as my ſenſes are as much confirmed in the error of the one as the other.

Again, in reſpect to the air's being ſo neceſſary to animal life, by taking phlogiſton from the ſyſtem, which is the prevailing doctrine of this day; in what manner then is this proceſs conducted? Is it diſcharged either as actual phlogiſton, or as neutralized? they leave us entirely in the dark in that reſpect not even offering a ſingle ſuggeſtion; but let us minutely conſider it.

If it was diſcharged as actual phlogiſton, the breath of animals would expreſs to the ſenſes this immenſe quantity of phlogiſton, (for certainly it muſt be immenſe, for the animal is killed in five minutes, if it is bereſt of diſcharging of it); but, upon examining the expired air, it is no hotter than if it was expoſed to any other part of the ſyſtem, under

the ſame circumſtances: then it muſt be by diſcharging neutralized, or what they call latent phlogiſton, as we have proved that it is not by the other. Let us examine that; upon the niceſt chymical examination of the breath or expired air, we cannot detect its preſence, even by the moſt accurate examination; and, what is wonderful, we are never foiled in finding phlogiſton where it really reſides, in any other of its ſituations in nature; therefore it is a little ſingular we ſhould not be able to find its preſence here.

For certainly if it is a diſcharge of that conſiderable conſequence to the ſyſtem, as to produce death, if the lungs are bereft of diſcharging it, even the ſpace of five minutes; therefore we muſt certainly ſuppoſe that there is an immenſe quantity of this phlogiſton diſcharged out of the ſyſtem; particularly as we have proved that phlogiſton is by no means ſo poiſonous to the animal, as it poſſeſſes it in ſuch great abundance, both in its actual and fixed ſtate; proved by the animal heat which it is conſtantly diſcharging, and the amazing quantity of fat and red globules, which are the great and principal part of its life and animation. Then our ideas are quite in a labyrinth, as we can form no conjectures of its quantity, quality, and form; whether it is diſcharged as actual

actual or neutralized phlogiston; we have not the least surmise from the establishers of this opinion, to lead us out of our labyrinth, for all is the most vague and unfathomless mystery. But I think I have unquestionably proved we got into it from a mistaken chymical experiment, and upon that authority alone, without having any philosophical arguments to second it. But knowledge, of that great and consequential nature, is not so easily discovered; it requiring a great train of philosophical reasoning, before the truth can be satisfactorily known; as well as a long connected chain, each ring resting firmly upon its neighbour; deducing the doctrine from slow and accurate reasoning, each link forming that elegant simplicity of chain which we always observe Nature to construct.

The doctrine of the atmosphere taking phlogiston from the blood, is so directly opposite to every point of philosophical and medical knowledge that we know of, that, instead of expounding the different phænomena, it is in direct contradiction, raising unsurmountable bars, in immediate opposition to philosophy, reason, and common sense.

But, in adopting my theory, each circumstance and phænomena immediately fall in and

coincide; they in reality being ſtrong ſupports to it; for I have followed a long chain of philoſophical reaſoning, taking in all the variety of phænomena, and, inſtead of being at a loſs to account for them and expound them, they are unqueſtionable evidences, each imperceptibly vindicating its neighbour; ſo that there is no one ſingle phenomenon, but what is accounted for both upon the principles of philoſophy and common ſenſe.

After, I have ſatisfactorily eſtabliſhed the general principles of my doctrine, I ſhall next proceed to make an immediate application of it to the animal ſyſtem, not only to ſhew how the great living principle throughout nature is received into the ſyſtem; by being expoſed to the blood's ſuperior attraction for it, from the fixed air and water, which before held it ſoluted; but likewiſe I ſhall ſhew what part of the blood it is, which attracts it; what part, after it is attracted, it forms in the blood; what are its uſes and qualities; and in what manner it is decompounded again, and given to the air; ſo that we ſhall follow it through all its variety of combinations, accounting in the moſt ample manner for both its cauſes and effects; giving the moſt extenſive explanation of all the great variety of appearances and ſymptoms of animal life, founded upon ſo ample a plan,

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that we can account for all the most abstruse phænomena which have so long and earnestly been sought for by every age; and which still eluded their search, they being obliged to give the most blind explanations and surmises, not founded in truth, but mere whim and caprice, the whole structure originating with their imaginations.

Having at last surmounted this great bar, we not only account for animal life, but life in general throughout nature, both the life of vegetables and all others; we likewise give the most copious explanation of atmospherical air, and all the variety of productions in nature, the principles of salts, &c.

To enter into the discussion of the explanation of each minutia, is not the intention of this book; that will be a future consideration. But what we have already proved, will be the great basis and key, opening to us that chain of reasoning that will explain to us all the variety; so that with propriety we may say, we have overleaped a bar which will shew to us the most extensive prospect of all-wise and bountiful Nature; such a prospect, that the philosopher may look round him at large, and view with admiration and wonder the enchanting scene. Most philosophers thought that this great key would never have been found out; but time and assiduity will surmount the

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moſt difficult taſks; and, as philoſophy gets enlightened, there will be many diſcoveries, which are now totally concealed from us; for I think ſhe is by no means ſo far advanced, as many have ſuppoſed; there are many circumſtances which, I flatter myſelf, in time will be thoroughly elucidated and inveſtigated; things, that many think will ever be unſurmountable bars.

Now, after giving ſo full and copious an account of my general doctrine, and I hope ſatisfactorily to the moſt tenacious and ſceptic reader; I ſhall now begin to make an immediate and particular application of it to the animal ſyſtem, ſhewing in what manner phlogiſton is received, upon what philoſophical principles; after it is received, what are its uſes and qualities; how neceſſary to animal life; what are its appearances in the animal; how it circulates and acts upon the different functions of life; and as life depends upon circulation, which circulation acts by receiving bodies, and after they are received, evacuating them; we ſhall ſhew then, after phlogiſton is received, how it is evacuated, and the effects and conſequences of that evacuation, giving the fulleſt hiſtory.

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I have before ſhewn the great ſimilarity there is between the red globules and oil out of the body, their repulſive quality to water, their inflammability, their eaſy incorporation with one another; which no watery bodies will do with oil, or indeed any other part of the blood will not, neither the coagulum lymph nor ſerum; their properties being likewiſe ſimilar to the feel, giving that greaſy, unctious quality when rubbed between the fingers; in ſhort, being ſimilar in every quality out of the body; and I likewiſe ſhall prove there is a ſtrong ſimilarity in the quality and effects of oil and red globules in the ſyſtem, as well as out of it: they are both authors of animal heat; this is evidently to be proved.

All animals in the northern climates lay up an immenſe ſtore of fat againſt the extreme cold ſeaſons; particularly all fiſh, found towards the Poles, in the Greenland fiſhery, where the animal is killed principally for its fat alone. But it is not only the fiſh in that cold climate, but indeed all other animals found there; they all poſſeſs nature's reſervoir of fat, to keep up their animal heat where ſo great a degree of cold prevails.

In animals which ſleep over the winter, this deſign in nature is conſpicuouſly ſeen. There are

are many animals which are well known to naturalists to sleep over the winter: how sleek and fat they retire to their beds, when the cold weather approaches; and how lean and meagre they are when they make their appearance again in the summer; for at that time the great abundancy of phlogiston, in the atmosphere revivifies them again, if one may be allowed the expression; or stimulates Nature's functions to perform their office with vigour; it is from this great stimulating property of phlogiston that animation or life is conducted; for, when the sun's rays act powerful upon us; what a number of reptiles and other animals it gives life to.

All that great quantity of fat, which animals had retired to their winter's bed with, is, upon their leaving of it, quite spent and exhausted in supporting their animal heat; for, if that did not take place in some measure, death would be the consequence; as it is that heat, producing that stimulus, which the life of the animal immediately rests upon; it being well known, when animal heat is totally extinguished, death is the result: and, tho' the heat of the swallow when sleeping, is not equal to its heat when in an active state; yet it exceeds the heat of the inanimate bodies around it.

Boerhaave

Boerhaave ſays, who was a philoſopher, and who moſt extenſively and moſt liberally ſtudied nature, that "animals, which ſleep a long time, do at laſt prey upon their own fat, which returns into the blood. The bear paſſes the moſt ſevere winter by ſleeping in his den, where he at firſt ſleeps and ſnores very ſoundly, and then growing by degrees hotter, he ſweats out a kind of oil, with which the whole animal is bedewed as with lard; but at laſt, the blood becoming more acrid, conſumes this lard, till at length the warm ſeaſon returning, awakes the animal. If you kill this beaſt in the midſt of winter in his den, he is found very fat, but in the ſpring he comes forth from his den extremely lean, and almoſt like a ſkeleton. Hence, therefore, it is evident that during the firſt part of this animal's long ſleep, an oil or fat is ſeperated from the blood, with which the body is preſerved and ſupported; but at length this oil being diſſolved and returned into the veins, ſupplies the blood inſtead of chyle."

That the fat went to the ſupport of the animal heat is highly rational; for we know, philoſophically, heat is an element that can only be produced from bodies which retain it; and, as the fat and red globules are the only two bodies which retain it, in any degree in the animal, therefore we have a right

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to presume that animal heat originates from them; particularly when those two bodies, the fat and red globules, are sensibly, and particularly diminished; for, nevertheless, the bear's laying up such a large store of fat, there is scarce, upon his appearance again, the least remnant of it left: nay, I am confidently told, their fat will sometimes not last the cold weather, or their long stupefaction and rest: in severe winters bears have been found dead, from the want of it; for, upon examining their bodies, they were totally emaciated.

If it was not for this reason, why should all animals indiscriminately, in the frozen zone, have such great loads of fat, while those of the torrid zone have little or none? only observe the whale, as an example of the former, and contrast it with the animals in the latter; indeed, it is conspicuously marked in every animal. You see it as evidently in the human species, for you seldom observe a fat native of the East-Indies; and contrast the natives there with Englishmen.

To bring this more strikingly to our senses, only observe English beef and mutton, and compare it with the French beef and mutton; which great difference, entirely depends upon the climate; for, carry an English bullock to France, and let it be fed upon the same food

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as it lived upon when in England, it being carried along with it, and you will ſoon find it will looſe its fat; which I hereafter will account for, when I come to ſpeak of the different temperaments. All this fat then is certainly deſigned for animal heat in the cold climates; for, in the warm and temperate climates, they have no need of ſuch ſupport, therefore they poſſeſs it not. To prove that this is its grand purpoſe, obſerve a groſs man, taken with a high fever, how ſoon his fat is exhauſted. In the courſe of two days I have known a man loſe a whole ſtone weight of fat.

Let us then enquire what has become of it; it muſt have been evacuated one way or other: agreeable to the old philoſophical axiom, ſomething cannot be reduced into nothing: there are only two ways of looſing it in the animal ſyſtem; which is either by the different excretions or by the animal heat. Let us examine the firſt way then of looſing of it, viz. that by the excretions. In a high inflammatory fever, it is well known that all the evacuations are ſtopped up; that by the ſkin is cloſed, it being quite dry and parched, there being a general conſtriction upon all the excretions; thoſe, by ſtool and urine being likewiſe obſtructed; in this example, indeed, no evacuation ſeemed to take place comparatively, they being

being considerably less than in the natural state; therefore this stone weight of fat could not have been discharged by them. But the other means by which it might have been discharged, viz. animal heat, is greatly increased, that very circumstance of increase of heat being the physician's pathognomonic sign of calling it a fever. Then, as the only discharge from the system appears to be phlogiston, let us see if it agrees with this sensible loss, that the constitution has sustained. The loss is of fat or oil, and likewise the red globules; for, upon dissecting a body, which dies of an inflammatory fever, you will observe its fat and red globules both broken down and evacuated, their presence in a great measure disappearing; the composition of which being phlogiston, as I have before proved; therefore the loss sustained, and the sensible evacuation, immediately agree: it is well known that those two bodies, viz. fat and red globules do consist principally of phlogiston neutralized; and likewise that phlogiston is capable of being decompounded or set loose, either by actual fire, by chymical mixture, or by friction; which latter operation is the same that takes place in the animal system; which friction is greatly assisted by the constant animal heat always existing in the living animal: that this heat must greatly assist the letting loose the phlogiston of the blood

blood is highly rational; for, take the red globules out of the body, expose them to a heat of ninety-six, and that heat alone, without any friction, will dissipate the phlogiston of the red globules; for in them it is very easily set loose, being exposed to the natural temperature of the air alone, will soon dissipate and take from them that red colour, which is observable in blood, recently drawn from the living animal. But then in this experiment the blood must not be exposed to the immediate contact of the air for any time, otherwise it will decompound the air, and attract fresh phlogiston, and in consequence become more red.

Therefore this saturation of phlogiston, which the blood gets by passing the lungs, (marked by its colour,) it very soon loses, it being an over-proportion as it were, the same as hot water dissolving a larger quantity of salts, which it very soon loses; so this very great saturation, which the blood obtains in the lungs, is capable of being dissipated by the animal heat alone, it so loosly coheres to the red globules. So that an animal, when asleep, when scarce any friction is produced in the body, will nevertheless give out animal heat; but then its heat is by no means equal to that produced when awake; for animals,

when sleeping, always feel considerably cooler, and likewise they are then, for the same reason, most susceptible of catching disease or cold, as it is vulgarly called: but then the red globules have another saturation of phlogiston, which it holds more strongly, being not so easily dissipated or let loose; marked by the black colour of the blood, as it returns in the veins to the lungs, to receive this strong or abundant saturation again. In an inflammatory fever there is always a quicker and stronger action of the vessels, considerably beyond their natural tone, which produces an increased heat, greatly above the usual standard, viz. ninety-six of Farenheit's; for we may observe, that the heat and motion of the system bear a regular proportion.

That motion will increase the heat of the system every one knows; from exercise; from increased motion of the blood in fevers, producing such a preternatural heat; from rubbing a limb with artificial friction externally; all of which sensibly increase the heat.

Then, as heat always proceeds from phlogiston, therefore the phlogiston of the system must produce it; and what can be more satisfactory, when we observe the phlogistic part of the system evacuated? If the phlogistic part

part of the ſyſtem, (viz. the red globules and fat) had paſſed off in a compounded ſtate, we ſhould have obſerved them, for the red globules are eaſily diſtinguiſhed by their colour; likewiſe both them and the fat or oil would have been diſcovered upon the ſkin, or excretions of urine, &c. ſwimming upon their ſurface. Oil, and the red globules, are bodies not eaſily evaporable, being greaſy to the touch, and a little quantity giving this property ſenſibly; therefore, from theſe two of their obvious properties, a ſtone weight of them (particularly of fat) could not have been diſcharged in their entire ſtates, without being detected. If they were diſcharged, by evacuations, upon the ſurface, they would remain there greaſy, obvious both to the eye and touch, being bodies difficult to evaporate, and would give a ſoft unctuous feel to the ſkin; but, inſtead of that ſoft lubricated feel, the ſkin is rough, dry, and parched. And again, if they had paſſed off in the diſcharges by urine and other evacuations, we ſhould have obſerved them ſenſibly upon their ſurface; for, put either of theſe bodies upon the ſkin or urine, and you may detect their preſence many days after, if they are not rubbed off or taken away.

Indeed, when maturely considered, the patient having loſt this immenſe quantity of fat and red globules; for they, upon examination, being the only parts of the ſyſtem that are ſenſibly diminiſhed; and, as we have proved, and which every chemical proceſs vindicates, that thoſe two bodies, viz. fat or oil, and red globules, are principally compounded of phlogiſton, can any thing be more conſonant to reaſon (as the only increaſed diſcharge from the patient's ſyſtem was phlogiſton, all the other evacuations being ſtopped up) but that the fat or oil, and red globules, were decompounded, and formed actual phlogiſton, and were the great reſource of the increaſed animal heat; particularly as we have proved that this heat was the only ſenſible evacuation which was increaſed, all the reſt being reſtrained or ſtopped.

But, to bring this doctrine beyond contradiction, I took blood, drawn warm from the animal, and put it into a common bladder; and, having tied the bladder, ſo that I might make the ſtrongeſt attrition upon its ſides, without looſing the blood; after which, letting it ſtand to cool, I placed it between two boards, and ſliding the boards backward and forward, by the aſſiſtance of a little machine, I gave the blood a conſiderable friction; imitating,

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as near as possible its motion in the living animal, not choosing to place it in immediate contact with my hands, for fear of imparting to it, animal heat: exerting upon the blood this mechanical force, I produced a heat in it considerably above what it was before. I likewise put a quantity of blood into a phial, and the same quantity of water into another phial; after giving them both a strong friction, by shaking the bottles, I examined them, and found the phial, which contained the blood, had its temperature of heat considerably raised, while that, which contained the water, had not. That this heat did not spring from the *mechanical force alone*, I put other fluids under the same circumstances, and gave them the strongest force; but little or no heat was produced, being fluids I tried the experiment with, of the same consistency of the blood; therefore this immediately implies that there is a principle in the blood within itself of generating heat. Take any fluid, which does not contain a deal of phlogiston, give it the strongest mechanical powers, and you will produce little or no heat. In my experiment, after I had produced a certain degree of heat, I let it cool, and then renewed it again by the same means as before; afterwards, upon examining the blood, which was in the bladder, I found the red globules dissipated in a great

measure; from which the heat therefore, without doubt, proceeded.

We obſerve the blood receives a bright florid appearance from the lungs; which, as I before have proved, contain more phlogiſton and red globules, in conſequence of that colour; but when the blood has paſſed the general circulation, and returned to the lungs again, by the vena cava, it will have loſt all this fine florid red colour, turning to a black dingy hue, containing, from my experiment with mixing a given quantity of each in water, leſs of the red globules. Let us enquire what has become of them. As I obſerved before, there are none to be diſcovered upon the ſkin, or in the diſcharges; and they are both ſo diſtinguiſhable that if the leaſt quantity were diſcharged, they muſt have been detected.

But on the other hand, here is an immenſe quantity of phlogiſton conſtantly diſcharging by the ſyſtem, viz. the animal heat, which likewiſe cannot be accounted for, where it immediately comes from; then, as I have proved, that the red globules and fat principally conſiſt of phlogiſton, and likewiſe that phlogiſton is conſiderably diſcharged by animal heat, can any thing be more rational than that they depend one upon another? if philoſophers would

would but maturely weigh each argument, the reaſon, I ſhould think, muſt forcibly ſtrike them: nothing can be more obvious, as the red globules are proved to be decompounded, and that that decompoſition muſt demonſtrate itſelf by heat, and that, that heat and that decompoſition are conſtantly taking place in the ſyſtem.

It may be argued, that the phlogiſton that they contain is not ſufficient to account for the conſtant animal heat; only conſider the great heat that a ſmall piece of tallow, in a candle, gives; then conſider what a deal of red globules and fat are broke down in the ſyſtem; how red the blood is after having paſſed the lungs, and how dark when returned again to the lungs; what a deal of heat muſt have been let looſe in their decompoſition; how quick the blood flows back again to the heart, to get a freſh ſupply of red globules.

Let a man faſt for a couple of days, and then examine his blood, and obſerve what a deal of red globules and fat he has ſpent; and accounting for the great quantity of phlogiſton, he is nevertheleſs receiving from the air, tho' greatly inferior to what he received before, as he has no freſh food to neutralize it; and likewiſe the decreaſe of his animal heat, which will be conſiderably leſs than ordinary; all of which

being comprehended and balanced, you may form an idea how much fat and red globules he deſtroys in twenty four hours.

What an immenſe deal of phlogiſton an animal is receiving by the lungs, and by every pore of the ſkin; there are many animals which receive all theirs by this means; for our ſurface, as well as the ſurface of vegetables, receives a great deal of phlogiſton. Indeed, the lungs and ſurface are the great means by which animals ſecrete their great living powers; for what animals receive by the mouth, and vegetables by the root, are only juices to neutralize or attract the living principle from the air.

Then, as phlogiſton is received by the lungs, &c. and there neutralized with the food ſo ſlightly, that the friction, cauſed by the circulation, will decompound it, and ſet it looſe; for it is a rational ſuppoſition, that as phlogiſton is eaſily attracted from the air, merely by the blood's being expoſed, though not in direct contact, for there is a thin membrane which intervenes betwixt the blood and the air; nevertheleſs, ſuch is the great attraction of the blood, that it decompounds the air, taking from it, by the principle of attraction, the bond of union formed of the air's

air's integrant parts; and, in consequence, the phlogiston, fixed air, and water, will all appear in the usual form; and from being bodies, which have such an affinity with other bodies, (particularly the air's phlogiston) they will unite themselves to the blood, and enter into its composition, forming the most necessary part of its fabric, as being the most essential part of it towards animal life; the phlogiston of the air in particular, giving the blood its great principle of animalization. Therefore it is a rational conclusion, as the phlogiston is so easily attracted by the blood, that its adhesion will be very slight, and be in consequence easily discharged, by the mechanical friction in the blood vessels.

That the surface is capable of decompounding the atmospherical air as well as the lungs, I proved by putting my foot into a large bladder along with a quantity of air; I secured them both with a string, and confined them together for some hours; upon examining the air, I found the same alteration had been induced upon it as it undergoes in the lungs. Cover any part of the body with that address, that not the least air can get to it, and you will find that it will loose its fine florid animated appearance, looking pale and dead, which is demonstrable from our dress; that part of the body,

body, which is covered by our cloathing, is ſenſibly paler and more delicate than that part which is expoſed. It is from this circumſtance that people wear gloves upon their hands, to give them that white bleached appearance. It may be ſaid, that it is owing to the extraordinary warmth, which the covering gives, that cauſes this alteration of colour, by relaxing the ſkin; but nevertheleſs, by artificial means, lower its temperature as much as poſſible, and you will ſtill find the ſame changes produced. Only obſerve a man, who is conſtantly expoſed to the open air, what life, vigour, and animation is expreſſed upon his countenance; upon the other hand, obſerve what a dead, pale, inanimate countenance a man has, who excludes himſelf from the open air, ſhutting himſelf up in a tainted atmoſphere. The ploughman characteriſes the one, who breathes a pure atmoſphere, replete with this great agent, phlogiſton, where there is that proper ſaturation of the three bodies which form atmoſpherical air; the mechanic affords us the oppoſite picture, who is ſhut up in a confined room, in a large town, being expoſed for a length of time to the ſame atmoſphere; what a greater degree of life is expreſſed in the one more than in the other!

