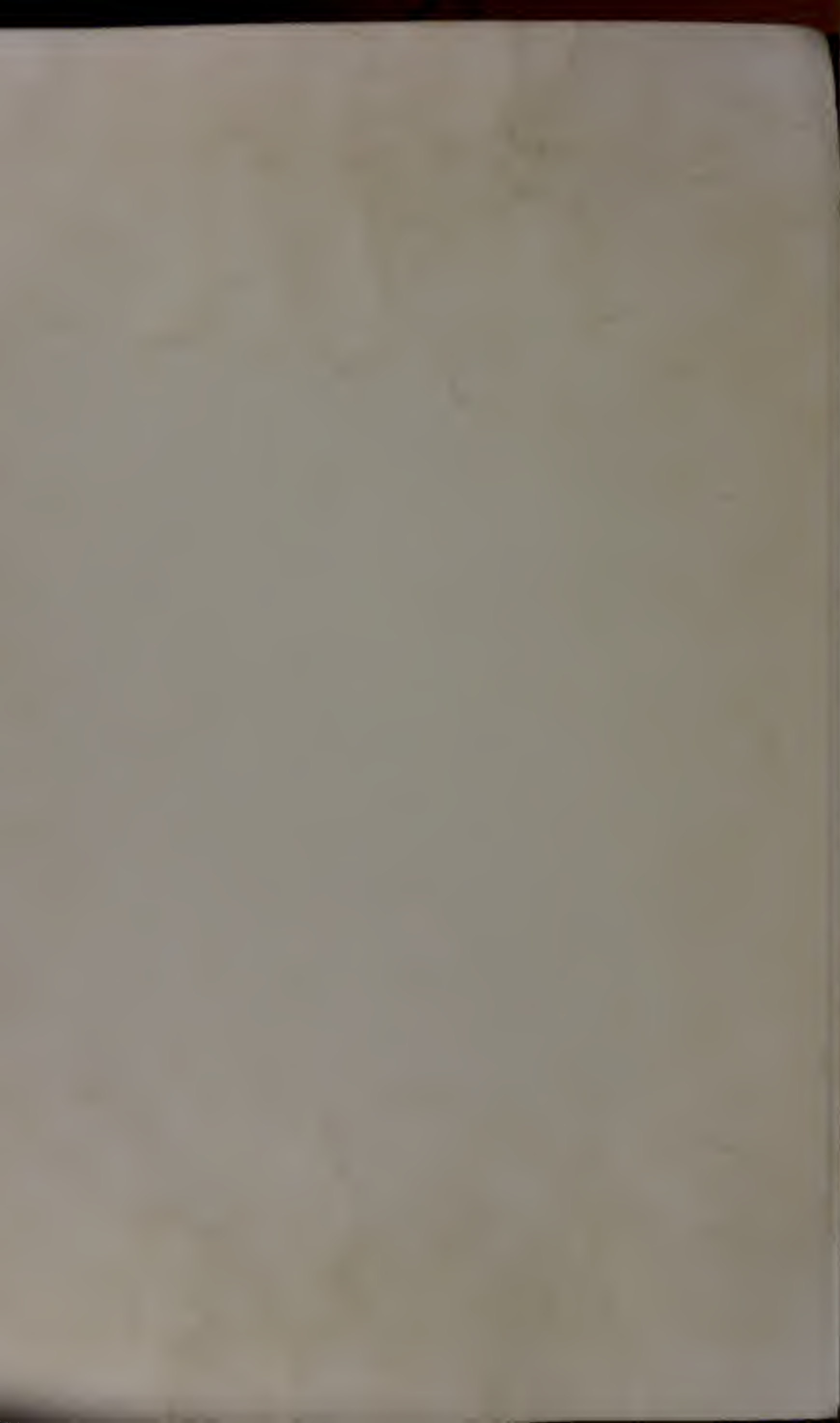




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A

LETTER

TO

ERASMUS DARWIN, M. D.

ON

A NEW METHOD

OF TREATING

PULMONARY CONSUMPTION,

AND

Some other Diseases hitherto found Incurable.

---

By THOMAS BEDDOES, M. D.

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[1793]



A

LETTER to DR. DARWIN.

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DEAR SIR,

NOTHING but compleat success in the treatment of Consumption could afford me greater satisfaction than to find that my theory of this destructive disease appears by no means destitute of plausibility to a Physician of your experience and ingenuity.

You ask whether I have any new facts to add to the probabilities which I have collected in my MEDICAL OBSERVATIONS: (a) and you

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express

(a) See *Observations on the Nature and Cure of Calculus, Sea Scurvy, Consumption, &c.* 8vo, Murray, London. 1793. page 113—148.

express a wish for information concerning the apparatus which I have just caused to be constructed for the purpose of reducing my theory to practice. I shall endeavour fully to satisfy your polite enquiries. Liable as they must be to misconception and mistatement, I am indeed very desirous to make my real views generally known. For although it is evident that none but beneficial consequences can result to the public from the prosecution of my design, yet it requires very little knowledge of the world to perceive the danger to which I am exposing my reputation. It is impossible to engage in a new and arduous undertaking without incurring ridicule and obloquy : Of course I must expect to be decried by some as a silly projector, and by others as a rapacious empiric. Secrecy, as you well know, and promises unrestrained by sense or shame, constitute the *essential character* of empiricism : Now I trust that the Book, to which I have just referred, will bear ample testimony that on medical subjects

jects I have no disposition to secrecy. The most inattentive reader must perceive that I have poured forth my ideas freely and without reserve; and I know not any thing I have so much to dread from the judicious critic, as censure for not taking more time to reconsider and arrange them more advantageously.

As to the new method, in which I propose to treat Consumption, as well as some other mortal disorders, I cannot but be aware that it would be equally impolitic and disingenuous to speak of it with greater confidence than it deserves. Its real efficacy must in a short time be ascertained either by myself or by others. I should not therefore fail finally to be a loser by injudicious boasting. And I flatter myself that I am above all temptations designedly to inspire false hopes, and so to add disappointment to the sufferings of the sick. Thus every consideration, you see, induces me to keep my expressions rather below the tenor of my expectations: And if I strictly observe this

law, surely no person of candour will reflect upon me for employing the best means that can, I think, till the progress of Science shall have furnished some new hints, be imagined for attaining one of the most desirable of all purposes---even though I should not at last be more successful than others have been before me. And with this reflection, I shall for the present conclude my apology for aspiring to be useful.

THE OLD MEDICAL WRITERS, and indeed modern writers on the continent, divide Consumption into a great multitude of species or varieties. It is no wonder that we, who are certainly their superiors in the logic of Medicine, should reject distinctions founded upon states of the body merely imaginary, or such as are not characterized by signs obvious to the senses. I am nevertheless disposed to think that there exists a more essential difference between different cases of Phthisis Pulmonalis, than the British practitioners in general seem willing to admit.

admit. This difference appears to be clearly indicated by the symptoms; and it would probably be completely ascertained by dissection, if it were more the custom to open the bodies of persons who die consumptive. Two varieties or two species have lately appeared to me well marked; they have indeed been noticed by several of the best observers in our own and foreign countries; and it is not unlikely that they may require a very different method of treatment during their first stage.

To the first, which may perhaps be termed *the Florid Consumption*, the reasoning in my book of Observations, is exclusively applicable. It is in this species, especially during its approach and towards its commencement, that we perceive at the time of the accessions of feverishness, the vivid redness of the cheeks, as well as an extraordinary permanent redness of the lips, of the tongue and fauces. Indeed these parts, since I have been at pains to examine them very attentively, have uniformly suggested

suggested to me the idea of meat reddened by saltpetre. The eyes, too, in such cases are remarkable for their vivacity. The blood, discharged by Epistaxis or Hæmoptysis, has a colour evidently more florid than usual. In the latter indeed, which in healthy persons is a rare occurrence, we have not many opportunities of remarking this difference in the colour of the blood, but in the spontaneous bleedings of the nose that so frequently take place both in incipient and confirmed Phthisis, we see the blood much brighter than when it flows from healthy persons, in consequence of accidental violence.

It is not my intention to repeat either what I have myself written concerning the hyperoxygenated state of the system in Consumption, or to transcribe from elementary books, a detail of the ordinary progress of the symptoms. But you will think it not improbable, from the attention I have been lately paying to this disorder, and the opinion I entertain concerning

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ing its nature, that I should be led to remark some appearances not commonly known or attended to. These I shall from time to time submit to the consideration of Medical Philosophers, as supplementary to the knowledge accumulated by former experience. In justice however to myself, as well as to my readers, I must remark, that I do not at present bring forward any of the following observations as *laws* to which the system, while affected by florid Consumption, is invariably subject. I have not yet had opportunities enough to enable me to determine whether they *generally* take place, or only accidentally occurred in some patients whom I have seen since the formation of my theory.