That

That there is a conſtant and direct attraction of phlogiſton by the blood, wherever they are expoſed together, is very obvious and clear from many caſes in ſurgery; for let any part of the body be expoſed to the air, which is naturally cloſed, what diſeaſe and inflammation will be induced? in conſequence an amazing greater degree of heat. This is well known to ſurgeons; for it is their firſt and great principle to hinder that contiguity or union. Nature, to obviate a greater quantity of phlogiſton being ſecreted or attracted than is requiſite for life, has formed a covering, viz. the ſkin, to take off the direct contact, only admitting a certain quantity; but, when this covering or ſkin is removed, and a direct union takes place between the blood and air, diſeaſe is certain to be the conſequence.

The air is the ſtrongeſt poiſon to cavities; it is from this that wounds in the abdomen are ſo very fatal, even though none of the viſcera ſhould be wounded; upon the application of the air, there is a ſtrong inflammation induced; the circulating fluids which before were colourleſs, now take on a high inflammatory red appearance; the ſame alteration of colour taking place as if they had paſſed the lungs, and been there expoſed to the air. The ſame baneful conſequences take

place

place if a common wound of the muſcles be expoſed; how inflamed and red the acceſs of the air makes it if it is not precluded from it; therefore it is the ſurgeon's firſt and great attention to keep the air from the wound; which he performs by the application of bandages, unctuous bodies, lint, &c. Upon this ſimple treatment depends the principal part of the cure. It may be argued, that the baneſulneſs of the air is owing to its cold ſtimulus; but that coldneſs would rather allay the heat and inflammation, by taking away part of the ſuperabundant phlogiſton of the diſeaſed part. Make the air of what temperature you pleaſe, even to the ſtandard of animal heat, and it will nevertheleſs produce its poiſonous effects; and, what is directly corroborating, if the air be examined, which has produced theſe baneful effects, by having acceſs to the diſeaſed part, it will be found to be decompounded, in the ſame manner as expired air.

It is by no means a ſtrange effect, if maturely conſidered; for my reader may recollect I proved that the ſame phænomena are induced by expoſing the blood out of the body, turning it to a bright florid red; which is the direct ſame colour that it takes in the body when inflamed.

How

How ſimple and uniform Nature is when known; very far from the far-fetched theories of man's whimſical brain. If the ſurgeon will but candidly and deliberately weigh this ſimple and uniform proceſs of nature, it will be a firm and unerring line of conduct to adhere by; and it will be found a juſt obſervation, (which our knowledge of nature has confirmed) that complex theories of her works are always mere chimera, ſhe being always ſimple and uniform.

In medicine, to preſcribe with that confidency, and to purſue nature in all her various ſtages, it is immediately neceſſary that facts and theory ſhould directly agree; for, though ſuch a mode of treatment is known to ſucceed, not knowing upon what philoſophical principle it acts, one's mind never gives that reſolute aſſent to it; and, if any alteration takes place in the ſymptoms, it confounds the practitioner. But when theory coincides, and he can aſſign rational arguments, he ſtands upon a firm foundation, practiſes with reſolution, and is not alarmed with freſh ſymptoms.

Men's minds are naturally of an active curious diſpoſition, anxious to reaſon dogmatically; and, if the true ſimplicity of nature does not ſtrike him, he will begin to fabricate

with

with a wild imagination, building and pulling down fantastically; and will, from a natural pride, force his practice to his theory. It is from this reason that the great and piercing cries of Nature have been heard unmoved, and been, if one may use the expression, impaled upon the stake of imagination: for, in inflammatory diseases, where the patient was consuming with heat and thirst, where cold air and water were ardently called for; the patient was refused them, being ordered heating medicines, (adding fuel to the fire,) upon some vain, trifling, and mechanical idea of evacuating the morbific matter, as they termed it. How many thousands have died votaries to men's whims: for elucidation, we shall point out one particular disease, viz. the small-pox, an inflammatory disorder, which has been the death of millions. It is an eruptive disease; and, from a quantity of matter being discharged by the pustules, they formed this mechanical idea, that heating sudorific medicines were necessary to force the discharge; and, when the patient was dying from the fever, they prescribed medicines that would have even produced a fever, if the patient had been well; then what must have been the consequence when nature was already overpowered by one? Why, they pushed her down the precipice headlong, which the disease had lead her to.

So

So ſtrongly were they influenced by their theory, though death gave their practice the contradiction, though the calls of Nature pierced their ears, though the patients' tongues were parched with heat, their bodies being all as it were on fire; yet cold air and water were forbid them; hot ſpirituous liquors, and an oven, were their portion till death freed them. If nature had been left to herſelf, ſhe would have purſued the preſent antiphlogiſtic method; which I do, with confidency, declare, is the greateſt improvement which medicine has experienced. This ſhould teach phyſicians how careful they ought to be in counteracting Nature's calls, ſhe being the beſt handmaid, and ought to be aſſiſted. And that man, who has the moſt knowledge of her, will be moſt modeſt.

This ſimple theory of mine will be a great key to medicine; the ſurgeon will have a grand land-mark to ſteer by; it will make him careful to exclude the air from all wounds, particularly wounds in the cavities, which are naturally cloſed: if judiciouſly cancelled, it will open to him many new improvements in his profeſſion: for it is certainly groping in the dark till we can properly underſtand Nature's different proceſſes and operations; then, when a man can do that, he can conduct his practice with firmneſs

neſs and uniformity, waiting with proper patience, and acting with proper reſolution in times of exigency; all which muſt be a pleaſing anchor for his own ſatisfaction and happineſs.

Here then is the whole doctrine of inflammation opened to us; a doctrine upon which the phyſician and the ſurgeon's knowledge ſo much depends; a doctrine which has been ſo much laboured at, that to give you a hiſtory of each ridiculous whim, would fill a whole volume. As it is ſo great a key to medicine, it is no wonder there ſhould be ſo many attempts to inveſtigate it; but thoſe attempts were not founded upon obſervation and facts, but were the wild chimera of fertile imaginations, the children of whim and caprice; very far from that true ſimplicity and perſpicuity which Nature ſhews in all her works.

Upon the doctrine of inflammation, the great Boerhaave built his great theory of obſtruction and lentor, which he formed for a foundation of his practice; but which muſt fall like all other fabrics, that are not founded on fact, but are mere children of the brain.

But I will give you my theory, which you will find will directly accord with that ſimplicity

plicity which marks Nature in all her operations.

By inflammation, I define and imply, an animal body, being preternaturally heated, attended with pain, tension, and a more red colour of the part; all these symptoms are produced by a more vigorous and stronger action of the vessels, and a greater quantity of red globules being thrown upon them, both of which, operating together, will give all these different symptoms. A greater quantity of red globules being thrown upon the part, will give a greater stimulus; (for upon their stimulus, the whole vital action of the animal depends; they are the *vis vitæ*, and the living principle of physiologists:) then, in consequence of a larger quantity of red globules being thrown upon the part, they will give a greater stimulus to the vessels; the result of this stimulus will be, a stronger action of the vessels, and this stronger action, with a greater quantity of red globules than is natural or usual to the part, will produce all the phænomena of preternatural heat, pain, and high colour of the part; for the red globules, flowing in a larger quantity upon the part, more of them must be decompounded; and, in consequence of that decomposition, a greater quantity of phlogiston will be let loose, and give that pain and

ſtimulus; for it is phlogiſton that is the univerſal ſtimulus, or living principle in nature; but more of this elſewhere. Which ſtimulus being ſo peternaturally ſtrong, ſo as to arrive at the ſenſation of pain, cauſes a ſtronger action of the veſſels; ſo that there is not only a greater quantity of red globules comparatively thrown upon the part, but there will be a greater quantity likewiſe comparatively decompounded. To elucidate it by example; it is like a fire which has not only a greater quantity of coals thrown upon it, but likewiſe its coals which are thrown upon it, burn conſiderably ſtronger than before. In inflammations, ſometimes it is ſo ſtrong as totally to deſtroy the life of the part, and produce a mortification; the explanation how that happens I ſhall give elſewhere; to enter copiouſly into that doctrine, being not the intention of this treatiſe. Sometimes, nay, indeed, it is often the caſe, that a bare expoſure of a partial part of the body to a current of cold air, will produce theſe ſymptoms of inflammation; the mode of its producing inflammations is this: cold has a mechanical power, which every philoſopher is acquainted with, of conſtringing the body, which it is applied to, inanimate as well as animate: then, in conſequence of this power, it conſtringes that part of the animal to which it is immediately applied; the reſult of

of which constriction will be a contraction in the diameter of the vessels; and, in consequence of that, a closer and stronger compression of the blood contained within the vessels. I have before proved that it is the mechanical compression of the blood and vessels, mutually acting upon one another, which decompounds the red globules, juices, &c. and likewise, that that decomposition sets loose a quantity of phlogiston, which gives the living stimulus and heat: therefore, in this case of the cold, there must be a greater stimulus and heat induced upon the part, which is really the case; they being in that degree, so as to produce pain and preternatural heat; which pain, or preternatural stimulus, will cause a larger quantity of blood to be thrown upon the part, adding as it were more fuel to the fire, so as to produce all the symptoms of inflammation. It may be asked, why should pain cause a larger quantity of blood to be thrown upon the part? which question I shall endeavour to investigate.

The fact, I presume, no one will offer to deny; if any one wants his senses confirmed; it is only stimulating any muscular part, or, in short, any other; and observe if a larger quantity of blood does not immediately flow upon the part; by taking a pin, and running

it into his finger, he will ſoon be confirmed in it: therefore we will ſet it down as a fact. The explanation and inveſtigation of which important fact I ſhall treat of elſewhere, when I enter more minutely into the living principle of animals; at preſent, it would lead me too far from my plan.

Here then we ſee that great doctrine of inflammation ſimply expounded, which before was ſo whimſically and learnedly laboured at by the imagination, (which is a Will of the Wiſp to inveſtigation in general) is now, I hope, clearly and ſatisfactorily explained. Then, as I obſerved before, if a cavity or fibre of the animal be expoſed to the air, how inflamed and red it will appear; which is certainly produced by the air's phlogiſton being attracted by the part, and the greater degree of cold in the temperature of air than that of the body; and which is nothing ſtrange, for I have ſhewn it is only what takes place out of the body; for the blood will equally attract and decompound the air out of the body as in the body; and it is from this, that the air produces diſeaſe, from being admitted into a cavity naturally cloſed; any ſtimulus, if carried to any degree, will bring on inflammation, acting by conſtringing and quickening the tone of the veſſels upon their fluids.

What

What directly confirms this doctrine of the air being so pernicious to cavities, from the principle of the blood and juices of that cavity, being immediately applied to the atmosphere, in direct contact, is, that if air has been breathed, it looses this poisonous quality, being then mild and bland, from having already parted with its phlogiston. Therefore it is not, as Dr. Priestley supposes, for, agreeable to him, it would have just been the reverse; as the air, instead of being more mild, would have received so much phlogiston in the lungs, as to have been very poisonous indeed; for he says, that the use of the lungs is to discharge phlogiston out of the system: phlogiston, which is so noxious, that, if it is not every moment discharged, it will kill in five minutes; as we well know, if the lungs be stopped only for five minutes, it will have that effect; but in this fact it appears, unhappily for the Doctor's theory, that, instead of being noxious and poisonous, it has those qualities taken from it by the lungs.

This great doctrine accounts for many phænomena in the animal system, which would never have been discovered upon the old theories; the explanations of which fall in so easy, that I may bring them as the strongest arguments in my favour, if I stood in need of supports.

Upon this rational doctrine, we can evidently, clearly, and satisfactorily, investigate the different temperaments which physicians have marked in the human system: they differing so very materially in point of colour, and many peculiarities in point of constitution, that physiologists have long observed them; and variety of hypotheses have been formed, as well as upon other points of knowledge. The difference of temperament between the inhabitant of the Equator and the Pole must have struck every philosopher, and vague opinions have been assigned; but, they being unacquainted with the grand knowledge of the principles of life, which I have in this work elucidated; they have left us in the dark. But now I think we may say without vanity, that we have found the great key, the great arcana, to knowledge.

Boerhaave, in his arduous researches for it, declares, that happy will be the man who finds it. It is certainly the greatest piece of knowledge which science has been blessed with, when we can rationally and philosophically reason about the principles of life, what a knowledge in the cure of diseases it must lead to. In the great variety of animals, we often observe a great number of different species of the same genus; exemplified in the great variety of kinds of dogs.

dogs. But in the human there is only one ſpecies, they being one and the ſame in every part of the globe; indeed, when we contemplate upon the dignity of man, being a part of the creation, ſo particularly honoured above the reſt, with the divine goodneſs, as to poſſeſs an immortal ſoul, which the ſacred writings confirm to us; therefore, under theſe circumſtances, it could not be ſuppoſed there would be that conſiderable variety that there are in other ſpecies of animals, being not only ſo dignified by their immortality, but by having the ſupreme command over all other animals; likewiſe a degree of intellectual reaſoning, capable of ſearching into and inveſtigating the myſteries of nature; nay capable of abſtracted reaſoning, and of forming imaginary perceptions: alſo of an active curious diſpoſition, having both reſolution and ſagacity to explode the vaſt ſeas and foreign climes: in all the habitable places we find man; but moſt other animals are peculiar to a climate or country. Nevertheleſs, under all the great variety of climates, ſituations, countries, &c. we find man the ſame ſpecies of animal. The alterations there are, are trifling and ſecondary, but let us conſider them. The firſt and moſt ſtriking diſtinction is in their colour, ſome being a perfect white, while others are a perfect black; nay, there is a regular gradation from one to the other, ſome

being of a medium between the two; the next distinction, which is most striking in some countries, is, that they are larger than in others; another distinction that we shall make is, that they are jollier, more fat, and muscular, under some climates than others,

As we have before mentioned, they are one and the same species of animal universally over the globe; then let us enquire from whence originate those alterations; it cannot be from the nature of the animal; that is, I mean principles within itself; as there is no doubt, for both religion and philosophy confirm to us, that they are all one and the same; then it must be from their peculiarity of situation of country and climate; which we shall philosophically prove to be the case.

I never heard a philosophical reason assigned for these alterations or distinctions of colour, &c. or at least such a reason as deserved the least regard being paid to it; indeed, till the principles of life were found out, the great cause for these changes could never have been discovered. Without complicating terms we shall give these distinctions the different names of temperaments, which physicians used to apply to little peculiarities of constitutions; therefore

therefore we ſhall make two grand diſtinctions; we might, no doubt, make a great variety of temperaments, but that would make it more complex: we ſhall form the two oppoſite temperaments, and any one may make the different intermediate ones himſelf, if he wants to be more minute.

We ſhall call the one the torrid, or melancholic temperament, the other the frozen or ſanguine temperament; one habitating near the equator, the other towards the poles: and from one to the other, viz. from the equator to the poles, there is a regular gradation, only allowing a little for the particular ſituation of iſlands, which have a peculiarity of climates, and for which (in this book) I have aſſigned reaſons why they do not partake of the ſame extremity of ſeaſons, as continents do; for they have neither thoſe intenſe colds, nor intenſe heats, that continents upon the ſame latitude have; owing to their contiguous ſituation to the ſea, which has a power of receiving heat in the ſummer, and of imparting heat in the winter, and by which the ſeaſons of iſlands are tempered; but you will ſee this explained more fully elſewhere in this book.

Then we ſhall eſtabliſh thoſe two grand temperaments, viz. the torrid and the frozen, and

and we shall find, what will directly confirm to us, that the different temperaments are not owing to a natural peculiarity of the human species, is, that all animals equally partake of the same peculiarities; *i.e.* all they who inhabit at the equator have the marks of the torrid, and they who inhabit at the poles have the marks of the frozen, even the same species of animals; therefore indisputably it is from the climate. For even take an animal from the torrid climate, and place it in the frozen climate, and it will imperceptibly dwindle from the torrid temperament into the frozen. Then, after establishing this fact, that these two different temperaments (so very opposite to each other as we shall find them upon inquiry) are owing to the difference of climate, let us direct our investigation, as an essential piece of knowledge, in what manner the difference of climate can affect the animal system so particularly as to make that variety of colours and other appearances, &c. And, as we have endeavoured to establish the general principles of life, let us see if they will expound to us these phænomena; I flatter myself, that upon enquiry, instead of finding it difficult, or being under a necessity to force explanations, we shall find that they will fall in so easy, and coincide with our doctrine, that, instead of being any opposition to it, they will actually be strong

ſtrong barriers in favour of it; and that thoſe phænomena, which uſed to be inexplicable upon old principles, (not even being capable of offering the leaſt explanation) will, with our theory, not only be expounded, but become the ſtrongeſt evidences in its favour.

Phyſiologiſts have marked out three different temperaments in the human ſyſtem, the melancholic, ſanguine, and phlegmatic: the two firſt are accurately defined and marked out, and are the ſame as our temperaments, viz. torrid and frozen; the latter ſeems more complex, and not ſo eaſily diſtinguiſhed; indeed, it ſeems to be a medium betwixt the two firſt; but the melancholic and ſanguine, not only have their diſtinction in the conſtitution, but likewiſe in the climate; the one is a native of the equator, the other of the poles. The general conſtitution of the torrid zone partakes ſenſibly of the melancholic, while the poles that of the ſanguine: indeed, the peculiarity of the different temperaments are not ſingular to the human ſpecies; the quadrupede likewiſe as clearly partakes of them.

The names which characterize each, viz. melancholic and ſanguine temperaments, are by no means properly adapted; but have a very partial view or meaning; originating from the

peculiar

peculiar circumſtances of the different temperaments, in that part of the globe where the names were given: for example, in this iſland of Great-Britain, the native temperament is the ſanguine, and, when there are ſtrong melancholic marks of temperament, as not being a native of the climate, the diſeaſe, which the name conveys, is ſubject to thoſe of that temperament; the northern ſituation of Great-Britain being rather too cold for the melancholic temperament. But the names that I have given them from the climate are juſtly appropriated to them, as, the climate, we ſhall prove, is the entire author of the change; therefore the names torrid and frozen certainly imply, in a more liberal ſenſe, the peculiarities of the temperament; yet, by way of making things obvious and eaſy, we have called them by both names.

Now let us proceed to the definition of each temperament. The melancholic or torrid is characteriſed by a denſe, firm, rigid fibre, and a dark, ſwarthy, and black complexion, with ſtrong black hair. But the ſanguine, or frozen, is the oppoſite to this; of a lax, tender fibre, with white or reddiſh hair, a plump fat look, with a fair and clear complexion.

Here

Here are two oppoſite temperaments, which nature hath framed, no doubt, for great and wiſe purpoſes; but I never heard a philoſophical and medical reaſon aſſigned for the great deſign which, no doubt, nature has in inſtituting them. An inveſtigation would, doubtleſs, have opened a great deal of the principles of life: but then the great means to have done this were concealed; they knowing nothing of the great leading principles, requiſite for ſuch an inveſtigation.

The different temperaments are ſo remarkable, that they muſt have ſtruck every philoſopher: that the human ſpecies, near the equator, ſhould be quite black ſkinned, while thoſe near the poles ſhould be white ſkinned: as it is univerſal all over the globe, and being in ſuch regular gradation, we have a right to preſume it is for ſome great purpoſes in nature. If it had been partial in one part of the equator, and poles, we ſhould then ſuppoſe it was a mere whim, or *luſus naturæ*; but we ſee it is as regularly marked as any one general rule in nature; the inveſtigation, therefore, of this important piece of knowledge, muſt be truly intereſting. I do not mean that peculiar part of the mechaniſm which makes that diſtinction in the colour; for that, as anatomiſts have evidently demonſtrated to us, lays in the ſkin;

but

but I mean to take up the question in a liberal, philosophical sense, upon what principles and purposes they are designed and formed.

There are not only those two opposite colours of black and white, but likewise there is such a regular gradation from the strongest jet black, to the most clear white. At the equator being a strong black; and that black regularly disappearing, and a white as regularly increasing, towards the poles. Why the same species of animals should differ so exceedingly in colour and temperament, in different climates? That it is the effect of climate, is demonstrable; for a native of the north going south, changes, in a great degree, his natural temperament, and takes that of the country which he then lives in. For instance, an Englishman living in the East-Indies, will turn considerably of a darker colour, both in respect to his skin and hair; losing the marks of the sanguine temperament, and partaking of the temperament of the East, viz. the melancholic; nay, this remarkable change of temperament is not peculiar to the human species:—take a quadruped, an English sheep for instance, and the same change will take place in its temperament; the same rigid, dense fibre; and its wool will turn hairy and dark, from the skin contracting itself.

These

These are circumstances, when maturely considered, which strike with a deal of philosophical admiration. I wonder that it has never been attempted to be elucidated; but the reason is, the true cause being so far hidden, and not being acquainted with the previous knowledge requisite for such a discovery. But I think my theory will satisfactorily account for it; indeed, the investigation of its causes is one of the strongest arguments I could bring in favour of my grand doctrine; as it not only gives us a key to this secret of nature, but likewise many other abstruse points are now clear; and I make no doubt, it will be of the greatest benefit and service to mankind, both in healing their diseases, and in pleasing that noblest of appetites, a thirst after the knowledge of nature, or philosophy; for it is that knowledge which exalts the human above the brute creation.

I hope I have satisfactorily proved that we receive that great animalisor or animator, viz. phlogiston, by the lungs, and by the skin; and that it is through their pores that this phlogiston of the air is admitted.