1. It is an evident consequence of my leading opinion, that a phthical patient would take a longer time than another person in being drowned, or in being suffocated in most of those airs that are unfit for respiration. I say *most*, because I suspect that nitrous air

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might

might furnish an exception. Being already provided, as I suppose them to be, with a larger proportion of that principle which respiration introduces into the body, they must be able to continue for a longer time without the necessity of a new supply. And as the left cavities of the heart seem to be more irritable in such patients, it is probable that they would be more easily recoverable from accidents of this kind, than persons in an ordinary state of health. This consequence of my theory is much countenanced by the subjoined case of the son of our common acquaintance, Mr. Crump, surgeon and apothecary at Albrighton, in Shropshire. You will find that he not only breathed with ease air of a very low standard, but that he even much preferred it to atmospheric air. But I do not pretend to say that this fact decisively proves the greater independence of consumptive persons on the function of respiration. The air he inspired was partly hydrogenic air. And it seems pretty well ascer-

tained

tained that asphyxia is less suddenly produced by hydrogen, than by any other species of air, unfit for respiration.

I lay rather more stress upon the following, which is the converse of this observation, I imagine that in constitutions injured by excess of spirituous liquors, and more particularly while they are under the primary operation of such liquors, there exists a deficiency of oxygen; at least of oxygen in a state of combination so loose as it is found in the circulating blood and moving fibres. A variety of considerations with which I will not detain you at this moment, seem to me to confirm this opinion. You recollect, among others the case of the inflammable woman of Coventry, as described by Mr. Wilmer. This woman seems to have reduced herself by dram-drinking to such a state as to be capable of being set on fire by a spark, and of burning like very combustible matter. And one is justified by all the known facts relative to combustion, in sup-

posing, that where the substance of the body was so eager to combine with external oxygen, there must have been an internal deficiency of this element. I premise this conjecture for the sake of relating that I once saw a sot, while under the influence of liquor, though not nearly intoxicated, reduced in a very short time to a state of insensibility by breathing air of an higher standard than that which Mr. G. Crump used to breath with pleasure for an indefinite and certainly a much longer time. I have twice in my life seen a person habituated to drinking much affected, and indeed on the verge of asphyxia, by breathing for a few seconds a mixture in which the atmospheric could not have been, to the mephitic air in a proportion less than that of five or six to one. I need not apologize to you for the want of precision in these observations. No person can or ought for a moment to think of ascertaining such points precisely by experiments upon Man. I hope, however, soon to be able to

to determine by experiments upon animals, whether the faculty of living in air of a reduced standard is really impaired by the influence of spirituous stimulants; and when you consider how nearly all animals of warm blood resemble each other in this function, you will not, I dare say, hesitate to transfer the result to the human species.

Before I pass on to another observation, I will stop to ask you if you do not think it probable that Divers would be able to continue much longer under water, if before immersion they were for some time to breathe air of a much higher than the ordinary standard, or pure oxygene air itself.

2. The French writers inform us that Consumption is less common in the southern than in the northern districts of France. From all that I have been able to collect by personal enquiry and by reading, I infer that in the the North of France compared with England

this disease is more rare than would seem to follow either from the difference of climate, or any cause I have hitherto heard assigned. In conformity with my principles, and indeed with what I have expressly stated (*Observations page 141*), I have lately been led to conjecture that this difference may partly depend on the difference between the ordinary diet of the French and English people. As far as the articles of food are the same in both countries, the French mode of cookery tends to divest them of oxygene, or to combine the oxygene more intimately with the other constituent parts. The fermentation of their bread is carried much further; hence must not a larger quantity of oxygene be carried off from the dough in the carbonic acid air?---Every body knows how much more the French dress their meat and vegetables than we do, and how much more oil they add both to the one and the other; all circumstances which render the food less apt to carry oxygene into the system.

If I should add that the greater summer heats even of the North of France may possibly contribute something to the greater freedom of the inhabitants from Consumption, you will perhaps think that I carry my principles to an extravagant length---and yet may not the effect of the temperature be to occasion the oxygene to enter, not only more rapidly but in larger proportion, into the saline combinations, formed in animal bodies, particularly the perspirable matter? And does not this hypothesis afford a better solution than has hitherto been given of the different effects of animal and vegetable diet in very hot countries? It seems to me well established that the latter in such countries is much more wholesome than the former; and as the natives---those of Egypt for example---do not think themselves in health unless they are perspiring profusely, may not more oxygene be wanting for the various purposes of the animal œconomy than respiration can supply? especially as the atmosphere both  
from

from its higher temperature and the greater quantity of water it holds dissolved, probably contains in an equal bulk rather less oxygen than in more temperate regions.