Now it is well known, that a strong dense fibre neither admits of such a quantity of juices and blood to be thrown upon the surface,

face, and likewise that that dense skin hinders the passage of phlogiston thro' it; all this is clear and evident, being rationally induced, from our knowledge of the relaxation and condensation of bodies; for if the skin is relaxed, it must certainly admit of a greater quantity of that subtle fluid, phlogiston being secreted through it: that the skin has a power of excluding, and a power of admitting, no one can deny. I took a bladder, being taken from the body of a small tender calf, and another taken from the body of a bull; in both, I placed a quantity of the same blood; after exposing them for some time to the same atmosphere, and then examining them, I found the blood in the small, relaxed, tender fibred bladder had attracted considerable more phlogiston from the air than the blood in the dense fibred bladder had. To argue, *a priori*, one would have supposed, that the thick coats of any bladder would totally exclude the blood's power of attracting phlogiston from the atmosphere, as the immediate contact is thereby hindered; but, yet such is the great power of our juices in decompounding the air, that the skin or bladder cannot hinder it; they only have it in their power to restrain the attractive principle within some degree or bounds.

That

That there is this different principle of attraction in the torrid or melancholic, and frozen or sanguine, temperaments, only mark the distinctions of each. In the frozen or sanguine temperament their vessels are juicy and full; having a great determination of blood to the surface, likewise of a lively blooming colour, and of a thin, tender, and relaxed skin; but the torrid or melancholic temperament has a strong and dense fibre, being lank, thin, and swarthy. But the climate, having such a power in forming the different temperaments is strongly characterised in one of our sheep; let it feed in England, where there is very little phlogiston in the air, comparatively with other climates, and it will grow fat; its vessels relaxed and full of fine lymphatic juices, that when killed it shall eat very tender and juicy; fine wool will grow upon its skin, it being fed by a fine lymph; in short, having every process to attract as large a quantity of phlogiston from the air as possible, having a great quantity of lymph in its vessels; (which, as I observed before,) is the principal basis for the attraction of phlogiston, and having a lax skin, to easily admit the entrance of phlogiston, likewise a deal of fluids thrown upon its surface, for the great motive of decompounding the air. But take the sheep to a warmer climate (to France for instance) and every thing will

be reversed. There the sun being more perpendicular, in consequence the air is far more strongly saturized with phlogiston, and therefore is far more easily decompounded and robbed of its phlogiston. Nature, finding under her present power and state of attraction of phlogiston in the sheep, that she does it too considerably, disease being the consequence; therefore she sets about correcting of it. She contracts the general stamina, making the fibres more dense, which hinders so large a quantity of lymph and blood to circulate in the vessels; therefore there will be a less proportion to attract phlogiston; and which likewise hinders the power of admitting of phlogiston by the skin, its fibres being far more close and rigid, and in consequence cutting off, in some measure, the contact of the air and juices: and, as the same skin every way covers the surface of the lungs, it is condensed in the same proportion; that it does not decompound such a quantity of air. The skin is so condensed, which before admitted of the growth of a fine soft wool, will now only admit of a hard hairy covering; and likewise the sheep, when killed, will eat hard and dry, not having the least fat comparatively; which, as I observed, is in a great measure peculiar to animals in cold climates, for two great reasons, their vessels being lax, admit of a

space,

ſpace, to lay up this fat; and likewiſe it is a proviſion in nature for the winter ſeaſon, when there is but little phlogiſton in cold climates in the air, by having a reſervoir within itſelf of phlogiſton and nutriment, both of which the fat is compoſed of; the one giving it animal heat, and the other ſtamina to its fibres.

That both the red globules, and fat or oil of the animal body, give animal heat to the ſyſtem, there is little doubt of; they both containing ſuch a deal of phlogiſton; and that phlogiſton, being capable of being decompounded by the circulation: Though there is a difference in the appearance of thoſe two fluids; in the fat, the phlogiſton is more cloſely attracted, adhering far firmer; but the phlogiſton of the red globules we can ſoon diſſipate or ſet looſe, by artificial heat, attrition, or even by the evaporating power of the air; for we obſerve, when blood is recently drawn from the animal, it ſoon loſes its florid red appearance; flying off in vapour, diſtinctly to the ſenſes; but after being expoſed ſome time, it will attract phlogiſton again. The phlogiſton, which is diſcharged by the blood, being that which adheres moſt looſely; but that contained within the fat is far harder to decompound, being deſigned by nature to lie

there firm and ſnug, till the winter's cold approaches; whoſe condenſing power, by contracting the diameter of the veſſels ſets this reſervoir a-float into the circulating veſſels; and, by their ſtrong tone which the cold gives the veſſels, they decompound the fat.

The ſheep, which in England had a plump, fat appearance, with fine wool to clothe it: and, if eaten, would be tender and juicy food; but after being ſome time in the hot climate will have no rich lymph, juices, or fat, nor tenderneſs in eating comparatively. Its blood, if examined, will have little proportion of lymph, being that body which has ſo great an attraction for phlogiſton, and which animals, in cold climates, therefore have ſuch a great proportion of; in order to attract the little proportion of phlogiſton there is in the atmoſphere, comparatively with hot climates. But in hot climates, their blood and juices are formed of a thin, watery, poor, fluid, which have but little attraction for phlogiſton; as there is ſuch a great abundance in the atmoſphere, therefore fluids of little attraction will receive enough to ſupport animal life. And, as we obſerve, there is ſuch a diſtinction of phlogiſton in the atmoſphere, in hot and cold climates, there is the ſame diſtinction in the animals' powers, which inhabit each, in receiving

ceiving of phlogiſton. Nature having, in her great, wiſe, and all-ſeeing providence, adapted the one to the other.

That this alteration of ſtamina is not peculiar to animals of a cold climate going into a warm one; as the change is equally obſervable in the animals of warm climates going into cold ones; all that rigidity and denſity of fibre, by being in a cold climate, partly goes away; which is ſtrongly to be obſerved of the ferocious animals in hot countries, where that denſity and rigidity of fibre, and living upon animal food, give all that fierceneſs and rage ſo remarkable in thoſe animals. The tiger, for inſtance; take him from the Eaſt-Indies, where he inhabits, and bring him over to England, and he will ſoon loſe all that natural ferocity in a great meaſure, notwithſtanding his being fed on animal food: he will get fat and unweildy, his fibres and veſſels becoming relaxed and yielding, will make him ſluggiſh and inactive.

It is from this cauſe of temperaments that there is ſuch a material difference between the conſtitution of the northern and ſouthern parts of Europe; the former is of a fair complexion, jolly, and muſcular; the latter is thin and ſwarthy, agreeable to the difference of climate. In

respect to their animal spirits, there is the same peculiarity of climate; the one being all volatility and vivacity, and the other all gravity and solidity. The one is remarkably irritable, his animal spirits being easily called into action: the other is far more callous, and not easily roused, his animal spirits being more inactive in giving their impressions. There is the same distinction in their food; the one living principally upon animal food, strong malt liquors, &c. and the other upon vegetable food, and thin light wines. That the difference of climate gives all these peculiarities of constitution, no rational philosopher can doubt; but the present enquiry is the investigation, in what manner it is performed.

First, then, we will examine the cause of the difference of their outward appearance and figure, The one is thin and swarthy; the other is of a fair complexion, jolly, and muscular. That it is owing to the heat, which produces this temperament, being thin and swarthy, is certain, if we will maturely investigate it. From the known properties of phlogiston or heat, we might have argued, *a priori*. Let us then candidly canvass the operation of phlogiston or heat upon the animal system.

Phlogiston

Phlogiſton or heat, acts as a ſtrong ſtimulus upon the animal fibre; indeed, we have before proved, that it is the great ſtimulus or living principle of life. That it acts as a ſtimulus to the living fibre is proved from an animal's being half frozen to death, its circulation juſt ceaſing, will, on the application of heat, have its circulation renewed. Likewiſe it is proved, that when a part has a preternatural quantity of heat applied to it, it will ſtimulate it, or give it pain: that in fevers, where there is an extraordinary temperature of heat induced, it will greatly increaſe the circulation; from going into a hot room will likewiſe increaſe the circulation: all which, I hope, ſatisfactorily proves, that heat gives a ſtrong ſtimulus. Then, in thoſe climates, where an abundant proportion of phlogiſton is ſaturated in the air, in conſequence thoſe animals, which live in it, muſt comparatively be under a ſtronger influence of ſtimulus than thoſe animals which live in a colder atmoſphere; which being granted, then let us conſider the effect which a ſtimulus has upon the ſyſtem. If you ſtimulate an animal fibre, you force it into action, which action is by drawing itſelf up into a leſs compaſs: that this is the effect upon the fibre is clearly proved, by ſtimulating a muſcle, which is a number of fibres placed together; the conſequence will

be, it will contract itself into a less compass, and pull the two bones which it is joined to, nearer together; that being the effect of a stimulus from heat, is evidently seen in a burn, where there is a partial application of heat; it constringes the animal fibres all into a heap, if one may be allowed the expression. If it is a general of heat, it will form a general constriction, either the application of external or internal heat; proved by Fordyce's experiment in the heated room, where he found his pulse amazingly increased; and likewise in fevers, where there is that general constriction evidently to be observed upon the surface, and likewise in the internal parts, by the rapid circulation of the blood. Therefore, physicians are wrong, in supposing the constriction of the skin as the primary cause of fever; it is only secondary, being the natural consequence of the stimulus, from the preternatural degree of heat, generated or let loose in the system; that constriction being only owing to the preternatural stimulus, which at that time is taking place in the system; for a greater quantity of phlogiston being let loose, must induce a greater stimulus, and in consequence a greater constriction. Therefore the great object of the physician should be to allay this great quantity of phlogiston, from being decompounded, and irritating, and stimulating, so strongly the functions

tions of life; that being the great object to be attended to, and not the confined idea of promoting a diaphoresis, which they attempted by heating medicines, and which they argued produced a diaphoresis in a healthy state: but what would have that effect then, in a fever, would just act in the opposite extreme; but not knowing the true cause of the disease, they were led into this great mistake. In consequence of that mistake, they levelled all their artillery to produce this relaxation of the skin; by warm atmospheres, by internal heating medicines, to push the circulation to the surface, as they called it; all which, instead of aiding nature, aided the disease, by generating a greater quantity of heat, and in consequence a greater stimulus, and quicker circulation: which treatment has been the death of thousands. Now, knowing the true cause of those fevers, the proper treatment is easily found out; viz. cool air, cool regimen, cooling medicines, and evacuations; for, if you can get this preternatural fire or heat extinguished, a relaxation of every fibre in the system will take place; as there is that general sympathy throughout the system, when one part is relaxed, the other parts will be so likewise; and this diaphoresis upon the skin, as physicians call it, or relaxation, implies this; that the preternatural stimulus, from the preternatural

quantity

quantity of heat, is overcome; and not that the diſeaſe is cured by that partial relaxation of the ſkin or ſurface, but that every part or fibre is equally relaxed. I know one great theoriſt, who ſuppoſes that this conſtriction of the ſurface, in fevers, is owing to the great wiſdom and ſagacity of the *medicatrices naturæ*; Nature ſo ming this conſtriction for wiſe purpoſes, to aſſiſt her to overcome the diſeaſe, and to give an additional force to the circulation, in order to overcome the ſpaſm which is generated by the diſeaſe; but the true cauſe he is miſtaken in, it being the reverſe, as the conſtriction and increaſed circulation are the effect of the diſeaſe.

That it is owing to the conſtriction of the animal fibre in general, and not to the partial ſkin or ſurface, is proved; if you wound or ſtimulate any part of nature, ſo as to produce a conſtriction of its fibres, it will bring on a fever and this conſtriction of the ſurface: when there is this general action or conſtriction of every fibre in the body, (ſeen by the quick circulation and heat generated,) why ſhould not the ſkin partake of it? therefore, inſtead of ſearching for particular cauſes why it ſhould be ſo, we ſhould have thought it moſt wonderful if it was not ſo.

But

But to return to our former ſubject, the inveſtigation why a greater quantity of heat, abounding in the air, ſhould make the animals, that live in it, thin and ſwarthy. We have proved, that either artificial or internal heat will produce it; give them that yellow, ſwarthy, thin look, viz. in fevers, &c. How thin, ſwarthy, yellow, and meagre a man looks, who has a fever upon him; ſo that one may eaſily diſtinguiſh when there is the leaſt preternatural or febrile conſtriction upon his ſyſtem; his countenance will immediately betray him; it looſes that plump, florid look; it becomes yellow, thin, and meagre: the countenance being an extreme good mark to judge of the health of the patient.

That the ſtimulus, induced by heat, will always produce this conſtriction of the animal fibre; and this ſtimulus, from the atmoſphere's heat, muſt more immediately act upon the ſkin, as it is the part of the animal which is immediately expoſed to its influence, being in immediate contact. A perſon, not being accuſtomed to ſo warm a climate, his ſkin being relaxed, will not only ſecrete a larger quantity of phlogiſton into his ſyſtem, by the mode of attraction, which I mentioned before, but likewiſe his ſkin will be preternaturally ſtimulated; which will, in conſequence of that

that preternatural ſtimulus, conſtrict itſelf, and that conſtriction will be imparted to the ſyſtem, and cauſe diſeaſe: which animals generally find, that inhabit a cold climate, and are afterwards expoſed to a warm one: but in time this conſtriction will looſe that property of ſympathy, or imparting to the general ſyſtem; for, by habit, the evil is overcome, as in any other diſagreeable pain or ſenſation by time, looſes its effect; therefore, under theſe circumſtances of climate, the ſkin only will be particularly conſtringed; the other fibres, no doubt, will likewiſe be conſtringed in a great meaſure, from the phlogiſton's being attracted into the ſyſtem; but not in ſo great a degree as the ſkin, which is moſt immediately expoſed: and this will anſwer the greateſt and wiſeſt purpoſes; for, as I proved before, agreeable to my theory, the great conſtriction of the ſkin will hinder the blood and juices from decompounding ſo great a quantity of phlogiſton; and in conſequence be received into the ſyſtem; for, if there was the ſame power and ability of receiving it in the animal of the torrid climate, as there is in the animal of the frozen climate, its life could not exiſt; it would be burnt and parched up; there being ſuch an amazing more abundant proportion of phlogiſton in the one climate, than in the other. How

ſimple,

ſimple, wiſe, and great, Nature is in all her purpoſes! how every thing tends to one great line or cauſe! — Oh, omnipotent Creator!

Nature, in her great wiſdom, that all parts of the world might be inhabited, hath therefore adapted theſe peculiarities of temperaments: the full explanation of which temperaments muſt, I am certain, be ſatisfactory; the phænomena ſo directly falling in, and coinciding with, the principles of my doctrine, which are explained upon its principles in ſo ample and full a manner.

Every peculiarity and circumſtance being directly contradictory to the late doctrine of Dr. Prieſtley, and according with mine; one in particular, which we ſhall now mention.

In warm climates they have by no means that diameter of lungs that the people in cold climates have; ſeen by the make of their ſhoulders: to bring an example which is familiar to us, ſee the difference in the formation of an Engliſhman and a Frenchman in the form of their cheſt; how narrow and confined the one is to the other; and no doubt for the great purpoſe of ſecreting phlogiſton; the Engliſhman, from the coldneſs of his climate, requiring a larger ſurface of lungs to decom-

pound

pound the atmosphere; there being not so great a proportion in the atmosphere which he breathes; but the Frenchman who breathes an atmosphere far more replete with phlogiston, therefore, requires a less surface of blood to be exposed, and, in consequence, a less chest. Which circumstance is immediately contradictory to Dr. Priestley's theory; for certainly if the lungs great office was to discharge phlogiston from the system, and not to receive it, the Frenchman's lungs should have been larger than the Englishman's; but it happens to be the reverse. Therefore the Frenchman who lives in a climate where there is such a greater abundance of phlogiston, and consequently must receive more, hath, nevertheless, a less diameter of lungs to discharge it, agreeable to Priestley: but when nature is freely canvassed, we shall find no such contradictions.

The next material alteration of temperament between the torrid and the frozen, which we shall take notice of, is the difference of their animal spirits; the one is all volatility, and the other is all gravity and solidity; the one is remarkably irritable, the animal spirits being easily called into action; the other is far more callous, and not easily roused; the animal spirits being more inactive in giving their impressions: which difference and peculiarities of

of temperament, will be easily explained upon our theory, so that we might have argued *a priori*.

I hope I have satisfactorily proved, that phlogiston is the great stimulus or animator, and that the principle residence of this phlogiston is in the blood; and that it is principally received by the lungs; therefore we shall see a direct concordance, that those animals which have most lungs and red blood, will be most animated; which is really the case.

Therefore in warm climates, where phlogiston so greatly abounds in the air, the system must in consequence receive a great deal of it, and be more animated; which animation will give that volatile spirit, and that sprightliness, considerably more than in the cold climates, where the blood is far thicker, and slower in in its motions; and where every vital action is more sluggish, and far less irritable; and in consequence more determined, resolute dispositions; not so easily moved, but when moved, more determined and stable.

Phlogiston is the great principle of fluidity in all bodies, and therefore you will find the blood considerably thinner in animals of warm climates, not abounding in that rich farina-

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ceous lymph, which animals in cold climates have. There is always a certain quantity of this lymph ſoluted in the ſerum; what ſolutes it there, is upon common chymical principles well known to every one; it is phlogiſton, forming itſelf into a kind of ſalt, with a quantity of water and lymph: that phlogiſton will diſſolve the lymph, no one can doubt; for if he will introduce phlogiſton to it, by artificial means, it will diſſolve or ſolute it; therefore, as there is a greater quantity of phlogiſton received by animals in warm climates, in conſequence their juices muſt be more diſſolved; which is really the caſe, the blood being conſiderably thinner.

Animals which go from a cold climate to a hot one, their lymph is not only diſſolved by the phlogiſton, but is likewiſe ſoon evacuated; it being diluted with a greater proportion of phlogiſton, and a more active circulation in the veſſels, from the greater ſtimulus imparted, and an immenſe quantity of water, which animals are obliged to drink in hot climates; all which acting together, ſoon diſſolve this thick rich lymph, and evacuate it by the different ſecretions; that evacuation being the natural conſequence from its being ſo thinned, &c. therefore it ſoon runs through the

the different ſecretions and evacuations, ſo that an animal cannot long ſuſtain its fat.

Here you ſee the reaſon why animals are ſo thin in hot climates, to what they are in cold ones; for all the reaſons aſſigned for diſſolving the lymph in hot climates, does not take place in cold climates. There is not that ſuperabundancy of phlogiſton in cold climates, to diſſolve their lymph; nor that active circulation to diſcharge it; nor that immenſe quantity of water drunk to dilute it; and moreover, in cold climates there is a great deal more of lymph received by the mouth as nutriment.

For in cold climates, nature dictates rich ſalubrious food, fat animal diet, and ſtrong malt liquors, which have a deal of the farinaceous nutriment in them; in ſhort, every thing to furniſh the animals with a rich nutritive aliment; all of which have a ſtrong appetite to attract the little proportion of phlogiſton in the air. While the food in warm climates is oppoſite to this, thin, light vegetable food, which has little attraction for phlogiſton: for if people in thoſe hot climates were to partake of the ſame aliment that is eaten in cold climates, diſeaſe and death would ſoon be the conſequence. In extreme cold climates,

the great object is to get the richeſt food, which has the ſtrongeſt attraction for phlogiſton; while in the hot climates, the object is to get the lighteſt food, that which attracts phlogiſton the leaſt. So great is this difference of diet in different climates, that in the ſmall diſtance of latitude between England and France, their nouriſhment differs materially; the one lives principally upon thin vegetable ſoups, and thin wines; and the other upon roaſt beef and porter; which difference is not the reſult of chance and neceſſity, but upon principles of nature. As we have quoted the diſtinction between the French and Engliſh diet, ſo we will in reſpect of their animal ſpirits. The one is conſiderably more volatile than the other, which confirms us in our propoſition, that in hot climates they have ſtronger volatile ſpirits, than in cold climates.

You ſee we have marked all the peculiarities and differences in the animals of each climate, and we have likewiſe accounted for them upon rational principles; ſo that inſtead of labouring to account for them upon our theory, they are the ſtrongeſt evidence in its favour; that, from knowing the theory, we might, without knowing the facts, have ſaid *a priori*, they would really take place.

In

In mentioning the words hot and cold climates, I do not mean by that to ſay, one is nearer the equator than the other; they are by no means ſynonymous: for iſlands which are ſurrounded by the ſea, have not thoſe extremities of ſeaſons, which continents have, though they are ſituated in the ſame latitude: for inſtance, they have conſiderably greater heats and colds in Ruſſia, than they have in this iſland, viz. in thoſe parts which are of the ſame latitude with each other. The reaſon is this, that in the height of ſummer, when the air is the warmeſt, the ſea being conſiderably colder, will ſaturate itſelf with a deal of the air's heat, and conſiderably cool it: while in winter, the ſea has the balance of the proportion of heat in its favour, and therefore will impart it to the air; upon the common principle of the activity of heat, if there are five thouſand bodies in a room, of different temperatures, that if they touch one another, they will ſoon be of the ſame temperature, owing to the heat's great activity and expanſibility. The air is a body, which will ſoon partake of heat and cold agreeable to the preſence and abſence of the ſun; becauſe it is ſo immediately open to its influence; while the large body of the ſea will require ſome time; but nevertheleſs, it will ſooner partake of the preſence and abſence of the ſun than the earth for many rea-

ſons, which could be aſſigned; but entering into a minute diſcuſſion upon the philoſophical principles why it ſhould be ſo, is not the intention of this volume: the fact being really ſo.

Iſlands are not only more temperate, but the internal parts of large continents, which are the fartheſt removed from the ſea, will be conſiderably hotteſt and coldeſt; which is the caſe with the internal parts both of the continent of Europe and America; therefore the changes of temperaments will not be ſo diſtinct in animals living upon iſlands as upon continents. Here then we ſee the evident principles of temperaments, their great natural cauſe properly elucidated; we ſee the ſimple and wiſe proviſion of Nature; which, in all caſes, whenever ſhe is elucidated, will be found to purſue one great and general rule.

To bring it home more immediately to the human conſtitution, and to our own obſervation and knowledge, we ſhall take an Engliſhman, and ſend him to the Eaſt-Indies. He will go with a full degree of health, indicated by a full vigorous habit, plump and fat, with a roſy clear look; but, upon his getting into that intenſe, warm climate, all his fat will be waſhed down; that blooming clear look

will

will become ſwarthy and ſallow; debility and diſeaſe will take place; which change is eaſily accounted for.

His conſtitution being born a native of this climate, (viz. Britain, comparatively cold with the climate of the Eaſt) he having a relaxed ſkin, with a deal of blood thrown upon its ſurface, with a roſy clear look, his veſſels being full of rich lymph, the natural conſtitution of his own native climate; and likewiſe a great ſtore of fat, in order to combat the cold winter: but upon his getting into the hot climate of the Eaſt, where the air abounds with three times the quantity of phlogiſton, his ſyſtem will, in conſequence, generate three times its proper quantity of phlogiſton; which will produce diſeaſe. Nature, therefore, to hinder this luxurious generation, will contract the ſkin; and, in conſequence, hinder ſuch a great quantity of phlogiſton to paſs through it; and likewiſe ſuch a large quantity of blood to be thrown upon it: which will take from him his bloom and fairneſs; and alſo the rich lymph, which circulated in his veſſels, will be diſſolved by the ſuperabundant phlogiſton and ſo diſcharged by the excretions; for it is well known, that phlogiſton will turn all bodies fluid, even the moſt hard and refractory.

And this power of the ſyſtem in contracting the ſkin, is not from any occult power in the living principle, (which philoſophers of this day call it,) but merely from the ſtimulating action of phlogiſton, which being ſo abundant in the atmoſphere of the torrid zone, therefore ſtimulates the living fibre of the animal; and from that bare and pure mechanical ſtimulus, produces all the different changes and circumſtances of conſtitution. Therefore we have no occaſion to run to thoſe occult cauſes, which phyſiologiſts at this day ſeem to run ſo much upon; this effect being upon that pure ſimplicity of operation which we can ſo eaſily and candidly inveſtigate.

In the ſerum of the blood, there is always a quantity of lymph diſſolved, with a certain quantity of a volatile ſalt; which volatile ſalt is nothing but phlogiſton ſaturated with a ſmall quantity of lymph or animal matter. This volatile ſalt has the power to diſſolve a certain quantity of lymph, and which ſoluted with a large proportion of water, form that fluid, called ſerum; therefore, upon an over proportion of phlogiſton being thrown into the ſyſtem, a greater proportion of lymph will, in conſequence, be diſſolved and diſcharged. The ſame change will take place in the fat of the ſyſtem, it likewiſe will receive an over proportion

portion of phlogiſton, and become in conſequence more fluid; that part of the fat or oil, which is the moſt ſolid, and vulgarly called fat, from this over-proportion of phlogiſton, will become more fluid, and ooze out of its cells into the general circulation, and will be diſcharged, being greatly aſſiſted by the greater conſtriction induced upon the *veſſels by the heat of the atmoſphere*, cauſing a more rapid circulation; all of which operating together, will ſoon alter the Engliſhman's conſtitution, ſo as to partake of the Eaſtern climate.

Here then we ſee how the ſyſtem is altered, and in what manner diſeaſe is generated, which is generally the conſequence to an Engliſhman, *in going to the Eaſt*; he being ſubject to a violent fever upon his firſt reſidence there. The ſallowneſs, which is induced upon his ſkin, is owing to the ſkin's being ſo much contracted, and likewiſe the fluids immediately circulating there, receiving an over-proportion of phlogiſton, which their expoſed ſtate makes them liable to.

That browniſh colour of the ſkin, vulgarly called tanned, is owing to the ſkin's having received a large proportion of phlogiſton, which is demonſtrable from many circumſtances. People's

being tanned upon going into the country, from large cities, where there is by no means that proportion of phlogiſton in the air; for, in towns, as I obſerved before, the phlogiſton in the air is decompounded, from ſo many cauſes, of animals breathing, and fires burning, in it, that there is by no means that proportion: and the ſyſtem, having adapted itſelf to the atmoſphere of the city, ſo that upon going into the country, and receiving a greater proportion from the air, it tans their ſkins in conſequence.

In the ſpring month of March, in this iſland, when the ſun begins to return to us, before that the conſtitution has adapted itſelf to the ſeaſon, tanning and inflammatory diſeaſes are the conſequence, they being both moſt general at that time. Children and women, from having a relaxed ſkin, and in conſequence their pores being more open; therefore they ſecrete a large proportion of phlogiſton, and are ſoon tanned; for you may obſerve, they are far ſooner tanned than other people, who are not under the ſame circumſtances. Phlogiſton having this effect, that when it abounds much in the air, it will in conſequence ſtimulate the ſurface or ſkin; which ſtimulus, being the natural conſequence of phlogiſton, will, in its effect, produce a conſtriction

conſtriction upon the animal's ſurface; the natural effect of which conſtriction will alter the colour of the ſkin, changing it from that delicate white colour to a brownish ſallow one; which change of colour is from two reaſons; firſt from the conſtriction, from the effect of the ſtimulus; and, ſecondly, the juices or fluids of the ſkin receiving a larger ſaturation of phlogiſton.

It is upon this principle that people often grow fat in the winter, and loſe it again in the ſummer; for, in winter, there is a general relaxation induced upon the ſurface and veſſels, to attract phlogiſton; and there is likewiſe a larger proportion of lymph, in conſequence, to ſteal it from the air, there being, at that ſeaſon, ſo ſmall a proportion, comparatively to what there is in ſummer. Therefore, as the ſtimulus, which a large proportion of phlogiſton naturally gives, is taken off in winter, the veſſels in conſequence naturally yield and extend themſelves, and admit of a larger proportion of fluids to circulate in them; but when the heat of the ſummer returns again, the veſſels are again ſtimulated; and, in conſequence conſtricted; the ſuperabundant fluids are diſcharged; ſo that many conſtitutions that I know of alternate

nate with the ſummer and the winter climate or ſeaſons.

What can be more rationally and philoſophically induced, than this plain, obvious relation of facts and theory; each directly agreeing with the other; accounting for all the changes and alterations, even to the moſt minutia; expounding not only the peculiarities of looks and appearances, but likewiſe diſpoſitions.

It is for theſe reaſons, the Germans, the Dutch, nay, even the Engliſh, are ſo phlegmatic; while the French are all action and volatility; why the firſt are heavy, ſtout, athletic built; while the other is ſlim and light. Comprehending fully my doctrine, and the reader will be able to explain the variety of alterations, even to the greateſt minutia; both of perſon, conſtitution, and diſpoſition: the great phyſical reaſons being clear and diſtinct.

Here then is the great ſecret of Nature's operation unlocked; now we can clearly diſtinguiſh the principles of the animal frame; and, if maturely weighed, will prove the greateſt key to medical and philoſophical knowledge that has ever been found. Nature! how ſimple and great are thy works when known; but

but how ignorant are we in our researches to find them, otherwise this great and simple process of thine would have been found out long ago!

If all the temperaments and powers in different systems of decompounding the air were the same, what a great inequality in the secretion of phlogiston would take place, as some atmospheres contain ten times as much phlogiston as others; so that in the torrid zone they would be burned and consumed, and in the frigid zone they would be instantly starved to death; but Nature, in her great wisdom, has provided against these two extremities, by forming different temperaments; so that all the earth might be inhabited, even those parts that have the extremest cold, and those that have the extremest heats: her provision, in these extremities, lies in that simple mechanism of the system, in forming different temperaments; and it is not only owing to their first form, but likewise upon the influence the climate has upon rearing the tender infant; that though a child should be born of parents, which inhabit the frigid zone, yet, if carried after birth into the torrid zone, and there reared to maturity, its constitution will partake of the natives of that zone; so *vice versa* The great influence, that the presence or absence of the sun has

has upon the living fibre, produces these different temperaments.

We ſhould not be ſurpriſed at this change being induced, in the courſe of the animal's life; when even the different ſeaſons will produce a conſiderable alteration; for, in continents, where the difference of ſeaſons are diſtinctly marked, there will be a ſenſible alteration of temperament; that the ſame animal in the ſummer will partake of the melancholic, and in the winter of the ſanguine, temperament: in ſome animals the change is very material, that they ſhall actually change their form in ſummer, taking on the appearance of one animal, and in winter another; and ſome change the colour of their ſkin, from a dark colour to a light or white colour; owing to the relaxation and condenſation of the ſkin; which, agreeable to my theory, is a great inſtrument in aiding or retarding the ſecretion of phlogiſton.

There are hares, and other wild animals, in the northern parts of this iſland, which are white, and every one knows how much darker they are in the ſouthern parts of the iſland; nay, there are ſome animals which will actually change their colour, agreeable to the ſeaſon; in winter of a white colour, in order

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to attract as great a proportion of phlogiſton as poſſible; and in ſummer, when there is a much greater proportion of phlogiſton in the air, and in conſequence that great attraction of it being not required, they turn dark, directly alternating with the ſeaſons; in the depth of winter they will have that relaxed ſkin, to receive from the air as large a quantity of phlogiſton as poſſible; and in ſummer, when there is an abundant proportion of phlogiſton in the atmoſphere, they will then have a contracted ſkin; the contraction and relaxation of the ſkin, and general fibres, we have before proved, will give this change of colour.

This doctrine of the relaxation and condenſation of the ſkin, will probably be cavilled at, by thoſe who conceive in a ſuperficial way, and who purſue the common and general idea; which is this, that the animal ſyſtem is relaxed in ſummer, and braced in winter. In reſpect to animal powers and ſtrength I agree with them; but this relaxation and condenſation, which I here ſpeak of, is in the animal fibre: there is a material difference between the ſimple animal fibre, and the great animal powers of the ſyſtem, they being two ſeparate things; and, without my readers will diſtinguiſh the two different ideas, they cannot comprehend my arguments.

There

There are two good lines of judgement in distinguishing the difference of the relaxation and condensation of temperament or fibre. The one is by the colour and feel of the skin; and the other, by the colour and feel of the hair. In the melancholic temperament, the colour of the skin is dark, and is dry and hard to the touch; the other is fair, and soft to the touch: the hair just the same; the one black and strong hair; the other light and soft hair. If all these different appearances are considered, the one, I should presume, has a relaxed fibre, and the other a braced one.

But let us take the animal system in its most relaxed state, and observe its appearance. The most relaxed and tender state (I presume no one will dispute) is in the infant state, when it first makes its entrance into the world; now let us consider what are its appearances then; why the sanguine temperament, to a great extremity: it has a plump, clear look; its skin fair and soft; and its hair light and soft; in short, every mark by which we may distinguish the sanguine temperament; and, as it gets up in years, it approaches nearer and nearer the melancholic temperament; its fibres become firmer, its skin and hair darker and stronger.

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In the eating of the brute animals, that diſtinction is eaſily known to every body; the young animals eat ſoft, juicy, and tender, the others hard and dry. In the male and female, this difference of temperature is likewiſe eaſily diſcovered, the former inclines more to the melancholic, and the latter to the ſanguine. As children, women, &c. have their ſkin fair and ſoft, and likewiſe their hair fair and ſoft; the characteriſtics of the ſanguine temperament; and, as their fibres become ſtronger and firmer by age, theſe appearances leave them. Can any one doubt then, but the ſanguine temperament has a more relaxed fibre than the melancholic temperament?

If theſe facts are maturely conſidered, conviction muſt in courſe follow. That young animals will be born with all theſe ſtrong marks of the ſanguine temperament, and as age approaches, when the fibre muſt, in conſequence, become firmer and ſtronger, that the marks of the torrid temperament will take place.

But only attend to the lamb, how fine, ſoft, and downy, its fibres and wool are; and, as age approaches, how imperceptibly they will grow harder and firmer. What a fine ſoft covering of wool Nature hath ordained for the

ſheep;

ſheep, that are inhabitants of cold climates; as in Great-Britain; but, if carried to the torrid climate, they immediately partake of the climate, their wool becoming hard and hairy, and their fleſh dry, lean, and hard.

That there is this difference of fibre in animals is very ſenſible to people who have eaten the ſame animals in different climates; for inſtance, beef and mutton in England, and in France; how ſoft, tender, and juicy, it is in one country to what it is in the other. It appears ſo very clear that I ſhall enlarge no farther upon it.

How ſimple and great nature is in this proviſion of the different temperaments, that the ſame ſpecies of animal ſhall be able to live in the extremeſt cold, and in the extremeſt heat; to balance this great diſproportion of atmoſphere, ſhe hath formed thoſe different temperaments, where there is the ſame inequality in the power and ability in receiving it; for ſhe has formed the inhabitants of one atmoſphere of twice the lax ſkin and fibre of the other. In the northern, where there is ſuch a trifling degree of phlogiſton, they ſhall have a very lax ſkin and fibre, of eaſy admittance to the air; and likewiſe that this lax fibre ſhall admit of more ſpacious veſſels, allowing

lowing a larger quantity of chyle, juices, and blood to be expofed; and againft the winter, when there takes place a great deprivation of heat, they will lay up a ftore of fat, in order to fuftain the animal heat and nourifhment, in their extreme cold: for, as I obferved before, that the fat or oil of the fyftem not only nourifhes, but is a great inftrument in fupporting the animal heat,

In warm climates the fibre will be fo braced, as not to admit of any refervoir of fat to lodge in the veffels and interftices; but, in the relaxed fibre this provifion is admitted of, from the relaxation of the veffels. In thofe countries, where the air is never comparatively cold, they have no fuch ftore. In the torrid zone their conftitution is marked by a denfe fkin, to admit of a very little air, having accefs to the fluids, and in confequence lefs of the air is decompounded; yet, nevertheleſs, there is fo much abundant phlogifton in the atmofphere, that the animals which breathe it are apt to accumulate too much, being very liable to difeafe. But nature, that wife and benevolent agent, has carefully provided againft it, by producing a deal of acefcent fruit, lemons, oranges, grapes, &c. acefcent vegetable food being their principal diet; oppofite in quality to phlogifton, neutralizing and cor-

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recting it, and taking from it its inflammatory and putrid quality; the effects of which every one is so well conversant in, I need not enlarge upon them here.

But in the northern climates there is no such strong acescent food; instead of acescent wines, lemons, &c. they produce fat animal food, and strong malt liquors; the latter contain little acescency, but principally a rich farinaceous lymph, to keep up their animal heat; being food that forms a rich chyle, strongly attracting phlogiston; but if they were to diet so in hot countries it would kill them.

In short, all animals partake of the same distinction of temperament as the human; for in hot climates there is scarce a fat animal to be seen; while in the cold climates, scarce a poor one. The whale, as I before observed, characterises the one, and the camelion the other. Even in March, when the warm weather begins to open upon us, how our skin alters in density; we then become tanned, and fair people are most susceptible of it.

That this lax fibre is principally the author of collecting fat and lymph is demonstrable from

from many circumſtances, particularly after the animal fibre has been greatly relaxed from a ſevere diſeaſe; a fever for inſtance. After being thoroughly free from the fever, how faſt do they accumulate blood and juices again, and, in general, grow fatter than before the diſeaſe. I have often obſerved people grow fat after taking mercury: the power of which, in relaxing the animal fibre, every body knows; from this cauſe; the tone of veſſels being weakened, the accumulating blood diſtends them, and in conſequence the ſyſtem extends.

It is from this cauſe, that people, after the vigour of life, grow fat; after the age of forty people are moſt ſubject to it; for then the tone of the veſſels is weakened; people, who accuſtom themſelves to a ſedentary life often grow fat; and that inactive life is well known to enervate the ſyſtem. And it is a juſt obſervation, that young people, who are inclinable to fat, are very inactive and inanimate, being lazy and ſedentary, as it proceeds from a relaxed inanimate fibre. It is from this cauſe that the Spaniards look upon an over-proportion of fat as a diſeaſe.

The quadrupedes expreſs this very demonſtrably; you obſerve that all the ſtrong vigorated ferocious kind, are, what is vulgarly

ſtiled lean; viz. the wolf, lion, tiger, &c. while the domeſtic animals, the horned cattle, horſes, ſheep, &c. are very fat. It is from this relaxation that the ox becomes ſo large, tender, juicy, and fat; ſo much, in theſe qualities, ſuperior to the bull, from being caſtrated; which every one knows enervates and effeminates; this is ſeen by the ox's loſing his majeſtic carriage, and ſpirits, which the bull poſſeſſes. But all this is ſtrikingly pictured in the eunuch, whoſe voice, beard, ſtrength of body and mind, are depraved and effeminated, he growing lazy, fat, and bulky. It is from this cauſe likewiſe that people, in the decline of life, when the natural vigour of their ſtamina becomes to be weakened, looſe their tone.

That phlogiſton is the great author of animal life is demonſtrable from a variety of cauſes; in thoſe large towns, where, from a variety of circumſtances, the air is decompounded; for inſtance, the city of London, the air being ſo much deſtroyed, by ſuch a number of animals living in it; by ſuch an immenſe number of fires, and other circumſtances, that deſtroy or decompound the atmoſphere, which that great town is replete with, that its inhabitants have a lax, tender ſkin, in order that they may abſorb a great deal of the air's phlogiſton: but when they go into the

the country, phlogiſton being there ſo much more abundant in the atmoſphere, it tans them very much. The ſame obſervation may be applied to people, who confine themſelves in the houſe, in a cloſe impure atmoſphere, when the neutralization of the air is much deſtroyed; they always look pale and relaxed; for there being a very partial neutralization of the phlogiſton in the air, within the houſe, it being deſtroyed by animals, fires, &c. and a free intercourſe of the external air being excluded; therefore the people's temperament naturally relaxes itſelf, to receive as much of the impoveriſhed phlogiſton as it can.

It is a common obſervation, that after a perſon has been for ſome time pent up and confined to the impure atmoſphere of a large town, that upon going into the country, he will grow very fat; that the relaxed ſtate of his ſkin and fibres receives a far more conſiderable proportion of phlogiſton than it did in the town, from there being a greater proportion of the ſaturation of phlogiſton in the atmoſphere in the country. Convaleſcent people, in London, when their ſkin is relaxed, from a ſevere illneſs, recover faſt in the country; how ſoon they get the phlogiſton renewed again, which they loſt in the fever; while, if they had ſtaid in the large town, how long they

would have been in recovering. The general relaxation, induced upon the ſkin and fibres, by the fever, makes them ſecrete phlogiſton amazingly faſt from the air.

That the ſkin being ſo very eſſential in ſecreting phlogiſton, is from this cauſe; that the lungs, the great organ, which is the great inſtrument in ſecreting phlogiſton, is covered by the ſkin, which univerſally covers the whole body, that there is a direct ſympathy between its ſtate upon the ſurface and upon the lungs; that when it is conſtricted in one part it is the ſame in another; ſo likewiſe, when relaxed in one place, it is the ſame in another: this ſkin is the body which preſerves the air and fluids from coming into immediate contact; and a little trifling alteration in its condenſation and relaxation makes a material difference in the ſecretion of phlogiſton.

The moſt eſſential conſideration to the health of the ſyſtem is to breathe a pure air where phlogiſton is in a proper ſaturation and proportion with fixed air and water; for, where phlogiſton is either in too large or too ſmall a proportion, it is always prejudicial, and alſo where any thing has diſturbed that proper ſaturation which Nature has formed.

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The ſkin, therefore, is of a greater conſideration in reſpect to the health of the body than phyſicians are aware of, it being ſo great an inſtrument in the ſecretion of phlogiſton; if it is too much relaxed, too much phlogiſton will be received by the ſyſtem; if too much condenſed, too little will be received. This is well known to farriers; for that is the firſt circumſtance that they attended to, to know whether a horſe is in condition or not; if he has a fine and ſleek coat, he then is pronounced in good condition; but, if it is rough and harſh, he is pronounced out of condition: and it is one of the firſt principles in managing a horſe, which all grooms know, to rub a horſe well down; this clears his coat from all heterogenous bodies; which would otherwiſe ſtop and confine his pores, and likewiſe promotes the circulation of the blood, which has already got its ſaturation of phlogiſton, in order to make room for more blood which has not received its ſaturation, or at leaſt loſt it again, in its circulation through the ſyſtem. If the blood and juices ſtagnate too long upon the ſurface, it not only hinders freſh blood, &c. from coming to get their ſaturation, but likewiſe they receive an overproportion themſelves.

One very material bad consequence resulting from this improper secretion of phlogiston is, that the blood and juices, which have received an over-proportion of phlogiston, and stagnating there, will stimulate the skin from this over-proportion, and so contract its surface, and condense it; and by that means retard that immediate intercourse between the animal system and the air, and produce disease in the animal. It will not only from that cause, of hindering the receiving phlogiston from the air, produce disease, but likewise, from hindering the system in discharging its phlogiston; for the skin is not only an instrument in the receiving a proper saturation of phlogiston, but likewise instrumental to the system, in discharging a proper proportion; for upon this great balance being nicely kept up, of receiving phlogiston from the air, and of discharging it in the course of the circulation, depends the health of the animal; for, if the proper balance fails, in either scale, in receiving or discharging, disease is the consequence; as a pure atmosphere, and a pure skin, are not only instrumental in giving phlogiston to the system, but in discharging of it, after it has gone its circulation in the system, and done its duty there. Just so of our food, which we take by the mouth; it is immediately necessary that we receive it; and, after it has

done

done its duty in the ſyſtem, it is as immediately neceſſary that it be diſcharged; for upon this circulation, of receiving and diſcharging, both phlogiſton and food, animal life depends.

The groom, therefore, knows that the great object to the health of his horſes, is in rubbing their ſkins well with ſtrong mechanical exertion, and keeping their coats as clean as poſſible. In the dragoons, I have heard obſervations from the officers, that their horſes are kept better upon their ſmall allowance of food than other horſes are; owing to each man's military duty, being to rub and clean his horſe; and therefore doing it ſo well: there is an old adage amongſt the grooms, "that a good dreſſing is better than a good feed."

It is upon theſe conſiderations, that that noble animal, the horſe, requires ſo much care and attention from the groom; for though it is an animal ſo ſtrong and active, yet there is a deal of tenderneſs in its conſtitution; not like many domeſtic animals, dogs, &c. which may be uſed the moſt ſeverely with impunity, requiring no care, but only plenty of food, and which may be given them in the moſt irregular manner. But the horſe requires his regular meals, and his regular dreſſings; his

coat

coat muſt be kept ſleek and fine, well and long rubbed at each dreſſing; for without this regular care and dreſſings are given him, even though he has plenty of the beſt food, yet he will ſoon get out of condition Only attend to the great care which they are obliged to pay to the race horſe; what nicety and attention it demands.