3. In the florid Consumption, I think I have lately remarked, before the period of extreme debility and emaciation, a much greater acuteness of the senses than is usual in health. Soon after I became acquainted with the effect of placing upon the tongue a bit of lead in contact with a bit of silver, or of placing one under and one above the tongue and then connecting them by a conductor of electricity, I desired each person in a pretty large company to repeat the experiment upon himself. To some the subacid taste was not sensible, others could perceive it distinctly; one person present was in a confirmed Consumption; and scarce had he applied the two metals to his tongue, than he put them out of his mouth with signs of disgust, declaring the acid taste to be so disagreeably strong as nearly to  
set

set his teeth an edge.---This opinion as far as it relates to the senses of smell and hearing, has been confirmed to me by persons who have accurately observed others suffering under the same complaint. But at the same time it should be recollected that the hearing becomes quicker in several disorders; and we know that in different states of the body equal impressions on the sense of smell will produce very unequal effects upon the sensorium. Perhaps this is also true of impressions of taste. I must therefore leave it to you and other attentive observers of animal nature, to determine whether the opinion is in any degree just (*b*), and by what limitations it is to be restricted.

4. In the indisposition preparatory to Consumption, I am inclined to suppose that a remarkable symptom occurs rather more fre-

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quently

(*b*) Cullen has an observation of an import somewhat similar. Hæmoptysis "happens to persons of a delicate slender make; to persons of *much sensibility and irritability, and therefore of quick parts.*" FIRST LINES II. 340.

quently than is commonly understood. This symptom is a convulsive cough, often of such alarming violence, as to be likely to perplex and disconcert inexperienced practitioners. It seems to alternate and intermix with the well-known short, dry cough. You will recollect that I had once occasion to describe to you this convulsive cough from nature. I find it occasionally mentioned, but not much insisted upon, by authors. Thus Dr. Murray, lately Professor at Gottingen, and author of the *Apparatus Medicaminum*, in describing the first symptoms he observed in his brother who died of Consumption, informs us: *Tussis VEHEMENTER .ingravescebat, quæ non catarrhalis unice videbatur, sed simul spastica.---Tussis antea sicca, humida fiebat. (Murray de phthsi pituitosa apud Baldingerum in sylloge Opusculorum: V. 316.)* Raulin (De la Phthisie pulm: Paris 1782. p. 44) mentions a person *qui fut pris au mois d'Aôut 1771 d'une toux sèche, qui devint plus forte & plus fréquente: au mois d'Avril,*  
1772,

1772, *elle étoit convulsive sans crachats ; elle augmenta au mois de Mai : il survint quelques crachats un peu sanguinolens ; & des frissonnemens au dos, &c. &c.* I suppose this kind of cough must occur in but a small proportion of cases ; otherwise it would be more distinctly described, and be the subject of more speculation in books than we find'to be. From my own observations I suspect this cough to be produced by the same irritating cause (as tubercles, for instance) which produces the short, dry cough or whatever other cough may happen in any given case to be the forerunner of Consumption. Upon the most attentive examination I could discover no other cause of irritation. And can you not allow yourself to conceive that some, and that perhaps a small alteration in the power of the cause or in the habit of the patient, may produce such changes in the action of the muscles, or of the stimulus that excites them to act ?

5. It is an opinion entertained by many persons conversant in the history of medicine, that certain diseases are now much more prevalent, and certain others much less so, than formerly : Some indeed, that made great havoc in this island centuries ago, have now totally or nearly disappeared. These variations have been imputed, and with great appearance of probability, to the entire change that has taken place during the lapse of ages in almost every circumstance of the manner of living. But in many instances we are not able to fix upon the particular alteration to which the introduction or the extirpation of any given disease is to be ascribed; and still less can we precisely determine the effect of the alteration upon the functions of the living body. If it be true, however, as so many medical practitioners believe, that Consumption is now much more frequent (c), it is easy according to my system, to understand whence this has happened. The  
inhabitants

(c) I know some old practitioners who are persuaded that Consumptions have become more frequent within their own memory.

inhabitants of this country, almost without exception, breathe a freer and a purer air than their ancestors. Nor do I believe that there is any particular in which the difference between the present and some past generations, is so remarkable. You see then that the subjects of our Edwards, and our Henrys, and of good Queen Bess may have found, in being more free from so formidable a disease than their delicate and airy posterity, some compensation for the confined air and filth in which they passed their existence.

6. I have mentioned (*Observations*, p. 146) a case of phthisis where the ribs on one side were pressed quite inwards, and a cavity formed on that side, in consequence no doubt of the destruction of the corresponding lobe of the lungs; and perhaps a subsequent softening of the ribs. If your curiosity was in any degree raised by this singular occurrence, I hope it will be gratified by the following communi-

cation, for which I am indebted to a Gentleman, perfectly well known to you.

*Letter from Mr. Yonge, Surgeon at Shiffnall in Shropshire.*

SHIFFNALL, April 15, 1793.