How neceſſary then does it appear to breathe a pure air, and have the ſkin in a proper condition to conduct the balance; for, as I obſerved before, there is a direct ſympathy between the ſkin upon the general ſurface of the body, and that ſkin which immediately covers the lungs; it being an extenſion of one and the ſame body.

We always obſerve, that thoſe people, who breathe an impure atmoſphere, have imperfect and tender conſtitutions. It is from this cauſe that children born and reared in London, have not that vigour of animation that they have in the country; for they never come to that maturity of animal life, being people of tender relaxed conſtitutions, and not of that energy of intellects: of a pale relaxed look, and little in ſtature; all which, as I obſerved before, is from a ſmall ſaturation of phlogiſ-

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ton in the air; that living principle, upon which animal life principally depends.

This imperfect atmosphere not only gives less phlogiston to the system, but likewise it attracts not the discharges of the animal, upon which the well being of the animal greatly depends; as the excretions and secretions of the system take place far more considerably in pure air than in impure air. For the receiving of phlogiston, and giving it back again, as animal heat, &c. is the great principle upon which the life of the animal exists.

It is likewise from this cause, that the inhabitants of large towns have not that healthy, animated, vigorous look, as the people in villages; but have a pale relaxed habit, the circulation of phlogiston through their system being by no means so considerable as that which the people in the country have through their system, being more imperfectly animated. It is from this reason that people die so much faster in towns than in villages. Dr. Percival, of Manchester, has made the calculation with a deal of accuracy, and the difference is amazing; the particulars of which you will observe in page 53; the extremes of which are in Liverpool, as 1 in 27; and in Hale, only 1 in 69, die annually. What can express it more considerably

ſiderably than this calculation, it being ſo evident and forcible.

But to make this doctrine indiſputable, obſerve the different ſtages and temperaments of men's lives; obſerve them upon their firſt entrance into the world, and then contraſt them with extreme old age; their temperaments will take on a regular gradation, you may trace them from the moſt relaxed ſanguine habit, in their infant ſtate, to the moſt denſe and rigid habit, in extreme old age; which gradation is evidently and ocularly to be obſerved, going regularly from one ſtep to another: and likewiſe their regular gradation, from the greateſt imbecility to the greateſt animation and vigour; all which, will equally ſtand as a bulwark to my doctrine.

The reaſons aſſigned for thoſe different ages, by different philoſophers, having not the bare ſhadow of truth, therefore I ſhall not think them worthy of being quoted and refuted here. But my doctrine will accurately account for each regular proceſs of age, animation, &c. it not only juſtifying itſelf, but I alſo bring theſe changes of age, &c. as a corroborating proof of my general doctrine. What happineſs is it when we can inveſtigate Nature with that ſimplicity which we always find her clothed in!

Children,

Children, when firſt born, have a tender lax ſkin, a plump look; in ſhort, have every mark of the ſanguine temperament; viz. lax tender veſſels, full of lymph; but, as they get older, their fibres become more firm, their ſkin and hair ſenſibly darker. That my reader may have a ſtriking picture of this ſanguine temperament, which I define by a lax fibre, full of lymph only obſerve the difference between eating a young animal and an old one; how tender and juicy the former is, and how dry and hard the latter; therefore, I hope, there can be no doubt of my aſſertion, of the young animal's partaking of the ſanguine temperament, and the old one of the melancholic temperament. — When a child is firſt born, how ſtrikingly he has all theſe marks of the frozen temperament, in the appearance of his ſkin; viz. that pale, delicate, white colour, and that general relaxation of every fibre: as he grows up to maturity, his ſtamina and fibre become more denſe, taking place imperceptibly; his ſkin becomes denſer, and changes in colour, growing darker; likewiſe his hair becomes darker and darker, and ſtronger and ſtronger, every day verging more to the torrid temperament; ſo that, towards the period of old age, it poſſeſſes the ſtrongeſt marks of the torrid or melancholic temperament; the fro-

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zen temperament imperceptibly loosing itself, becoming the melancholic.

Agreeable to my theory, the young animal must receive considerable more of that living principle, viz. phlogiston; which is really the case, demonstrably proved from many circumstances. When the human animal first receives its life, he grows faster than at any other period, his most rapid increase is in the womb, from the most minute and delicate embryo, to the lusty state (comparatively) in which he is born; and he goes on, increasing in proportion, till he gets to maturity. The first nine months he increases, as I before observed; the next twelve months he trebles his growth; and the next twelve months he only doubles his growth; so on, in that regular gradation, till he gets to maturity: then likewise he decreases in a regular gradation.

In these gradations of bulk, will be found accurately to follow the gradations of temperament; at first, in the infant state, very lax and juicy; till, at the extreme age of life, a hard, rigid fibre, with a firm dense skin; so extremely rigid, as to turn the hair grey, from having no lymph thrown upon it, from there being very little within the system, and the density of the fibre hindering any being thrown upon

upon the ſurface, and paſſing through the pores of the ſkin; which colour is always the conſequence of hair's being hindered of its proper nouriſhment, firſt turning dark and then grey. This is the caſe when horſes receive wounds upon their ſkin: it often turns grey, from an inflammation being induced upon the wound; and in conſequence the regenerated ſkin grows more hard and denſe. In conſequence of that denſation, it will hinder the fine lymph or nutriment paſſing the ſkin, for the nouriſhment of the hair. The hair is a ſtrong indication of the temperament; how red and white it is in the frozen temperament; and how jet black it is in the torrid temperament. Obſerve the Indian, what ſtrong, jet, black hair, he has; his conſtitution being of that denſe, rigid fibre. It is from this reaſon that there is ſuch alteration of temperament from age; children differing ſo much in temperament from old people; the hair likewiſe alters in the ſame ratio; firſt being light, and then turning darker and darker; at laſt, it receives ſo little nutriment, that it turns grey.

Now, as I have before proved, that the infant receives comparatively moſt phlogiſton in its earlieſt age, which is demonſtrable from its growing ſo much quicker at that time; and

and what proves it beyond a dispute, is its having an increased degree of animal heat to what it will have in its adult state. Nothing can be more demonstrable than this increased degree of animal heat; it is proof evident, and indisputable; for we know nothing can give this animal heat but phlogiston; and its growing so quickly is likewise the most strenuous circumstance; for it certainly is phlogiston which is the author of it, as life and growth depend upon one another; and they both depend upon phlogiston or animal heat, as that is the grand characteristic by which animal life is distinguished; and even when animal life is apparently taken, by suffocation, &c. artificial heat will restore it again; as that is the present method adopted in restoring people, who are apparently drowned.

Children have a far greater degree of animation than adults; a child is like a lamb, always at play, running up and down, full of sports and spirits: while, at the period of old age, they are scarce to be called animated; both their bodily functions and intellects having quite left them, they cannot move, their fleshy fibres are so rigid, as almost to become bone; nay, in some instances it is the case, where the muscles have been much exercised, they have taken on bony appearances, of the same

ſaime form and texture as the bones of any other part of the body. Their animal heat is quite depraved, being almoſt exhauſted, requiring rich animal food, rich liquors, and the warmeſt clothing; nevertheleſs, they can ſcarce keep the ſpark of life alive, it being almoſt extinguiſhed; being the next door to a vegetated ſtate, their animation having quite left them. But how different a ſyſtem have children, living upon a diet of the moſt abſtemious and cooling kind, totally vegetable; no rich liquors to feed their animal heat, ſuch as malt, wine, or ſpirituous liquors; nevertheleſs, they will have the higheſt degree of animation, ſhewing itſelf, by their bodies extending in that rapid manner, their great volatile and animal ſpirits, with a conſtant action, in running, and playing up and down, ſimilar to the lamb; but what is moſt ſingular of all, will have a temperature of heat beyond the adult. Then contraſt this high ſtate of animation along with this poor vegetable diet, with that ſtate of old age where not a function has a fiftieth part of the energy that the functions of young animals have, though the old animals' diet is of the ſtrongeſt and richeſt food: only weigh all theſe circumſtances together, how heavy they throw the balance in my favour; each circumſtance is almoſt ſufficient of itſelf. That it is owing to the relaxation

and condenſation of the fibres of the ſyſtem, which not only form the different temperaments, but likewiſe the different ages, is a ſimple, juſt, and clear doctrine, expreſſing that ſimplicity which Nature conducts in all her operations.

We obſerve an accurate and regular gradation, as age approaches, of that condenſed fibre; nay, we can go farther, we can, by artificial means, condenſe the animal fibre, and bring on its natural conſequences, change of temperament and animation; nay, to go ſo far as even to ſtop its growth: this is well known to thoſe people who are fond of meſſets. If the dog has not attained its full maturity, (by bathing him in aſtringent liquors, of various compoſitions, which they have,) they will ſtop his growth, and hinder him from getting to maturity: if he has paſt his grand climax, the bathing of him will bring on the ſymptoms of old age. The liquor, which they make uſe of to bathe him in, being of an aſtringent quality, and by that means conſtringing the dog's animal fibre. It is from the ſame principle likewiſe that young people, lying in bed a long time, from a fever, or other cauſes, will grow comparatively faſter than if they had not been expoſed to the warm influence of the bed, which we all know re-

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laxes the animal fibre; therefore the body, at that time grows in greater proportion. In extreme old age, the animal fibre gets ſo much contracted as to exclude the blood and juices from receiving the phlogiſton of the air, that at laſt, if no particular diſeaſe intervenes, the vital functions will ceaſe, and death will take place, from a want of that great principle, phlogiſton, the intellectual and corporeal functions will fairly and gradually be extinguiſhed.

Here then is the great cauſe of death, from age elucidated; the fibres growing ſo rigid as at laſt to cut off the communication between the atmoſphere, the blood, &c. of the animal.

We have elucidated both the cauſe of life and death; we have begun with the infant, and accounted for its growing to maturity; for the particular gradation in which it grows; for its coming to maturity; and, after it has got to maturity, to its decline in old age; and at laſt we have given a philoſophical and incontrovertible reaſon why death approaches, accounting for the general decline and imbecility of age: all which reaſons, I flatter myſelf, muſt forcibly ſtrike my reader with their propriety, as one argument ſo im-

perceptibly follows another, that not in one circumstance we have been foiled. As this evidently points out why death approaches, it certainly will be an excellent land-mark, if properly canvassed, to the physician, to prolong that which he is the guardian of; viz. life.

I took an old animal and a young one, of the same size and species; and having inclosed them in a determined quantity of atmospherical air, I found the young animal destroyed, in a given time, very considerably more air than the old one.

Now we have a doctrine which explains all the principles of animal life and death; nay, vegetable life will be found to be conducted upon the same principles; but more of this in another place, when I shall write expressly upon the vegetable kingdom.

This it is at which all physiologists have been aiming at. But I am sorry to say they have shot their arrows very far from the right mark, not the least idea of the truth being ever, that I heard of, hinted or suggested. Upon this great and simple principle does Nature conduct her great and wise operations. It is, without doubt, this power or principle in the system,

ſyſtem, of being capable of decompounding the air, and receiving its phlogiſton, that characteriſes the age of the animal, and at laſt is the author of death. You may diſtinctly obſerve, in old people, how their ſkin is ſhrunk and condenſed, being, as it were (to make uſe of a vulgar phraſe) withered.

In the ſummer ſeaſon theſe old people are conſiderably beſt in health, when there is a great proportion of phlogiſton in the air; therefore they receive more; always finding benefit in removing to a warm climate, from the ſame cauſe, and likewiſe in drinking warm liquids, which old people ſhould always do; they having a ſtrong effect in relaxing the ſkin, and giving it a greater property or power in receiving phlogiſton; and likewiſe warm clothing and warm bathing.

It is from this cauſe, that young animals, or the young part of the human ſpecies, are moſt ſubject to inflammatory diſorders, from their having a conſiderable ſtronger or greater circulation of phlogiſton; what I imply, by a ſtronger or greater circulation of phlogiſton, is their receiving a greater abundance from the air, and returning it back again to the air. Old people ſeldom have inflammatory complaints; and thoſe few they have never run to

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that extremity which the ſame diſeaſes in young animals do; the latter being ſubject to high inflammatory diſorders, both general and local, raging to great extremities, which the old animals are ſtrangers to,

It is a common idea among the faculty, that the denſe fibre is moſt ſeverely held in inflammatory complaints, and that it is owing to this rigid fibre that inflammations run ſo high; but if they will maturely weigh this doctrine of temperament, they will find the reaſon that inflammations run ſo high in young animals, is principally owing to their ſyſtem's containing a deal of phlogiſtic blood, juices, &c. their fibres, in reality, being more relaxed and leſs rigid, being the ſanguine temperament; which temperament has a relaxed fibre and a copious ſecretion of phlogiſton, with a large proportion of lymph in their yielding veſſels, with a full circulation, and bloom upon their countenance and ſurface. No doubt their tone of fibre may be taken to account likewiſe, but that is more an animated and vigorated fibre than a rigid, denſe one, there being a material difference; the one having a far greater ſenſibility and animation than the other. But more of this elſewhere, when I ſhall ſpeak more fully of the principles of the ſyſtem.

You

You have not only the different temperaments elucidated by this doctrine, but you have likewise the variety of ages, the peculiarity of circumstances attending upon those different ages, and likewise the great cause of death from age. Why in the young animal it should grow and thrive so rapidly, having all that life, vivacity, and spirits; and likewise when having passed the grand climax, the great animator, phlogiston, will be imperceptibly debarred from entering the system; and at last death will take place. As we have found out the great cause of death, we certainly can be better able to prolong that awful destiny; and, if maturely cancelled, must be of great service to physicians.

The infant, who at first receives such a large proportion of phlogiston, not only so much as is necessary for its life, but an over-proportion, which makes it grow so rapid, and which in its infant state it does; but, as it gets older, it grows less and less; and in consequence of its growing less and less, (as we have proved that phlogiston is the great author of its life and growth) it must receive less of phlogiston comparatively. The reason why it receives less of phlogiston comparatively is, its fibres, by being stimulated and put in action, and by the natural conse-

quence of that action (which I shall elsewhere explain) become more braced and condensed; the consequence of which bracing and condensation will be, they will receive less of phlogiston. So Nature imperceptibly goes on, being more braced or constringed, and in consequence receiving less of phlogiston, till it arrives at that period, the grand medium between relaxation and condensation, being the full maturity of the system; so that, upon either side, is a declension of life and vigour, they just balancing each other. Here then the animal is at its full maturity, and would for ever stand, but by the natural consequence of the circulation and action of the animal fibre, it becomes more dense and rigid; (the physical reason why it does so, I shall elsewhere explain, when I enter into the minutiæ of animal life;) and in consequence of the animal fibre becoming more rigid, it excludes the secretion of this great animator, phlogiston; the result of that will be, the animal will loose that vigour and energy of life: it doing that very slowly at first, but afterwards, as it gets to the extremity, faster and faster; till at the period of extreme old age, it receives so little as is unable to conduct the functions of life; and they, in consequence, cease, and death takes place: So that Providence, in her great wisdom, hath ordained a constant succession of bodies,

bodies, that life and death shall be taking place alternately; not that the same body shall last for a great number of years, but in the natural consequence of things its life will cease, giving birth to the life of other bodies; so that there will be a constant circulation of matter, from one body to another; for upon that circulation the life of matter consists.

It is a universal observation, that the human species, in cold climates are of longer life than those in the warm climates; or that the torrid temperament is of shorter life than the frozen or frigid; as this seems to be a general rule in nature, let us endeavour to elucidate why it is so. It is not confined to the human species, but all animals in the frigid temperament, enjoy greater longevity. In the East-Indies, the natives come to maturity at five and twenty, and die of direct old age at forty; then contrast their lives with ours in this island, and we shall be sensible what great difference there is; what a number of years we survive longer than they do!

This is a material piece of knowledge, and let us see if we cannot investigate it, why the frozen temperament should enjoy longevity so much above the torrid temperament. We have elucidated all the variety of circumstances belonging

belonging to these temperaments by our general doctrine, and let us see if we cannot likewise expound this.

We have proved, that the torrid temperament is of a more fixed, rigid fibre, than the frigid temperament; and that the secretion of phlogiston greatly depends upon the relaxation and condensation of the fibre; likewise from the infant state to old age, there is a regular succession of the condensation of the fibre: therefore, in the torrid temperament, the infant being so much more condensed than the frigid or frozen, must in consequence get sooner to the grand climax of condensation, which I have proved is the state of maturity; add to this, not being so phlegmatic as the frozen temperament, but being under a greater degree of animation, owing to their possessing and secreting more phlogiston; and the greater degree of irritation they are under from the heat of the sun; all of which must stimulate the animal fibre the more, and in consequence wear it out; making it become more dense and rigid. The physical reason why it has that effect I shall reserve till I come to the explanation of the more munitiæ of the animal organs. That a strong action and stimulus have this effect upon the animal fibre is indisputable; proved by the effect that hard

labour

labour and exercise have upon a horse, tho' he be taken the utmost care of, in respect to food, &c. yet how soon he will be worked out, as they vulgarly call it. So in our species, those that have undergone great fatigues and exercise have the marks of old age sooner to take place, than those who have passed their lives in greater ease. There is no doubt, a necessary degree of exercise is requisite for life; I do not mean that, but an over exertion and fatigue of the system; for indeed we are too apt to err in the luxurious, easy side of the question; therefore it is more demonstrable in that noble animal, the horse, which is too often too severely used and exercised; for it is so majestic and useful an animal, that it deserves the greatest attention from us, which, I am afraid, it too seldom receives. And therefore a heathen philosopher, who used to believe in transubstantiation, prayed most fervently, that he might not be turned into the body of a hack horse.

We have taken a full and extensive arrangement of the different temperaments, from the different situations of climate; also the different temperaments from age; and also the different temperaments from sexes; fully explaining the peculiarities of each, that we find no phænomena but what have an easy explanation

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upon our doctrine, there not being a single circumstance which forms a bar to our pursuits; but they all immediately fall in and agree; not hunting for complex suppositions, and being under no necessity for every little phænomena to make a new theory; and obliged, at last, to let many remain in obscurity. But the great variety of phænomena all immediately coincide with our general doctrine; nay, are in reality, strong supports to it, It is a system too of that easy and elegant simplicity, no forced gigantic structures, at the direct opposition of common sense; no, all go hand in hand, each stone imperceptibly rises upon its neighbour, till we have formed an immense structure, with all that majesty and elegant simplicity of architecture: where the spectator may comprehend, at one view, the whole edifice; there being no fresh foundations, and variety of buildings, but all may be seen at once, towering with all that simplicity of true and genuine taste, so as to strike the beholder with admiration and wonder.

I hope the establishers of Priestley's doctrine will not deny but that animal life is equally conducted, being in all the same, and upon the same principles, and that the gills of the fish are the same as the lungs of other animals; that they

they are so, is demonstrable; for, if either be stopped, the same phænomenon of suffocation immediately takes place, death is the consequence; indeed I never heard it disputed.

Then, as we have indisputably proved that the effete phlogiston, which they speak of, is not discharged as actual phlogiston by the lungs, (for I do affirm that the other part of the system discharges fifty times more of actual phlogiston than the lungs do,) let us farther enquire if it is discharged in a fixed state.

Water, we have proved, has an amazing strong appetite for fixed phlogiston as well as actual; and though we have been foiled in detecting its presence in the expired air, we certainly shall not in water, as the analysis of phlogiston, in water, is the most easy and obvious thing in chemistry.

In examining water, that fish had breathed and lived in for a long time, instead of finding it to possess more phlogiston than it did before the fish were put into it, wonderful to relate, it had lost a considerable quantity, just the same as if it had been dissipated by the fire, by boiling; for there was the same deposition of calcareous and vegetable matter, in both the boiled water and that which the fish had lived in; for the phlogiston, which neutralized and

ſoluted this vegetable and calcareous matter had been taken from them: in the one caſe by the fire, and the other by the fiſh; nay, to bring it beyond diſpute, that the water, in both caſes, had loſt, and not gained phlogiſton, they both froze ſooner than the ſame water which had undergone neither of theſe proceſſes. If philoſophers are not contented with theſe plain, obvious facts, that phlogiſton is received by the lungs, (their great office being to receive, and not diſcharge phlogiſton,) no reaſoning can ſatisfy them.

But, moreover, let us conſider this theory in a general way, that the lungs are the great ventilators to the ſyſtem, in diſcharging phlogiſton; and that the blood, which imparts it, becomes in conſequence more red, from loſing its phlogiſton.

Dr. Leſlie, a late ingenious writer, hath eſtabliſhed this opinion, that the lungs are the great ventilators, in order to diſcharge phlogiſton; and, in the ſame publication, he endeavours to prove, that the phlogiſton of the ſyſtem, which forms the animal heat, is ſet looſe in the courſe of the circulation, by mechanical friction. Only to reflect upon the direct oppoſition, nay contradiction, of ſuch doctrine; for the eſtabliſhers of it aſſert, that the blood

blood turns red in the lungs from losing its phlogiston; and, in the general circulation black, from the same cause, likewise losing its phlogiston; how are we to reconcile such contradictions! In the lungs, where phlogiston is supposed to be discharged, the blood turns amazingly red, but in the circulation, where it is evident to the senses (beyond philosophical conjecture) that phlogiston is discharged, supporting a degree of heat equal to ninety-six of Farenheit's scale, universally over the whole system, the blood turns amazingly black, and never recovers its red colour till it has passed the lungs again. If philosophers had only attended to this single circumstance, they would have renounced their opinion; such contradictions are incompatible, that the same cause should produce such opposite effects. But if they will only attend to the principles of my doctrine, they will find every circumstance and fact in nature directly consonant to my theory; there being no phænomena which does not immediately coincide; in reality, they are strong facts in my favour.

It will be found, and evidently proved, that our food, after being purified, cleansed, and strained through a variety of circulations, has a power, when exposed to the common atmosphere, of decompounding it, and attracting its

its phlogiſton, and by that means forming the red globules, &c. of the blood; which union adhering ſo ſlenderly, is broke or diſunited by the mechanical friction and heat which they are expoſed to in the general circulation, and produces all the phænomena of life, animal heat, &c. &c.

This great proportion of phlogiſton, which the blood receives in the lungs, gives it that lively red colour; but loſing it in the circulation, gives it that dark, black colour; therefore Nature returns it immediately again to the lungs, to get its abundant ſaturation, otherwiſe it would not do to ſupport the animal functions of life.

All the particulars concerning how it is received, diſcharged, attracted, neutraliſed, decompounded, let looſe, &c. and likewiſe in what manner theſe phlogiſtic proceſſes ſupport life, by giving ſenſation, accretion, excretion, and all the ſecondary varieties, minutely attending to each particular function, I mean to treat of elſewhere. And upon opening the great arcana of life, my readers will be ſtruck with that heavenly ſimplicity and uniformity which Nature will appear in.

But

But what thoroughly elucidates my doctrine, are the experiments upon fish. As animal life is conducted the same in fish as in other animals, upon the direct same principles, only living in a different element, but no doubt the same great cause, being the author of life in the one as well as the other. As my doctrine proves that phlogiston is the great mover and author of life, and that water and air are the two great menstruums which convey it to animals; and, as water is a body which is far more easily analised, I thought it a proper subject for my experiments.

Then, as water is an element which dispenses life to such a number of animals, I presume to upwards of one half of the animals upon this globe; and as its animals are perfectly animated, with all those strong animal powers, it well deserves an enquiry, how it dispenses that life. As my doctrine clearly and sufficiently proves, that air dispenses its power and influence upon life, by giving it phlogiston, the great feeder of all life. No doubt (I argued *a priori*,) that water dispensed its influence upon the same principle, as there can only be one general cause in Nature which produces life; whether it is conducted through the medium of air, water, or

earth; nevertheless, life is universally the same, and it is the same great agent which conducts it.

Water is a body in its fluid state, being the state which fish live in it, which possesses a deal of latent phlogiston; proved by Dr. Black's ingenious experiments; but what I call neutralized phlogiston. To prove which he accurately demonstrates, that in dissolving ice, there is an immense quantity of phlogiston enters the ice, before it becomes water, in its fluid state; and that immense quantity of phlogiston does not shew itself to the thermometer and senses; that is, not being in the water in its active state, but lying latent or neutralized in the water; but that, by being set loose from its neutralised state, it will shew itself to the thermometer and senses, becoming again what I call actual phlogiston or fire: then, as Dr. Black has clearly and evidently ascertained this fact, that water contains a deal of neutralised phlogiston, let us examine what influence fish have over it.

Fire has a great power in decompounding neutralised phlogiston, which we have, in this book, clearly proved, even capable of breaking its union or neutralization with metals; therefore,

fore, no wonder it ſhould have the ſame influence over water.

I took water, and boiled it, in order to diſſipate its neutralized phlogiſton. In boiling, I obſerved it depoſited the calcareous and vegetable matter, which neutralized it, being depoſited at the bottom of the veſſel; it is from this cauſe that makes the inſide of teakettles ſuch a covering. Then, as fire acts upon water, by diſſipating or ſetting looſe its phlogiſton, and by that means the bodies that neutraliſe it being depoſited at the bottom.

Into water, which had been boiled, (and in conſequence a great part of its latent phlogiſton diſſipated) I put ſome fiſh; immediately upon their being put into it, they had all the ſymptoms of ſuffocation; their gills went as quick as poſſible, opening their mouths, and leaping in the water, with all that appearance of convulſions; their blood and juices becoming pale, looſing that red colour which phlogiſton gives them. That this effect was owing to the water's having parted with its phlogiſton, is demonſtrable; for if you will ſaturize the water again with phlogiſton, no ſuch phænomena take place.

Another experiment: I put fish into pump-water, (that being the water which I tried all my experiments with, it being most convenient,) having let them live a long time in it; upon examining the water, I found there was the same deposition at the bottom of the vessel, in which it stood, as if it had been boiled, and no doubt from the same cause; the matter, which was deposited, having in one case lost its phlogiston, which neutralised and soluted it in the water, by the fire dissipating it; and in the other case, the juices of the fish having a sharper attraction for the water's phlogiston than the bodies which were soluted with it, therefore decompounded them by their superior attraction for phlogiston.

To put it beyond dispute, I put bodies into the water, which had a superior attraction for its phlogiston than the fish had, and accurately attended to the phænomena. I took lime, which is a body that has a stronger attraction for phlogiston than the blood and juices of the fish have; upon putting it into the water, the phlogiston of the water neutralized or soluted a certain proportion, till its point of saturation. After that, I put living fish into the water; immediately they expressed all that sense of suffocation, and were soon killed; that

that it was owing to the fishes being suffocated, I satisfied myself.

First, the effect being so quick and strong.

Secondly, If I put them into common water before they were far gone, they lived the same as animals which breathe air, being put into water; by bringing them to the air again they will recover, if they are not far gone.

Thirdly, That it only acted upon the lungs; for there was a discharge of blood from them; and, upon examination, they were collapsed and white, the same as animals which breathe air, and had been suffocated.

Fourthly, That it could not be from any poisonous quality in the lime, being imbibed into the stomach of the fish; I satisfied myself, by pouring a large quantity of the lime-water into the stomach of the fish, without producing any sensible bad effect in the least.

This phænomena is not peculiar to lime, as any body, produces the same effect, that seizes upon the phlogiston of the water, and has a superior and stronger attraction for it than the blood and juices of the fish, viz. the vegetable acids, &c. &c. And not, as I ob-

ſerved before, in reſpect to the lime water, from any poiſonous quality, by being thrown into the fiſh's ſtomach, for I poured a large quantity into the ſtomach with impunity. Therefore there is not the leaſt doubt but that their whole and ſole action is in ſuffocating the fiſh; that is, ſtealing the water's phlogiſton, which the fiſh imbibes, to ſupport its principle of life.

And it is demonſtrable, that theſe bodies act by ſeiſing upon the water's phlogiſton; and by that means kill the fiſh.

We know very well, that vinegar is a body which ſolutes itſelf immediately with water, moſt minutely incorporating with it; therefore, mixing the water and vinegar together, we have a right to expect, that if it was any poiſonous quality in the vinegar, that it would kill the fiſh the ſame as if it was mixed a long time together; nay ſooner, for, the nicer the ſolution with the water, it would actually blunt and neutralize the activity of the acid, which it really does, proved by taſting of it, turning quite inſipid; but when it becomes inſipid, or neutraliſed with the phlogiſton of the water, it only then becomes ſo very noxious to the fiſh.

I took

I took a fish, and put it into this mixture of vinegar and water, immediately as the mixture was made, keeping it in for a certain time; after the acidity of the liquor was gone, being neutralized with the phlogiston of the water, I put in another fish for the same length of time; the result was, the latter was killed, and the former scarce expressed the least injury: can there be a stronger and more convincing proof? I must own it answered to my most sanguine expectation.

Vinegar immediately solutes itself with water, but it requires some time before it can decompound the union between the water and its phlogiston; as is the case in most decompositions, conducted by similar processes. If the acid acted by any poisonous effect in itself, either from seizing upon the lungs, or entering the stomach, (for I made them drink it with impunity) certainly it would have had considerably the strongest effect before it was neutralized, and had lost its activity; for the strongest mineral acids entirely grow innocent when neutralized; but here they only become so active from their neutralization.

The impregnation of the vinegar is the least in the world, just sufficient to neutralize the water's phlogiston.

I poured both the mixtures into the ſtomach, viz. that immediately mixed, and that which ſtood ſome little time; but they had no pernicious effect upon the lives of the fiſh: can there be more rational and ſimple facts, directly corroborating our general principles?

If the breathing of the water, which fiſhes evidently do, acted, agreeably to Dr. Prieſtley, in taking phlogiſton from the blood of the fiſh; certainly then, by adding a ſmall tincture of the vegetable acid, that, inſtead of ſuffocating the fiſh, would actually aſſiſt the water in receiving phlogiſton; as one of the moſt obvious and direct laws of attraction exiſts between phlogiſton and acids; but upon trial we found it produced ſuffocation; which no doubt it performed by neutralizing and ſeiſing upon the water's phlogiſton, and keeping it ſo ſtrongly ſoluted, that the fiſh could not decompound it; therefore it was debarred of its great animating principle phlogiſton, and death took place.

It is from this reaſon that the water which has fiſh living in it, requires the conſtant application of freſh air, otherwiſe the fiſh will die; and it is amazing how faſt the water ſteals the air's

air's phlogiſton, and decompounds it, the ſame as animal reſpiration.

To ſatisfy myſelf, that the immediate effect which the lime and acids, &c. had upon the lives of fiſh, was by ſuffocating them, I took oil, which is a body that all philoſophers know hinders the tranſmiſſion of phlogiſton; and, having applied it to the gills of the fiſh, and immerſing them immediately into water, all the ſymptoms of ſuffocation immediately took place, the ſame as in the other experiments.

That lime being ſoluted in water, (in the proceſs of making lime-water) is from ſeizing and neutralizing itſelf with the phlogiſton of the water, I ſatisfied myſelf.—Boiling of water, I proved before, diſſipated in a great meaſure the water's phlogiſton; I took lime water, and having boiled it, I in conſequence diſſipated the water's phlogiſton; and as it was diſcharged, the lime was ſet looſe, and ſhewed itſelf by ſwimming at the top.

In another experiment, I previouſly boiled water, diſſipating its phlogiſton, and afterwards endeavoured to make lime water of it; but it took up little of the lime; making conſiderably a leſs ſolution of the lime than unboiled water.

ter. Nay, fixed air, and other bodies which have a ſtronger attraction for phlogiſton than lime, will decompound the lime.

Therefore from theſe experiments there can be no doubt, but that the fiſh were ſuffocated from the water's phlogiſton being neutralized with bodies that had a ſuperior attraction for it, than the blood, &c. of the fiſh: that the fiſh's principle of life is phlogiſton; and that they live in water by imbibing and attracting phlogiſton from the water; and that any proceſs which hinders that attraction, deſtroys the animal; there cannot be any thing more clearly eſtabliſhed, than this great and important fact; it accords with the ſimplicity of nature, and accounts for all her different phænomena.

As phlogiſton ſupports animal life, there is a great variety in the manner of animals receiving of it; ſome receive it through the medium of the air, others through water; nay, there is a difference in receiving of it in water. In freſh water, the animal imbibes its neutralized phlogiſton; and, as it is deſtroyed, the air ſupplies it with freſh phlogiſton; its ſaturation being very ſmall, therefore requires a freſh contact of air to ſupply it again as deſtroyed: but in ſalt water, where

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its ſaturation is very ſtrong, and in great abundance, the contact of the air is not ſo neceſſary: in fiſh which inhabit freſh water, if you ſeclude the air from the water, the fiſh are ſoon ſuffocated; but in fiſh, which inhabit ſalt water, excluding the air from them, when in the ſalt water, no ſuch ſerious conſequences take place, they live and thrive without it.

To prove which, I took two oiſters; and, after putting them into their proper element, ſalt water, in a couple of veſſels, I carefully covered the top of one of the veſſels, excluding the air; upon accurate examination, I found that the fiſh, which was debarred the acceſs and influence of the air, lived equally as well as that which was not covered from the air's influence.

As we have proved that phlogiſton is the great author of animal life, it being immediately neceſſary for the life of the animal, to be conſtantly imbibing it, otherwiſe it will be ſuffocated or killed; and, as the great feeder, or giver of phlogiſton to animals, viz. the air, was here excluded; then how did they receive phlogiſton? Why, it is eaſily anſwered, from the ſalt water, which is a body that has the ſtrongeſt ſolution of phlogiſton, a hundred times ſtronger impregnation than freſh water:

water: therefore, as it has ſuch an abundant ſaturation of itſelf, it does not require the conſtant application of the air to renew its phlogiſton, in the ſupport of its animals. The phlogiſton in the ſea, having a ſtrong union with the bodies it is neutralized with, therefore requires animals of high and rich blood and juices, (ſuperior to the blood and juices of animals which breathe air,) to decompound the ſalt or phlogiſton; for, if they were not formed of ſtrong, rich, blood and juices, of ſuperior attraction for phlogiſton than the bodies which confine the phlogiſton in the ſalt, they would not decompound the ſalt's phlogiſton.

This is proved from expoſing fiſh to the atmoſphere; — how ſoon it putrefies, conſiderably ſooner than if an animal, which breathes air, had been expoſed. Therefore, as it ſo much ſooner and quicker, putrifies when expoſed to the atmoſphere; which putrefaction, as we before have proved, is produced by attracting the air's phlogiſton; it muſt, in conſequence then, attract the air's phlogiſton ſo much quicker and ſtronger; which it really does. How ſoon all kinds of fiſh run into the putrefactive fermentation, in hot weather, ſometimes inſtantaneouſly.

That

That ſalt is the body, which carries this principle of life to the fiſh, is demonſtrable; for, if you take ſea fiſh, and put them into common water, with a ſtrong ſolution of common culinary ſalt, they will equally live in it, the ſame as ſea-water. This fact is well known to all oiſter-ſellers, &c. &c.

It is well known, that the atmoſphere has a ſtronger imgregnation of phlogiſton in it than freſh water; as animals, which live in the air will be ſuffocated in the water; and putrefaction goes on ſo quick in the one, and ſo ſlow in the other.

I have been told, by oiſter-ſellers, that an oiſter will live longer in the air than in freſh water; for being an animal which requires a deal of phlogiſtion for its life, it can get a larger quantity from the air, than from freſh water; although water is its proper element.

There are animals being amphibious, who can adapt themſelves either to the air or water, live either in the one or other.

Can any one, after theſe facts, have a doubt but that phlogiſton is the great author of animal life, and that it is the office of the lungs

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to receive it; and not the confined idea, that it is so poisonous or effete to life, that the lungs great office is to discharge it.

In short, this is such a doctrine, that when enquired into philosophically, it is at direct enmity with every principle of life, and every piece of philosophical knowledge, that has been established for ages; for every one always looked upon the sun as the great author of life both to animals and vegetables; so obvious and distinct a fact, no man that ever I heard of could deny: and certainly the sun is the great phlogistic reservoir; that fact likewise I presume no one will deny. Then, after establishing these two undoubted facts; with equally the same authority we may establish, that the air supports and gives life, by giving phlogiston; and that the lungs great office is to receive it. For Priestley acknowledges, that animals' breathing, and putrefaction, affect air in the direct same manner. Now granting this, I suppose no one will deny, that an animal body being exposed, when dead, to the direct rays of the sun, that it will putrify so much quicker; therefore both the air and the rays of the sun promote putrefaction; then upon what principle? agreeable to Dr. Priestley, it is by stealing phlogiston

giſton from the body; very ſingular indeed, that the rays of the ſun, formed of the pureſt phlogiſton, ſhould by entering a body, come out of it: What a paradox! why, a man by going into a houſe, upon that argument, comes out of it. Nothing can be more obvious, than that phlogiſton is carried into the dead animal, and that it makes it putrify; but as clear as any fact that was ever proved in this world, it muſt be by giving the animal phlogiſton, and not by receiving it: therefore equally the ſame argument holds good with the air, as being from the ſame cauſe.

While I am writing, immediately before me is a piece of putrid fleſh, produced by the rays of the ſun falling upon it; and if any ſceptic's olfactory nerves were ſtruck with the effluvia, they would agree with me, I think, that the ſun produced it, by giving it phlogiſton, it ſmells ſo ſtrong.

The human blood and the blood of moſt animals is compounded of three different kinds of bodies, which we can eaſily analiſe and produce the ſeparation of.

The names of the three are, the red globules, the lymph, and the ſerum.

The

The red globules, are a phlogiſtic, oily body, whoſe hiſtory I have given before.

The lymph is a rich mucous body.

The ſerum is principally water, with a little of the lymph ſoluted by phlogiſton.

If you receive blood warm from the animal into a veſſel, and let it ſtand to cool, there will be a ſeparation; the ſerum will ſeparate from the red globules and lymph, which will be incorporated together, floating in the ſerum.

Immediately upon its firſt appearance, after being diſcharged from the animal, it is florid and red; but upon ſtanding, it ſoon loſes that floridneſs, excepting that part of it which is expoſed to the air's influence, and which will become conſiderably more florid and red than it was at its firſt appearance; which is evidently from the air's influence; for if you expoſe any part of the blood, it will equally become as florid; and that which has obtained that floridneſs, if taken from the air, will loſe it again.

If you take phlogiſton neutralized, it will have immediately the ſame effect; in the form of ſalt-petre, &c. Nay, the animal phlogiſton pro-

produces inſtantaneouſly the ſame effect; put blood into animal urine, and it will turn it into the higheſt florid red colour; and the ſtronger it is, that is, the more phlogiſton it contains, it will turn it the redder.

Phlogiſton from the rays of the ſun, will likewiſe give it this florid red colour.

I expoſed pieces of the ſame blood to the air, and I obſerved that ſide which was expoſed to the rays of the ſun, turned more highly florid and ſooner than that ſide which was in the ſhade.

Here is an evident proof that the rays of the ſun (which I preſume no one will deny but that they are phlogiſton) form the red globules, making the blood turn ſo highly a florid red: to take away all cavil, that there may not remain the leaſt diſtant ſuppoſition of its being from diſſipating the blood's phlogiſton, that it became red, and not from receiving it; I covered the blood's ſurface with oil, it being a tranſparent body, which would admit the rays of the ſun to paſs it, and likewiſe would not admit of the eſcape of the blood's phlogiſton. It is a body which all philoſophers know will not admit of the eſcape of phlogiſton; being from that reaſon ſo univerſally

made use of in covering the surface of bodies, to hinder them from putrefaction.

Then as oil is a body which is transparent, admitting of the rays of the sun to pass without the least interruption through it; and as it likewise has a power of hindering the escape of phlogiston from bodies, in what manner are we to account for the blood's turning immediately of a high florid red, upon being exposed to the sun? Upon Priestley's doctrine, a mysterious labyrinth indeed. That blood turns black from losing phlogiston, and not receiving it, is proved; for if you take blood, and wash away the red globules, you will distinctly observe, as the red globules are washed away, the blood to grow blacker; and I hope the Doctor, nor no one will dispute, but that the red globules are the phlogistic part of the blood.

But how disconsonant to all observations and facts are their doctrine; for agreeable to them, putrefaction should go on fifty times quicker at the poles, than it should do in the East-Indies, if the air acts by receiving phlogiston from putrid bodies, and not giving, certainly that air that is comparatively bereft of phlogiston, to the super-abundance it has in the East-Indies, without the least doubt, would hasten

haſten putrefaction a hundred times ſooner, than the other: but the reverſe is the fact; for at the poles animal bodies will keep for months in the open air, without putrifying, while in the Eaſt-Indies it begins in a few minutes.

If the putrefaction of bodies depend upon their phlogiſton being ſet looſe by the air, and the air impregnated with it, being what the Doctor calls phlogiſticated; I declare with the moſt pointed certainty, beyond an idea of a doubt, that putrefaction would take place in a few minutes at the poles, and not till months at the equator.

The appetite which cold air has in ſeizing upon bodies' phlogiſton, is diſtinctly ſeen in its great power, in ſtealing water's neutraliſed phlogiſton, and ſo freezing the water: then, as cold air has this immenſe appetite in phlogiſticating itſelf with the water's phlogiſton, and likewiſe the ſame appetite for other bodies' phlogiſton, certainly it would haſten the water's prutrefaction, in the ſame degree: but the reverſe is the fact, it turns it to ice, the oppoſite to putrefaction; but in air, which abounds with phlogiſton, (in the Eaſt-Indies,) it will turn it immediately putrid, and which it performs by giving it phlogiſton, evident to the ſenſes, it turning warmer and warmer.

Let a person go to the East-Indies, and after that to the poles; and ask him where the air gives heat or phlogiston, and where it receives it: that is, in the Doctor's own language, where he phlogisticated the air, and where he dephlogisticated the air, in a greater degree.

Indeed, I should think, after this review of the doctrine, neither the ingenious Doctor, nor any one else, can have the idea of a doubt. What I have said, must certainly be satisfactory to the most sceptic mind. I have omitted one or two facts, which are however directly demonstrative, as by mentioning them here I must have entered into the principles of some doctrine, which I shall omit till another publication; where, if a person will give credit to his eyes, he must believe; but, indeed, I think what I have already said, must be satisfactory to the most tenacious reader, if he is ever so great a sceptic.

There is one circumstance, which I have forgot to mention, in respect to the different temperaments; that in the torrid temperament, viz. those of the human species, whose skins are black: as they are situated so immediately near to the equator, and in consequence must breathe an air highly impregnated

ted with phlogiſton, have therefore beſides their fibres ſo extremely rigid and denſe, an oilyneſs thrown upon their ſurface; which anſwers the greateſt and wiſeſt purpoſes, as oil is a body, whoſe repelling quality greatly retards the intercourſe between the atmoſpherical air and the blood, and juices of the ſyſtem, therefore ſo much of the air cannot be decompounded; it being for the ſame reaſon to break the intercourſe between the atmoſphere and any body, that they oil it; which is a common practice among artiſts, to preſerve wood, iron, and other bodies. And it is owing to this oilineſs of the ſkins of black people, that they have that greaſy, velvet, ſoft feel, likewiſe that they have a ſtronger effluvia than white people.

The reaſon of it, I preſume, is this, the juices of their ſkin being expoſed to an atmoſphere ſo replete with phlogiſton, that in conſequence they muſt have a richer and higher impregnation of it. The difference of which impregnation makes the variety of alterations of blood and juices which we find in animals; the oil or fat being the higheſt impregnation; and likewiſe another material circumſtance, there is not that general intercourſe and circulation of freſh lymph or juices, thrown upon a black ſkin; that what are there, ſtagnate for

ſome time, the intercourſe between it and the general fluids of the ſyſtem being cut off, by the denſeneſs and rigidity of the fibres. So that a negro has not only the torrid temperament to exclude the great influence of the air upon his ſyſtem, but likewiſe a rich oilyneſs upon his ſurface; whoſe phlogiſtic, repulſive property, will cut off the communication. Which effect of oil, being ſo univerſally known that I need not enlarge upon it.