DEAR SIR,

You will find subjoined a brief statement of the case of Miss Farmer, though I fear not sufficiently accurate or distinct to afford you much satisfaction; it is formed from memory, and the information of sisters who attended her during the whole time of her illness, aided by reference to prescriptions, and a few imperfect memorandums. It seems unnecessary to detail at length the gradations of her incipient disease--they were the same as in other phthical cases---or the succession of inefficacious medicines employed. I shall only remark that during the few first weeks, the patient was more reduced in flesh and strength than the apparent severity of the symptoms, or the means used  
for

for her relief led me to expect ; both however were somewhat restored before she relinquished the use of medicine in 1775, though without any abatement of the cough or expectoration. I am unable to discover at what time the depression of the chest commenced, or the exact period of its increase or termination.

Your's Sincerely,

To

W. YONGE.

Dr. BEDDOES,

Bristol Hotwells.

“ Mary Farmer, of a spare habit, and hectic  
 “ appearance was attacked at the latter end  
 “ of the year 1773 with cough, pain in the  
 “ left side of the thorax, and slight feverish  
 “ symptoms.---These complaints were allevi-  
 “ ated by bleeding, saline medicines, and blis-  
 “ ters---but after a few weeks introduced  
 “ phthisis pulmonalis, which though mild in its  
 “ appearance, was distinct and perfectly formed.  
 “ During

“ During the period between this attack and  
 “ the middle of the year 1775, the medicines  
 “ chiefly employed and repeatedly varied  
 “ were---gentle emetics of ipecacuanha, opi-  
 “ um, Peruvian bark, vitriolic acid with con-  
 “ serve of roses, and fixed air taken into the  
 “ stomach, none of which gave her permanent  
 “ relief. In this interval also it was observed  
 “ that some distortion of the thorax had taken  
 “ place, from depression of the ribs on the left  
 “ side. The expectoration was not more than  
 “ three ounce measures every twenty-four hours,  
 “ of perfectly purulent matter, untinged with  
 “ blood. The night-sweats and pain constant,  
 “ but not severe.---These circumstances con-  
 “ tinued until the year 1779, without variation,  
 “ when she tried the air and waters of Bristol  
 “ without advantage, and in 1780 repeated  
 “ some of her former medicines with no better  
 “ success. The depression of the left side of  
 “ the thorax was now very great, but did not  
 “ increase after this time; and the disease in-  
 “ creasing

“creasing by almost imperceptible gradations,  
 “she died in September 1785, without the  
 “intervention of any unusual circumstance.”

In this case, you see, the patient lived between ten and eleven years after the depression of the ribs. Mr. Portal, the French anatomist, relates a case where the progress of Consumption was remarkably slow, and where *la cavité droite de la poitrine fut trouvée absolument dépourvue de poumon, en sorte que les trois lobes en étoient entièrement détruits. La bronche droite étoit racornie et desséchée comme un ligament. On doit remarquer qu’il n’y avoit aucune espèce d’épanchement dans cette cavité; ce qui indique que cette destruction du poumon s’étoit faite depuis long temps & vraisemblablement depuis quatre ans. (La Médecine éclairée, par Fourcroy I. 207.)*

You must have seen instances where the progress of Consumption has been remarkably slow. I do not know whether you have remarked any corresponding peculiarity, internal or external.

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The other variety of Consumption sets in at least with very different symptoms, though I believe in its progress the higher oxygenation of the system takes place: The ruddiness, at least, of the tongue is conspicuous at an advanced period of the disease (*d*). This variety has been called, on account of the prodigious expectoration of mucus at its commencement, the *pituitous* or *catarrhal* Consumption. I have seen the countenance pale and bloated, and seemingly but not really œdematous, in the first stage. In one recent instance where a very copious expectoration of mucus preceded for a long time the appearance of pus and the formation of the regular hectic fever, this fever vanished together with the purulent expectoration; and a true anasarca, not a mere œdematous

(*d*) *Accedit tandem febris primum erratica, horroribus calori crebro intersertis, dein plerumque post partum accedens, tandem uno fere tramite decurrens, post meridiem et vespèram versus exasperata. Quæ postquam impetuit, macies celeri gradu increscit, siti hand parum molestâ, linguâ purâ quin rubicundâ, sputis subinde adeo tenacibus ut suffocationem minentur.*

Murray de phthisi pituitosâ, § 7.

œdematous swelling of the feet from weakness, came on. You know what has been written on this variety of Consumption, and for the present I shall content myself with referring readers, not so well informed, to Huxham (*e*) Chalmers (*f*) Duncan (*g*) and Macbride (*h*).

SEVERAL YEARS AGO a firm persuasion settled upon my mind that the system might be as powerfully and as variously affected by means of the lungs as of the stomach. And the more knowledge we have acquired of the properties of elastic fluids, the more has my opinion been strengthened. Of all the functions, Respiration is, I think, the best understood; and it will also be found in skilful hands to be the most easily manageable. It is impossible to doubt that we are nourished by the lungs as truly as by the stomach; and that what we take in at the for-

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(*e*) De aere and morbis.