Water poſſeſſes a great quantity of phlogiſton, which is conſtantly ſoluted with it, and before it can become ice, it muſt looſe phlogiſton. When the air is conſiderably below the freezing point, then it gradually ſteals the phlogiſton of the water, and by that means freezes water. One method to haſten the freezing of the water is to boil it, for phlogiſton being a volatile body, by the heat of the fire it is ſoon diſſipated; but, upon the phlogiſton's being diſcharged by the fire, the earth, which neutraliſed the phlogiſton which was diſſipated, will fall to the bottom of the water, its phlogiſton being evacuated. But if the water is expoſed long enough to the atmoſpherical air, above the freezing point, it will recover from the air its phlogiſton, which it loſt by boiling; and, if boiled again, the ſame phænomena will take place. Here

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is an evident fact, that the boiled water possesses less phlogiston than the water which was not boiled, but its extraordinary phlogiston layed dormant, for they both expressed the same heat to the thermometer.

Here then is a clear demonstration, that the phlogiston, which lies dormant in water, neutralizes itself; for when we, by art, set it loose, it deposits the body which neutralized it. There are many springs which have very hard water, that will neither dissolve soap, nor will do for many culinary purposes; but if this water is previously boiled, its phlogiston, which neutralised or soluted these heterogeneous bodies, will be dissipated; and there will be a deposition at the bottom of the water, and in consequence the water will become softer.

But I mean to give a general history of water and all its varieties, mineral, sea, &c. &c. for we are quite in the dark, in respect to the great variety of impregnations which water possesses, being unacquainted with the great soluting principle.

It is amazing, as I proved before, the appetite that phlogiston has for water, to neutralize itself, upon the same principle of

attraction; as is shewn in the chemical tables of attraction; and upon the same principle, neutralizing itself with the water, the same as alkalies with acids; and by that neutralization, they loose both of their sensible properties; forming a third body, just in the same manner as a neutral salt is formed.

Therefore, when Dr. Black discovered, that actual heat or phlogiston was absorbed into water, and became fixed, not discovering itself to the senses, but becoming latent, he was amazed, thinking it a most strange phænomena; and he and the world, from having no just idea of phlogiston, what kind of a body it is, its principles and effects, could scarce give credit to it, many still disputing it. But, by experiment, establishing it as a fact, he demonstrated that it was so; and as he knew nothing of the true physical cause, he called it latent; that is, it disappeared, and he knew nothing farther; but by disappearing, he proved it produced fluidity.

Now we shall prove, it is by no means a singular circumstance in nature, but what is universally taking place; in short, in every part of nature, viz. the absorption of phlogiston, neutralizing itself with matter, and by that means producing all the great variety of bodies

dies which we ſee in nature. Therefore, inſtead of calling this dormant phlogiſton by the confined name of latent heat, we ſhall call it neutralized phlogiſton; and, inſtead of confining its great powers, by neutralizing itſelf with matter, to make bodies fluid, we ſhall prove that it produces all the variety in nature; both in reſpect to form, quality, fluidity, and ſolidity. We ſhall find it to be, as before obſerved, the univerſal *æther* of philoſophers, the *pabulum vitæ* of chemiſts, and the *medicatrices naturæ* of phyſicians; but we muſt enlarge no farther upon its principles and effects here, it will lead us too far from our preſent ſubject.

Now, after having thoroughly eſtabliſhed this great and important fact, of phlogiſton's having ſuch a ſtrong appetite to neutralize itſelf with water; then the immenſe quantity of phlogiſton, which falls upon our earth, from the great author of it, the ſun; what muſt come of it all? Why, one immenſe method of its acting, is its neutralizing itſelf with bodies upon the earth, particularly as we have juſt now proved fluid bodies: what comes of this neutralization is next to be conſidered, as we have evidently proved ſuch neutralization does take place; proved by Hales's calculation of the immenſe quantity of water which is exhaled from the ſea, and every

day

day to be discovered upon our earth; the evident principle of this neutralization is to evaporate, form itself into a transparent solution, and disappear; what comes of them? no one can argue, such sensible bodies of matter can be annihilated; no, the answer introduces itself, they form atmospherical air; as, by analysing the air, we can get the same bodies from it. Then, instead of being surprised, that there is such a body as air, we should have been more surprised if there had been no such body; as from this doctrine we had a right to argue, *a priori*, of there being such a body. But the general principles of atmospherical air, and all the other varieties of air, I mean to give a history of them in a seperate production; to do that here, would lead me out of my present plan.

If the phlogiston in our system originated from the food, and so much of it was received from it, as not only to do for every animal function, and to support a heat of 96; yet we must have the necessary organ the lungs to be constantly acting to discharge phlogiston to the air, otherwise we should be burnt up; and such a quantity is constantly discharging as to phlogisticate such an immense quantity of air; and all this to originate from vegetable food. Agreeable to this doctrine, we should certainly

expect

expect, that the heat of each animal would be agreeable to its food; that animal eaters would have a ſtrong degree of heat, and vegetable eaters an impoveriſhed degree.

But we obſerve that there is not that diſtinction; that the horſe, bull, ſheep, &c. have as much as the animal eaters; then therefore, as the food of one is twenty times more phlogiſtic than the other, without producing more heat, they muſt of neceſſity have larger cheſts, to give the ſuperabundancy to the air; but the reverſe is the fact: for though our ſpecies lives upon animal food, drinking the richeſt and moſt ſalubrious liquors, yet have no ſtronger heat than the ſheep, and our cheſts, inſtead of being larger, are comparatively leſs.

In the atmoſphere which a Frenchman breathes, there is a more abundant proportion of phlogiſton, than in that which an Engliſhman breathes: therefore nature in her great providence, hath formed the diameter of their lungs accordingly. But agreeably to Dr. Prieſtley's theory of reſpiration, this form ought to have been reverſed. That in the ſouthern parts of France, where there is ſo great an abundancy of phlogiſton, their cheſts ought to have been proportionably large, to have diſcharged it; and the Engliſhman's ſo much

much more confined, as his phlogiſton muſt have been proportionably ſo much leſs; as the Doctor ſuppoſes that the great office of the lungs being to diſcharge phlogſton; phlogiſton which he and no other philoſopher can aſſign the leaſt reaſonable ſuppoſition, how it is received into the ſyſtem.

To ſhew more ſtrikingly that Dr. Prieſtley hath directly miſtaken the office of the lungs; it is a determined fact and obſervation, that thoſe animals which are taken from a cold to a hot atmoſphere, inſtead of their lungs growing larger, which we muſt have immediately ſuſpected, agreeably to the Doctor and others, they ſenſibly ſhrink, more particularly in that organ, in greater proportion than any other. An Engliſh dog taken to the Eaſt-Indies ſenſibly decreaſes, but particularly in his cheſt. But nature, that great and wiſe agent, if the office of the lungs was to diſcharge phlogiſton, (as there muſt be a greater proportion circulating in the dog's ſyſtem in the Eaſt-Indies than in England) would certainly have increaſed rather than ſo ſenſibly decreaſed the diameter of the lungs.

I do not ſee what direct neceſſity there was for either forming lungs or air, agreeable to Prieſtley's doctrine; as it would have been

been only eating less food, and in consequence there would have been no overplus of phlogiston to be discharged. Therefore we see that the first organ is unnecessary; and likewise, that the great distributer and author of life throughout nature, is also unnecessary; — irrational! for I have a different opinion of the great presiding Deity, let philosophers say what they will.

There is another contradiction, equally repugnant to the modern doctrine. In cachectic women, who had been confined in a large town, where this great and important proportion of phlogiston in the atmosphere was greatly destroyed, though their diet was of the richest and most salubrious kind, yet disease, and the most impoverished habits were the consequence, their blood and juices were scarce animated, being of a loose, watery texture, scarce a red globule or any fat to be discovered; all their muscles emaciated, in short, being only one twentieth part animated, their corporal powers being quite exhausted, their animal spirits and animal heat, almost extinguished, their skin quite shrunk and shrivelled. Such were their situation when in this impure atmosphere; but, upon being ordered into the country, where they breathed a pure atmosphere, highly impregnated with phlogiston, health

health and animation were re-eſtabliſhed. Their blood, inſtead of being of that leucophlegmatic, watery, nature, became phlogiſtic, forming large red globules and rich lymph; their countenance and ſpirits animated, their muſcles extended, and fat accumulated. Here was a remarkable change; from whence did originate this important change, from being a ſyſtem, of little or no impregnation of phlogiſton, till this highly elaborated animal phlogiſtic one? Why, without the leaſt ſhadow of doubt, from the air. That the food, the other great reſource, could have no part in furniſhing this great and extraordinary addition of phlogiſton; for, when in the town, it was of the moſt ſalubrious kind; and, when in the country, it was of the moſt impoveriſhed, conſiſting of nothing but bread and water. I dare ſay, every phyſician can remember ſimilar facts in their practice. Boerhaave expreſsly relates a caſe, of the direct ſame kind, of a young girl, when he is ſpeaking of the important viſcera, the lungs, how neceſſary they are to animal life and animal heat. While the patients were in the impure air, their ſkins were ſhrunk, and dry; admitting, agreeable to my theory of the tranſmiſſion of little phlogiſton, no blood being thrown upon the ſurface, to receive it. But after going into a perfect and pure atmoſphere, things were reverſed; the ſkin became

became moist and relaxed, admitting of a deal of blood to be thrown upon it, becoming plump and clear; the countenance florid and animated.

Can modern physiologists assign reasons for such a change upon their flimsy and contradictory theories? nay, common sense rebels against it, for without doubt they received all their extraordinary addition of phlogiston from the air, and not from the bread and water.

What is a great elucidation of the animation of bodies, is the hatching of birds from the egg. They deposite their embryo in the form of eggs; the anatomy of which every one is well acquainted with; but before these eggs can produce chicken or birds, there is required an application of heat or actual phlogiston, either from the mother or artificial heat. The oven animates a number; that being the custom in Egypt. By the application of this heat, the animal is endowed with that strength of organs, so as at last to break the egg, appearing with all its functions, perfectly and distinctly formed; as in partridges, as soon as they quit the shell, to be capable of running with great rapidity.

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In chymically diſſecting the egg, before being hatched, and the chick at the time it leaves the egg, we ſhall find that the one is a ſimple watery lymphatic body, containing little phlogiſton; but the other, viz. the chick, is an animal phlogiſtic body, containing red globules, fat, &c. From whence did this phlogiſton ariſe? why, either from the mother, or artificial heat, or immediately from the ſun, as ſome birds are hatched by the heat of the ſun; the mother depoſiting her eggs on ſands expoſed to the ſun, and leaving them entirely to its nurture. That phlogiſton therefore is the author of their animation, no one can deny; and likewiſe that heat or phlogiſton, either from the ſun, that great animator, or from the mother, or from fire, are equally the ſame body, having the direct ſame effect on animal life.

But after the chicken have broke the eggs, and expoſed themſelves to the cooling air, they require no longer this artificial heat; their own internal heat being ſufficient, as ſome birds after that never require the artificial heat. From whence comes it, juſt ſo the fœtus in utero, before expoſed to the animal heat of the uterus, viz. ninety-ſix degrees of Farenheit's thermometer, ſhall after expulſion from the uterus into an atmoſphere at the extreme

treme poles, ſuſtain a degree of heat of ninety-ſix degrees, equal if not ſuperior to the mother's, and ſuperior to its heat generated in the uterus: from whence comes this great phænomena? its food is the ſame; for the fœtus after birth, is ſtill ſupported from the mother; and in hatching of chickens the richeſt and moſt ſalubrious food you can give them, is the white of eggs, the ſame as they fed on when in the ſhell. Then what can produce this great and important change? If we ſhould argue *a priori*, that after being expoſed to the air, they would be ſtarved; yet they can bear it even in the coldeſt regions of the earth, where water is ſcarce ever fluid. The only alteration that takes place when in the uterus and egg, and when in the open air, is, that they breathe in the latter, but not in the former: then certainly from thence we muſt induce the great alteration, and expound this phænomena. But then our labyrinth increaſes agreeable to modern phyſiologiſts; for this breathing, inſtead of giving animal heat, is the great author of exhauſting it; lame and ungovernable indeed! how, by that theory, can they expound this problem? unphiloſophical! for I do aſſert confidentially, that inſtead of modern phyſiologiſts elucidating this great and important queſtion, they have made it more myſterious: and Prieſtley's

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experiments would have been the greatest bar; for a person of his authority, from his experiments, would have shackled future generations, that it might probably have never been investigated. I myself would probably have been led by them, as his authority is so great, and he relates them with that confidence, and seeming ingenuity: but I had luckily formed my opinion before he had given his to the world.

Only to reflect that the infant or embryo being surrounded by a temperature of ninety-six of Fahrenheit, in the womb, and immediately plunged into a temperature many degrees below the freezing point; yet instead of having its own temperature decreased, it shall be increased; it being still under the same circumstances in respect to its food; for as I observed before, concerning the chick, there was no alteration in that circumstance. The only great and sensible circumstance that takes place is, that they breathe when in the air, and not in utero; therefore from this circumstance we must seek the explanation of that great problem.

If there are accurate observations upon the fœtus, we shall distinctly observe, as soon as it breathes, that rapid changes are immediately

taking

taking place; that all its fluids and ſolids are becoming highly phlogiſtic; that its red globules are amazingly accumulating; its blood turning highly florid and red, before ſcarce coloured; that its fat becomes properly formed and rich; in ſhort, that every ſymptom of animal life is taking place. All this from breathing; not as modern phyſiologiſts would teach, exhauſting its phlogiſton, but, as diſtinctly and apparently to the ſenſes, rapidly increaſing, as ſenſibly as black is diſtinct from white; that the proving the one is equally as clear as the other; and common ſenſe will equally vindicate the one as the other.

Can any philoſopher, after a candid review of theſe circumſtances, offer a doubt, or ſuggeſt any of their far-fetch'd, vague arguments, to account for theſe palpable contradictions?

We obſerve as ſoon as the animal breathes, that its blood, which before was colourleſs, now becomes red; that its animal heat, and every mark of life become eſtabliſhed, before being in a kind of vegetable life. As I obſerved before, there are only two grand reſources of animal life,—air and food; the latter is the ſame as took place when an embryo or fœtus; the former being entirely new to the animal, therefore demonſtrably from thence we muſt

impute all this great and important change, this extraordinary animation and phlogiſton, for that is the only ſource which it can poſſibly come from.

Every time that the blood paſſes the fœtus's lungs, you may obſerve its colour ſenſibly to increaſe. But if the lungs did the office of exhauſting the phlogiſton, we ſhould find every thing to be reverſed; its animal heat, animation, colour of the blood, in ſhort, every mark of that great principle and animator phlogiſton to be decreaſed; every expiration would decreaſe the proportion. Indeed, when it is candidly conſidered, we wonder that ſuch an error could gain ground. It ſhews how weak the reſearches of men are, in inveſtigating the myſteries of nature.

There is a general error which prevails, a ſuppoſition that air is received into the blood by the lungs; people of this doctrine know nothing of the analyſis of the air; but ſeeing that breathing of air was neceſſary to life, therefore they ſuppoſed it was received; but the ſuppoſition is a very ſingular one, that ſo rare a fluid could be received into the ſyſtem. Atmoſpherical air is a rare ſubtle fluid, and can take on no other form. When the ingredients, of which it is formed, are decompounded, and formed

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into the compoſition of different bodies, it cannot then be called air, no more than the graſs which the animal receives into his ſtomach; that, when it is analized, that is, decompounded, and a freſh union and compound take place, it ſhould be called graſs: it is a ridiculous ſuppoſition; for every one that knows the principles of hydraulics, muſt know that air, by circulating in a tube along with water, would burſt the veſſel, and ſtop the circulation; which is ſometimes the conſequence in water pipes. So ſubtle and elaſtic a fluid, of that great diameter and expanſibility, circulating in the minute ramifications of the tender veſſels, is highly ridiculous, and the ſuppoſition does not deſerve a ſerious refutation. But it is amazing, the great variety of wild ſuppoſitions the ingenuity of man hath formed.

In inflammatory complaints, where there has been a greater tone in the veſſels upon the fluids, and in conſequence a more rapid and quicker circulation, which is the caſe in all inflammatory complaints, either general or local: this extraordinary circulation and tone of the veſſels, agreeable to my theory, will produce a greater heat, by decompounding the red globules, which is really the caſe; theſe circumſtances of additional heat, &c. being

the reason why the physician calls it an inflammatory disorder. Then, from these peculiarities taking place in the system, let us observe what is the consequence, what alteration it makes upon the blood, by this additional mechanical exertion being made upon it: why it has a singular appearance; for after blood is drawn from the patient, and it has stood to cool, there is a whitish congealed substance, which fixes itself upon the top of the blood. This congealed substance is concomitant with this additional circulation, and always when it makes its appearance, the physician pronounces the patient's system to be inflamed, or that he is under a degree of febrile heat; produced, as I mentioned before, by this increased circulation.

So singular an appearance has actuated the curiosity of physicians, and upon examination it is found to be a substance similar to the lymph; which as I before observed, makes up an essential part of the blood; then let us investigate, and see if we can discover, why an increased circulation should produce so singular a separation of the lymph; and its being likewise changed in its appearance, it being tougher and whiter.

In

In our general doctrine we proved, that the lymphatic part of the blood has a power of attracting phlogiston from the air, neutralizing each other, and forming the red globules; and that these red globules are the authors of animal heat, by means of mechanical friction, produced by the circulation and muscular motion, &c. Now upon this mechanical motion being so preternaturally exerted by disease, it must in consequence decompound the red globules so much the more; which is really the case. In a perfect healthy state, in general, the red globules are only so much decompounded as to lose part of their phlogiston; seen by their returning to the lungs blacker; but in this case of a high fever, some of them are totally decompounded, leaving the lymph entire; which upon the blood's congealing will be found swimming upon the top. That it is pure lymph, is demonstrable from every examination; only it is a little tougher and whiter than it is discovered when incorporated with the blood in a healthy state; owing to its being not so moist.

This being so essential a piece of knowledge, and that it was really true, I anxiously attended to it, and I confirmed it by experiments beyond a doubt.

I took a piece of this coagulated lymph, or buffy coat, and exposed it to the rays of the sun, and it very soon and sensibly regained its red florid colour again. I was extremely accurate in these experiments, and I am sensible they are just.

I took another piece and exposed it to the air alone, and it had the same effect; it formed again into red globules. This is discoverable in drawing a bason of blood from an inflammatory patient: after the buffy coat appears, how imperceptibly it changes its colour, turning redder and redder, so as sometimes totally to disappear.

As nitre has a power of turning the blood, so immediately red, I tried its effects upon this buffy coat; immediately upon its being applied, it turned it instantaneously red: can we have any thing more convincing?

But to be still more confirmed, I took pure red globules, and dissolved them in water, taking care to exclude the least lymph from being mixed along with them. After standing a few days, there was deposited a quantity of lymph at the bottom of the vessel; the red globules had almost entirely disappeared, their phlogiston, I presume, being evaporated by the atmos-

atmosphere, and dissolved, or attracted by the water; for water has sensibly this property in dissolving the red globules.

Can any thing be more satisfactory, than that the lymphatic particles of the blood attract phlogiston from the air, and that when neutralized together, they form the red globules. That the chyle, after having passed the different digestive animal functions, and mixtures, &c. is at length brought to that great animalizing viscus, the lungs, in a rich lymphatic state; a state that has a strong attraction for phlogiston, which it attracts from the air, forming a red ring around it; and the lymph is easy to be discovered in the centre, being opake, and appearing like a little black hole, which Father de la Torré took it for, supposing them annular. But Hewson, upon a more close examition, found that they were not perforated: father de la Torré being mistaken.

We can but admire that great chain of nature, how one link is dependent upon another; this is strikingly observable in canvassing that genuine simplicity, which we observe in the dependence and connection, there is between the atmosphere and vegetable life; they have both their life and existence from each other, having

having an equal dependence, being mutual in their ſupport.

Every one was acquainted how neceſſary the air was to vegetation; but they were entire ſtrangers to the power that vegetables have in forming air; they little thought that vegetables had a power in decompounding the air, and by that means taking from it phlogiſton, water, and fixed air; and that, after thoſe three bodies had circulated for ſome time in the vegetable, they were diſcharged from it in their compound ſtate, viz. atmoſpherical air; which circumſtance of receiving phlogiſton, fixed air, and water, and then evacuating them in their compound ſtate, is the immediate and direct author of vegetable life; it being the great cauſe of its circulation and living powers; likewiſe the air's life and circulation receives equal benefit from it; its exiſtence having the ſame dependence upon it as the vegetable.

We ſee how Nature has conſtructed thoſe three bodies, viz. phlogiſton, fixed air, and water; the compounding and decompounding of which are the great authors of animal, vegetable, and atmoſpherical life; that they all ſhall be dependent on each other; each life promoting the circulation of theſe bodies,

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neceſſary for its own life, for each others life, and for their general life; ſo that the alternate circulation of theſe three bodies will be the great and general author of life upon the face of this earth.

This is ſtepping over the great bar which has ſo long kept our knowledge and reſearches in the dark, and viewing that beautiful and extenſive field of nature, with the greateſt and moſt liberal proſpect; this is giving us the great key, where we may look at large upon Nature, beholding her clothed in all that elegant ſimplicity of dreſs, which marks out to us the great omnipotence of God, the great author of all things.

Here, then, I have given you the whole principles of animal life, how it is conducted, and what body is the *primum mobile*, if I may be allowed the term. I have explained all the different phænomena of life; which, inſtead of forcing my theory to account for them, have been its ſtrongeſt advocates. I have begun with the embryo, and purſued its life to old age, pointing out the reaſon for each gradual change as they take place, elucidating both the cauſe and effect: a bar which has held ſcience in the dark; and, till it was removed, all our reſearches were wild

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and ridiculous conjecture; which has really been the case, proved by looking at the vague theories and whims which the world has been loaded and pestered with.