(*f*) Diseases of South Carolina.

(*g*) Medical cases.

(*h*) Theory and Practice of Physic.—See also De Haen R. M. xv.

mer entrance becomes like our food a part of the substance of our solids as well as of our fluids. By the lungs we can also introduce effectual alteratives of the blood, and by consequence of all the parts nourished by the blood.

Early in the course of my medical studies I met with the writings of Mayow<sup>(i)</sup>; and not long afterwards I became intimate with Dr. Edmund Goodwyn, to whom we owe a most masterly  
experimental

- (i) In the abstract which I published of Mayow's physiological and chemical writings, I expressed myself in the following manner :
- “ That the blood departs from the left or posterior cavities of the  
 “ heart, richly laden with nitro-atmospherical spirit (oxygen) and  
 “ returns destitute to the right, seems sufficiently established ;  
 “ and that it is more impoverished, as it approaches nearer the  
 “ end of its circuit, is highly probable. From the frequency of  
 “ respiration it is evident that much of this principle is received ;  
 “ and much therefore is left behind for the consumption and use  
 “ of animal œconomy ; and surely it serves other purposes besides  
 “ keeping up the play of the left ventricle of the heart. If we  
 “ consider further that the fœtus, though it can live without  
 “ respiration, must nevertheless borrow from the maternal blood,  
 “ by means of the placenta, a supply of the same principle—that,  
 “ as our author observes, the transmission of the blood can never  
 “ be the sole object of respiration, since this object might have  
 “ been accomplished by continuing the organization of the fœtus—

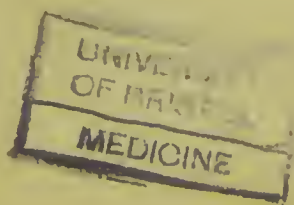
experimental investigation of the function of respiration. These circumstances led me to reflect with peculiar earnestness upon the action of the atmospheric air on the blood during its passage through the lungs; and at Edinburgh I made or witnessed many experiments upon animals, tending to illustrate this important subject. Being afterwards appointed to the Chair of Chemistry in the University of

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Oxford,

“and how much blood goes to the secretory organs and the  
 “brains—from the whole we may safely infer that these data  
 “will one day conspire with future discoveries in chemistry to  
 “unravel the mysterious operation of these organs. And the  
 “MAYOW of another age, by explaining, and perhaps also by  
 “teaching how to manage their intricate and multifarious  
 “machinery, may see that art, which can rest firmly upon no  
 “other foundation than a just theory of the functions of the  
 “body, rising under his hands into a beautiful and solid structure.  
 “Nor, however remote MEDICINE may at present be from  
 “such perfection, do I see any reason to doubt that, by taking  
 “advantage of various and continual accessions as they accrue to  
 “science, the same power will be acquired over living, as is at  
 “present exercised over some inanimate bodies; and that not  
 “only the cure and prevention of diseases, but the art of pro-  
 “tracting the fairest season of life and rendering health more  
 “vigorous, will one day half realize half the dream of  
 “Alchemy.”

*Chemical Experiments and Opinions, 1790, p. 60, 61.*



Oxford, I found myself obliged to acquire as minute a knowledge of the properties of elastic fluids as possible.

From the moment I became acquainted with the effects of pregnancy in suspending the progress of Consumption, I conceived hopes that by combining this fact with the discoveries daily making in pneumatic chemistry, a successful method of treating this disease, in some of its stages at least, might be devised. During the same interval the idea of turning these discoveries to the benefit of consumptive patients occurred to others: And several attempts, not absolutely unattended with success, were made to palliate their symptoms. But they were random trials, guided by no fixed principle; and, if we except those of Dr. Fourcroy, it was impossible that they should have been successful, even if the means, properly employed, had been adequate.

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In the mean time, my own reflections, aided by information obtained from various quarters, suggested to me an opinion concerning Consumption, which leads to a method of practice totally different from any hitherto employed. And you, I am sure, will not judge more unfavourably either of the theory or practice on this account. Just before the publication of my *OBSERVATIONS*, in which the theory is stated at length, an opportunity offered of bringing it in some degree to the test of experiment. The writer of the following letters, (who, you know, has been long extensively engaged in the practice of medicine) brought me his son, at that time far gone in a Consumption of the lungs. I proposed that he should breathe a mixture of airs, and be put upon a diet, conformable to my views. The father, convinced of the utter insignificance of all the ordinary means of cure, cheerfully consented. An apparatus in itself very imperfect, but as good as the time and place would admit, was accordingly

ingly fet up in an apartment of a common dwelling-house. But as the persons, who used it, had never been accustomed to the processes of pneumatic chemistry, it was unfortunately often out of order; and as it was necessary to send seven miles (to W. Hampton) to have it repaired, the patient was often three or four days, or even a week deprived of his modified air: And he passed upon the whole four or five times as many days entirely without it as with it; and when he did use it, the supply of air was infinitely more scanty than I could have wished. Yet even so, the effect exceeded my most sanguine expectations. And I cannot but suppose that if the effect of a larger supply had kept any proportion with the effect of the smaller, and if I had fallen upon the same plan of medical treatment and of diet that has since occurred to me, his life, even in that advanced period of his disease, might have been preserved.

*Letter*

*Letter from Mr. Crump, Surgeon and Apothecary, at Albrighton, in Shropshire :*

ALBRIGHTON, May 29, 1793.

Dear Sir,

I am very sorry it was not in my power to give you any sort of history of the case of my son by the messenger you sent, not having committed any thing to paper relative to him, but the opinion of ....., given about four years and a half since, at which time he recovered in some measure at least from his fever, pain in his side, &c. The cough, however, never left him, but was of little consequence, except he took fresh cold; and then his fever and expectoration always returned with violent fits of coughing---but in general soon subsided by his observing rules nearly similar to what had been previously followed---until such time I brought him to you; and I hope you will not think me guilty of flattery, when I tell you that I am very well satisfied, that if your

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method

method of living with the free use of the mixed air had been entered upon sooner, we should have saved him---I can only add that whenever we could procure the air properly, he was always most wonderfully relieved not only by diminishing the expectoration, \* but evidently the fever, &c. On those unfortunate days that we did not succeed (which was too often the case either from my other engagements, as also those of my assistant when in the pursuit of unavoidable business---or at other times from our lutes failing, so that we could not keep the air confined) the poor boy used frequently to ask me for some of Dr. Beddoes's breath---for the  
 little

\* If he was without the air for two days the foetid state of his breath was sure to return with a considerable increase of the matter coughed up, which seemed always to be in a declining state so long as we could procure the air---and even continued so to the last without variation---his appetite and relish for animal food considerably better during the time he inspired.---Previous to his leaving the inspiring off, he was seized with a violent fit of coughing, which brought up a quantity of red blood, which was succeeded by a great profusion of matter, which was literally pumped up, and so much reduced him that he was not able to sit up, and we could not convey the air into his lungs in bed.

little he had was almost gone. And I cannot in justice to you do otherwise than inform you that his dyspnæa and expectoration of matter were always relieved by two or three inspirations---and more so than by any medicine I ever gave him, or ever saw administered to others labouring under the same complaints.

Another thing I must observe, that the poor boy always regretted the loss of blood---as you seemed to think it an improper mode of proceeding in Pulmonary Consumption.

I wish very much to hear from you at some future period upon this business, and if you will be kind enough to point out any defect in the information I here send you, I will gladly answer you, as I can send you to Bristol any further account in franks---at the same time I shall be happy to know if you have made any further trial of this promising plan for relieving this dreadful malady.

An observation I made during the time G. Crump inspired the air, is perhaps worth notice---at least I should wish to know if it produced the same effects in others, that is, in a morning previous to his using it his breath was most abominably fœtid---that after using it two or three times it became not only very easy, but also very sweet, and continued so, sometimes for two or three days---he also told us at the first inspiration, whether it would relieve him or not, by saying he would not tire himself, for that it was not of the right sort---though the bell shaped instrument rose with the usual regularity in the water: I am not chemist sufficient to explain this†. I beg you will excuse the hasty manner in which I have sent you the above account; and hope you will

† The hydrogen air having been procured sometimes by means of heated iron, and sometimes by means of charcoal, it is probable that some impurity (as a proportion of sulphur in the iron larger than ordinary, or of bitumen in some pieces of charcoal not well burned) might have produced that air, which the patient felt not to be of the right sort.

will remember that I shall have a pleasure in answering any further enquiry you may wish to make---at the same time beg leave to tell you, that I have a heart replete with gratitude for your kind assistance to my poor boy,---and remain,

Dear Sir, your's truly,

To GEORGE CRUMP.

Dr. BEDDOES.



*Extract of a second Letter from Mr. Crump :*

ALBRIGHTON, June 2, 1793.