After establishing the first grand principle of life, the many secondary ones, which are attendant upon it, viz. animal secretion and excretion, the nervous system, glandular secretions and excretions, &c. &c. I mean to take notice of in another book, having already digested the principles of each in my own mind. This book, being designed for establishing the first principles of animal life, as upon these principles we shall establish the others, which are concomitant; and I hope we shall be able to give the fullest history, accounting for the most minute circumstances attendant upon life, and in the most satisfactory manner. Before we finish, we shall give one or two facts, which are strongly demonstrative.

First, the incubation of the egg, in hatching the chick.

The external form and appearance of a common hen's egg I need not here describe, as it is so universally known; but an inward dissection may not be so generally understood, therefore I will enter upon it.

The

The firſt body you meet with is an external calcareous covering, called the ſhell; immediately adhering to the internal part of the ſhell is a membranous, tough covering, which anſwers the ſame purpoſe to the egg, I preſume, as the membranous coverings of the animal body. Upon following and examining this membranous covering, it adheres very intimately to every part of the ſhell univerſally; immediately under that is another membrane, which is cloſely connected with it, excepting in one part, about the ſize of a ſhilling, where there is air interpoſed between them, ſo as to make this membrane project into the body of the egg. Within the egg, immediately cloſed by theſe membranes, is a white, gelatinous, pellucid body, reſembling the lymph of other animal bodies; after removing this gelatinous body, immediately in the centre of the internal part of the egg is a yellow gelatinous body, which is likewiſe covered by its proper membrane; which membrane is connected with the pellucid body, by a ſtring of veſſels and fibres, which runs ſome length into it; upon the other end of this ſtring of fibres they imperceptibly looſe themſelves, running along the membrane, which covers the yellow part or yolk of the egg, forming ſomething like ſuch a ſeries of veſſels upon its ſurface, as the placenta in geſ-

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tation makes; upon their other extremity, forming a connection at the broad end of the egg with the air vesicle; so that there is an immediate circulation kept up, by means of that string of fibres, between the yolk of the egg and this air vesicle. The great intention of these vessels, being not to the yolk in general, but seem principally to center to one point, marked by a little white speck. The air is formed by introducing itself at the broad end of the egg, between the two membranes. In many eggs, by holding them between the light and your eye, you may distinctly discover this air, by hindering the rays of light passing through it, and appearing opake.

But, what is a great philosophical fact, there is a strong animal heat, distinctly to be discovered by the tongue, issuing from that part of the egg which contains the air vesicle, and from no other part of it; I have repeatedly taken up an egg, and by clapping the broad part of it to my tongue, found by the sensible heat derived from it, the direct situation of the air vesicle; for it is not immediately at the extremity, but rather upon one side. I tried an hundred eggs, and never found myself once mistaken; for the animal heat of the egg immediately and solely issued from that part of the egg which has the air

air interposed between its membranes. The air vesicle being upon this part of the egg implies the great providence of nature; for, whatever situation the egg is in, either from the mother's setting upon it, in order to hatch it, or from the situation of other eggs around it, yet it will still have access to the air, which would not have been the case, if it had been placed in any other part of the egg.

Here is a direct fact, which proves that animal heat is immediately depending upon the air; for there is not the least heat to be distinguished in any other part of the egg, no more than in any inanimate body, but only in that small part of the egg where the air vesicle is. I am surprized so great a philosophical fact has never been taken notice of; for, no doubt, animal life and animal heat are conducted upon the same principles in the egg, as in any other animal.

Then, under that consideration, in elucidating so great a piece of knowledge, we ought to observe animal life and animal heat in all its variety of situations, and see those circumstances which are always attending upon them, and those which are not: as we may be certain that the former are immediately necessary, and the latter are not so essential. Then as one great

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attendant upon animal life and animal heat; which we always find, is the atmospherical air, that great and necessary agent; therefore we may set it down as being immediately necessary, particularly as life and heat are so soon extinguished when bereft of it. That animal heat is so immediately and particularly dependent upon it, is demonstrable; for that part of the egg only which possesses air, has animal heat; though this is the only peculiarity it has (viz. having access to the air) which differs from the rest of the egg, it being of the direct same lymphatic matter, but only exposed to a little bag of air; the consequence of which exposure is, it possesses animal heat, which you distinctly discover, by placing it to your tongue; but examine any other part of the egg, which is not exposed, and you will discover no animal heat. Can there be a stronger proof, than that one is dependent upon the other? It certainly is satisfactory.

There is a very curious and singular animal, the cameleon; as it is an animal whose method of receiving its principles of life, is a great elucidation of our doctrine; I will give you a description of it, taken from Chambers, who says:

"It

"It is a ſpecies of the lizard, with a ſhort, round, incurvated tail, and two or three toes joined together.

"There are four diſtinct varieties of this animal: 1. The Arabian kind, which is ſmall, and hardly exceeding the green lizard in ſize: this is of a whitiſh colour, variegated with yellowiſh and reddiſh ſpots. 2. The Ægyptian, which is twice as large as the Arabian, and is of a middle colour between the whitiſh hue of the Arabian, and a fair green; this changes its colour to a paler or deeper yellow. 3. The Mexican. And, 4. a kind ſometimes ſhewn about as a ſight, and met with by J. Faber Lynceus at Rome, which differed from all the others. The Arabian and Mexican cameleons ſeldom exceed ſix inches in length; the Ægyptian is nine or more. The head is very like that of ſome fiſhes, and is joined almoſt immediately to the breaſt, the neck being extremely ſhort, and having at the ſides two cartilaginous eminences, in the manner of fiſhes. It has a creſt ſtanding up in the middle of the forehead, and two others over the eyes, and between the creſts there are two remarkable depreſſions; the noſe and mouth running from the eyes with a double edge to the end of the ſnout, reſemble thoſe of a frog: at the extremity of the noſe there are two perfo-

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rations, which ſeem to ſerve as noſtrils; the mouth being always kept cloſe ſhut, and the creature appearing to have no power of reſpiring but by means of theſe. It mouth is furniſhed with teeth, or rather with continued denticulated bones. Theſe are of no ſervice to the creature in eating, ſince it preys on flies, and ſwallows them whole; but may ſerve for its defence in holding faſt a ſtick in its mouth, which according to Ælian, this creature does, placing the ſtick croſs-ways, to prevent its being ſwallowed by ſerpents.

" The ſtructure and motion of this creature's eyes is very ſurpriſing; they are very large, and ſet in large cavities, appearing to be large ſpheres, of which one half ſtands out of the head, and is covered with a thin ſkin, perforated with a ſmall hole at the top, through which is ſeen a very vivid and bright pupil, ſurrounded with a yellow iris; this hole is properly a longitudinal ſlit, which the creature opens more or leſs wide at pleaſure, and the eye ſeems fixed to this eye-lid, ſo as to follow all its motions, not turning round within it, as in other creatures. The motion of the eyes of this creature is not leſs ſingular than their ſtructure, ſince it can turn them ſo as to ſee what paſſes either far backward, on either ſide, or directly behind it, without at all mov-

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ing the head, which is fixed to the ſhoulders; and the creature can give one eye all theſe motions, while the other is perfectly ſtill. The trunk of the body is properly all breaſt, for the creature has no belly, its ribs being continued to the ilia; the feet have all five toes, two behind, and three before, the hinder ones being as large as the others. This creature moves as ſlow as the tortoiſe, which appears very ſingular; as its legs are ſufficiently long, and it has no great weight of body to carry; but it is ſaid, that on trees, in its wild ſtate, it moves very nimbly. Its tail, when inflated, is round as that of a rat or ſnake; when empty, it is very lank, and has three longitudinal ridges running along it, which are owing to the apophyſes of the ſpine. This tail is a great ſafety to the creature on trees, as it twiſts it round the branches when in any danger of falling.

"The accounts given by the ancients, and later writers, of the long hollow tongue of the cameleon, which it can dart with ſuch celerity to take flies, by means of a ſpongy nodule at the end, is found, on experience of thoſe who have kept the creature alive, to be true. M. de la Hire thinks that it is provided with two kinds of muſcles, the one circular, and the other longitudinal, by the action of the former

of which it is extended, and contracted by that of the latter. Thoſe among the former, therefore, who ſuppoſed the cameleon lived on the air only, were greatly miſtaken; ſome of late have alſo favoured this opinion, becauſe of the long time the creature will live without food; but this is the caſe with all the ſerpent kind alſo, which yet we know to eat ſolid food when they can get it.

" The tongue is half the length of the animal; conſiſting of a white fleſh, round as far as the tip, which is flat and hollow; ſomewhat like an elephant's proboſcis, or trunk; and accordingly ſome call it a trunk.

" The thickneſs of its body is not to be determined, as the creature alters that at pleaſure, whilſt it more or leſs inflates the body; and this inflation not only goes through the whole body, but into the legs and tail. This inflation is not at all like the breathing of other animals, for the body when thus puffed out will remain ſo two hours, only gradually and inſenſibly ſinking all the time, and afterwards will be inflated again, but much more quickly than it ſubſided. It is able a long time to continue either of theſe ſtates, but more frequently remains empty for a conſiderable ſpace, in which time, tho' it appeared before

before in good eaſe, it looks miſerably lean and lank, and its back-bone may be clearly ſeen, its ribs counted, and even the large tendons of the feet diſtinctly obſerved by the naked eye through the ſkin. The back-bone, however, is not ſerrated, as many have affirmed, but makes in this its lean ſtate, a plain, ſharp ridge, and the whole animal looks ſo miſerably meagre, that it has not unaptly been called a living ſkin.

" Naturaliſts are very little agreed, as to the reaſon or manner of its change or colour: ſome, as Seneca, maintain it done by ſuffuſion; others, as Solinus, by reflection; others, as the Carteſians, by the different diſpoſition of the parts that compoſe the ſkin, which give a different modification to the rays of light. Kircher aſcribes the change of colour in the cameleon, to the power of imagination in the animal, becauſe it loſes it when dead: others, as Dr. Goddard, aſcribe the change to the grains of the ſkin, which in the ſeveral poſtures, he thinks, may ſhew ſeveral colours; and, when the creature is in full vigour, may have, as he terms it, *rationem ſpeculi*; that is, the effect of mirrors, and reflect the colours of bodies adjacent.

"The animal having it in its power to fill the skin more or less, has it in its power not only to alter the tone and texture of the fibres, upon which their reflexive quality in a great measure, depends; but also to bring parts into sight which before lay concealed, or to conceal such as before lay open; and it is more than probable, that the parts which are ordinarily covered, are of a somewhat different colour from those constantly open to the air.

"On these principles, probably, all the phænomena in the cameleon's colour may be solved. The animal, it is evident, has a power to reflect different-coloured rays from the same parts; also to make certain parts reflect, and to prevent others reflecting: and hence that variety, that medley of colours."

It has three very great peculiarities; its living without food comparatively; its inflating its body so considerably; and being capable of changing and reflecting such a variety of colours.

As it appears so singular and remarkable an animal, let us endeavour to investigate these peculiarities, and see whether our doctrine will not aid us in our enquiries.

First,

First, its living without food comparatively.

Authors seem greatly divided in this respect, some do with a great deal of confidency and seeming truth declare, that it can actually live upon the air, without receiving any food by the mouth, agreeable to the old adage; being like the cameleon, to live upon the air. Philosophers are very tenacious in receiving facts which they cannot account for, and which is certainly right; throwing off all the superstitious stories which former ages believed from ignorance; but yet we may err in being too sceptic. There are many authors, whose veracity and authority are of the first consequence, who declare, that the cameleon can live without food, having nothing to subsist on but the air. After maturely reading and attending to both sides of the question, I have deduced this opinion; that the cameleon, in those warm countries, where it inhabits, can really subsist without food; but that, as necessary to its perfect vigour and luxury, it will feed upon flies, but in so small a quantity that they scarce can be called food to it.

A gentleman declared to me, that he has kept a cameleon confined, when he was certain no flies could get near it, inclosed in a large net, for the space of two months without food; and the animal after it appeared perfectly well. In England, in this comparatively cold country, people who have kept them, have subsisted them upon three or four flies a week, without the animal's choosing any more; nay, sometimes voluntarily they would go many days without any food. Nevertheless, it has all the different functions of life, having a high degree of animal heat and sanguification, with animal moisture, &c. &c, then how did it receive these? Can it be supposed from the flies, sometimes not eating one for such a length of time; can this fly, I say, give all its phlogiston, that it will not only support such a degree of heat for weeks, but that it must have lungs (which it has, and comparatively large, being indeed almost all lungs) in order to discharge this phlogiston. Can this argument be supported with any serious gravity? Besides, if it is philophically considered, its changing its surface so instantaneously into such variety of strong, lively colours, will be found owing to its surface abounding with such a deal of phlogiston, so as sometimes to give light in the dark; and all this from the poor fly;

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— wonderful! No; neither common ſenſe nor philoſophy can be forced into ſuch ſuppoſitions; it will not be found a paradox.

The next remarkable peculiarity it has, is its inflating its body ſo conſiderably. Chambers ſays, "the thickneſs of the body is not to be determined, as the creature alters that at pleaſure, whilſt it, more or leſs, inflates its body; and this inflation not only goes through the whole, but into the legs and tail. This inflation is not at all like the breathing of of other animals; for the body, when thus puffed out, will remain for two hours, only gradually and inſenſibly ſinking all the time; and afterwards will be inflated again, but much more quickly than it ſubſided."

This conſiderable inflation of its body is a very great ſingularity, as no other animal that I ever heard of is capable of it; then, as it is ſo particular, let us endeavour to inveſtigate Nature's deſign for it. Whatever promotes the circulation to the ſurface, and whatever depreſſes it, will give this appearance of inflation and depreſſion. As any good news which gives a ſpur to the circulation, what a ſudden joy and diſtention it will give to the countenance; on the other ſide, ſudden grief or fear, how they retard the circulation; what

a lank

a lank, meagre appearance they will give the countenance; or a part being inflamed, from the circulation of blood being thrown upon it, how it will diſtend the part: all which proves that this great diſtention of the diameter of the cameleon's bulk muſt be from a large quantity of the blood being thrown upon its ſurface. Then let us enquire from what deſign, or what will be the conſequence of its blood being ſo long at a time, and particularly expoſed upon its ſurface? Why, it will decompound the air, which is the effect of animal blood being expoſed, as we have incontrovertibly proved; nevertheleſs, its expoſing ſo large a quantity of blood upon its ſurface, it has a large diameter of lungs likewiſe, to expoſe its blood; then, why does it ſo conſiderably expoſe its fluids? The reaſon, which I preſume no one will deny, is becauſe it eats no food comparatively; and, therefore, having no freſh chyle to decompound the blood, it makes that up by diſtending its body ſo conſiderably; in order, no doubt, to decompound the air.

Chambers ſays, the trunk of the body is properly all breaſt; for the creature has no belly, its ribs being continued to the ilia. — Then why are all its viſcera lungs comparatively? Prieſtley's doctrine ſays, in order to diſ-

discharge phlogiston, this amazing quantity it got from the fly; unphilosophic! for animals who live entirely upon whole fat phlogistic bodies, devouring at a meal equal in quantity and bulk to themselves, have not one tenth of the lungs comparatively; nay, many of those ferocious animal eaters have no lungs.

The next circumstance to be taken notice of, is, its being capable of changing and reflecting such a variety of strong colours. As its skin is so relaxed, and having every advantage from exposing its fluids to the air, in consequence it must decompound the air very considerably by its surface; and must, from that considerable circulation of phlogiston upon its surface, reflect those strong lively colours. That the reflection and refraction of phlogiston will produce these variety of colours is proved by the rainbow; the explanation of which, if the reader will look into Sir Isaac Newton's optics (that greatest of men,) he will see fully.

The cameleon's living upon air, not only elucidates our theory in respect to phlogiston's being received by the lungs and surface, but likewise that its animal moisture and fixed air are likewise received from the atmospherical air; for

for it equally receives as little moisture by the mouth as it does food; therefore, as it equally supports the same animal heat and moisture as other animals have, it must in consequence receive them from the air.

Most animals feed upon the spontaneous product of the earth, viz. grass, &c. which, upon analysis is compounded principally of water, earth, and a weak acid, the latter being the same as fixed air, but only more concentrated; and this grass, when received into the animal, and there passing the digestive functions, and exposed to the air, will decompound the air upon the principles of attraction. In this case the animal has grass in large quantities to form its chyle, in order to attract and neutralize the air's phlogiston: but in the case of the cameleon we find no such chyle, all is received from the air; I presume the fixed air that is in the fly is scarce worth mentioning.

Then, as I establish it as a general rule, that all animal and vegetable bodies, are formed of phlogiston, water or earth, and fixed air, but differing in their proportion of each; how must the cameleon receive its bodies, requisite for its life? as they cannot be received

received by the mouth, they muſt be by its lungs and ſkin from the air, as it is no doubt a neutralized body, the ſame as other animals formed of thoſe three ingredients.

There is another great and extenſive idea opened to us, that the lungs are not only inſtrumental to life, by receiving phlogiſton from the air, but likewiſe in receiving fixed air, earth, and water; which it performs by decompounding the air, upon the principle of the attraction of matter: for after the air is decompounded by the blood, thoſe three bodies will, from their great natural principle of attraction, neutralize themſelves with the contiguous bodies; ſo that when the great uniting principle phlogiſton, is taken away from the fixed air and water, or earth, from the natural appetite that theſe bodies have to neutralize themſelves again, they will unite with the blood and juices of the animal; and being there fixed and concentrated by the animal functions, they will form freſh matter, and decompound freſh air. Therefore the lungs of animals not only receive the firſt principle of animal life, viz. phlogiſton, but likewiſe fixed air, earth, and water; which confirms to us what an eſſential organ this viſcus is to animal life.

That

That air is the great author and feeder of animal and vegetable life, is proved by the cameleon, and by vegetation taking place upon hard bodies, ſtones, &c. whoſe refractory quality could be of no other ſervice to it than merely as a place to reſt on; every thing muſt have been produced from the air. How often do we obſerve marble and other refractory bodies in old buildings, covered with vegetation; even the different metals, lead, iron, &c. and it could not be from earth falling upon them to form a bed, for their impending ſituation entirely deſtroyed that ſuppoſition; but it muſt be entirely from the air; as no other body could have acceſs; therefore of what healthy moment is air to life in general!

It is amazing what error and obſcurity this body, phlogiſton, is under; philoſophers having not the leaſt determined idea about it; ſome ſuppoſing it one thing, and ſome ſuppoſing it another; yet all their ſuppoſitions are vague and undetermined. In reality, authors not knowing what they mean by it, having no juſt ideas to connect with the term phlogiſton, being quite in a labyrinth; that ſo far from expounding its principles, they do not know what it is, either in reſpect to its form, appearances, or effects; they do not know what they mean when they

they name phlogiſton; therefore how ſhould they elucidate it:

The general received opinion, (though it is hard to collect their opinions) ſeems to be, that it is of the nature of fixed air; the properties of which, viz. fixed air, is undoubtedly an acid. But we ſhall prove that they are diametrically wrong; for inſtead of phlogiſton being the ſame body as fixed air, or of the nature, quality, or appearance, it is juſt the direct oppoſite; as different as alkalies and acids, or black and white.

It was in attending to this great principle phlogiſton, its great powers and effects, in the great planetary world, that I found the great key, by which it directs its great operations; it being, as I obſerved before, the *æther* of the philoſophers, the *pabulum vitæ* of chymiſts, and the *medicatrix naturæ* of phyſicians; in ſhort, it is the great living principle through the whole univerſe. Having this great and extended idea of it, I accurately attended to all its phænomena; firſt finding out what body it really was, then obſerving accurately its great qualities and effects.

The firſt great object of theſe enquiries were directed to the planetary ſyſtem, to ſee its great effects

effects there: for, upon reading the great Sir Isaac Newton, there were some circumstances in his great system I could not give assent to; therefore in attempting to digest his system, and to rectify those parts which were not agreeable to me, were the first origin in making me launch into the general system of nature, and there to behold the great and powerful effects of phlogiston.

After establishing a planetary system of my own, which differed in some points considerably from Newton's; in the principles of which system I found out what phlogiston is, and what are its powers and effects; and when I came to apply my knowledge of it to its effects upon animal, vegetable, and mineral life, I found it as directly consonant and agreeable to them, as it was to the planetary system.

So that, after I had thoroughly digested my planetary system upon paper, and then attended to its effects on animal, vegetable, and mineral life, I found not a great deal of difficulty in elucidating them, as I found out the great key before, in searching for planetary life; for, in that great and interesting search I found out the principles of the air, it imperceptibly taking place, in establishing my doctrine of planetary evolutions; finding out, that

that in planetary life there muſt be ſuch a body as phlogiſton, of ſuch and ſuch effects; and, to aid and aſſiſt ſuch and ſuch effects, phlogiſton muſt produce air, formed of ſuch and ſuch bodies, of ſuch and ſuch qualities: That after eſtabliſhing this grand link of the chain, viz. the principles and powers of phlogiſton upon the planetary ſyſtem, all the reſt imperceptibly followed.

All theſe may be thought bold aſſertions, but I leave them to the candid and impartial public, to know whether they are juſt or not, and whether they are to live or die; for, certainly, inveſtigations of this kind, if they are done with any kind of ingenuity, are to be applauded; as it is incumbent upon every philoſopher to ſearch for them, they being of ſuch eſſential ſervice to mankind. And, upon the impartial public being the umpire, if I ſhall be found to have failed in the attempt, I hope they will not cenſure, as ſo many of the greateſt men have been foiled before me in the ſame reſearches. And, as I have entirely launched into a large field, the whole being entirely new, that at leaſt it may be aſſiſting to others, who ſhall purſue the ſame enquiries; they have been my conſtant ſtudy for theſe ten years, and I hope the world will not

too severely criticise upon my youthful labours.

But, however, I shall take leave of them, well knowing whatever may be their sentiments, they will be founded upon knowledge and justice.

THE END.