Dear Sir,

I conceive, as nearly as we can trace back by the medicines my son took, &c. that it might have been about a year and a half that he laboured under the symptoms of Phthisis Pulmonalis. The quantity of facitious air was as nearly as possible as one to two of atmospherical---sometimes, I think a little

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“ *disordered apparatus left no doubt of the fidelity*  
 “ *of his testimony, so fully confirmed to us by*  
 “ *his father.*”

W. YONGE.

I do not know whether you will allow that the circumstances of this case offered a reasonable inducement to prosecute this method of treating consumption. With me they were particularly calculated to weigh, as they seemed to give as much countenance as could possibly be expected to my reasonings; in which I had even ventured to suggest that it would be more advantageous to lower the atmospheric air with hydrogen than with azotic air, because the hydrogen has been observed in experiments made upon blood out of the body “to have the power of darkening its colour” (*Observations p. 141*), because blood absorbs a good deal of this air, and because when inspired, it is found to “possess no irritating quality,” a fact, which I hope to establish to your satisfaction below. The experience of

Dr.

Dr. Percival, who found that carbonic acid air alleviated the symptoms of consumption, and still more that of Dr. Fourcroy, who observed them in not less than twenty cases to be excessively aggravated by the inspiration of oxygene air, contributed to induce me to try fully whether this method, which I now certainly knew to be safe and more palliative than any other, might not also in some stages hitherto hopeless, effect a real cure. After some hesitation, Bristol Hotwells was fixed upon as the most proper place to erect the necessary apparatus, because this resort of invalids seemed more likely than any other situation to furnish patients in all the various gradations of Consumption.

In the construction of the apparatus three essential objects were to be accomplished: 1. To provide the means of procuring the several species of air, at least azotic, hydrogene, carbonic acid, and likewise oxygene, for I had no intention to confine myself to one incurable disorder,

disorder, as you will infer from my former speculations, especially what I have said concerning Fever. 2. It was necessary that the reservoirs should be so large that the patients might be supplied with any quantity their symptoms might require. 2. It was also necessary to have it in my power to mix these airs with one another as well as with atmospheric air in any proportion.

These objects have been compleatly attained by a construction not very dissimilar to that employed in the gazometers of Mr. Lavoisier and Dr. Van Marum. I once thought it would be desirable to introduce patients into rooms filled with modified air; and if this plan could be easily carried into execution, it would be preferable to inspiration through a pipe or mouth-piece. But there would be some difficulty and much expence in fitting up such rooms; nor I am sure that they would be so totally exempt from danger; besides experience has convinced me that patients very soon learn to inspire

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through

through a tube, held in the mouth, and to expire through the nostrils. They are indeed at first apt to respire with a greater effort than ordinary ; but even in this particular they very soon correct themselves.

I once thought of annexing drawings of my apparatus to this letter. But as I am in hopes of being soon furnished with materials for another publication upon the same subject, and as in the mean time the apparatus will hardly fail to receive considerable improvements, I concluded that it would be more adviseable to defer the engravings for a few months. I have however provided a model for the inspection of such persons on the spot as may be interested in acquiring an accurate idea of the method of treatment. I have also found it necessary to provide a portable apparatus for the use of patients unable to quit their beds or their apartments : And of this also I intend to publish a drawing and a description. It may perhaps be said that I should have done better if

I had delayed all public notification of the existence of the apparatus, till I had certainly determined the efficacy of the practice in which it is designed to be employed. But in the first place, it will be necessary for me to have the care of a considerable variety of cases, before I can determine its efficacy with certainty ; and I could not expect this advantage till the nature of the design was generally known through the kingdom. Secondly, I did not choose to trust to unauthorized rumour to make it known ; and, in the third place, I imagine there are many practitioners of medicine so convinced of the futility of all former methods of treating Consumption, as to be desirous that their patients should have the chance of any new method that affords hopes of relief, and is ascertained to be safe and not disagreeable ; a sentiment in which I suppose many patients will concur : And in proportion to the efficacy of the method, will be the number of lives preserved by making it speedily known. I may add, that the

expenſe of keeping ſuch an apparatus in uſe is not inconfiderable ; of courſe I muſt wiſh to be able as ſoon as poſſible to form a judgment whether it would be prudent to lay it aſide, or to extend it.

OF THE THREE AIRS above mentioned, I hope the moſt from the employment of hydrogene to reduce the air of the atmosphere to a lower ſtandard. From a number of trials it appears to be ſo totally free from all irritating and poſitively deleterious properties, that it may be breathed unmixed with impunity for a much longer time than any other of thoſe airs that are incapable of ſupporting life, except perhaps azotic. Thus Mr. Scheele tells us that having by a ſtrong expiration expelled from his lungs as much atmospheric air as poſſible, he was able to make twenty inſpirations without inconvenience. Pilatre de Rozier frequently repeated the ſame experiment ; and when it was objected to him that he did not empty his lungs of atmospheric air, he proceeded in the following

lowing manner. He inhaled a large quantity of hydrogenic air, and then, applying his mouth to a tube, he blew out the air and fired it at the end of the tube, so that he appeared to breathe flame. In this case, he observed, if there had been any admixture of atmospheric air in his lungs, a detonation must have taken place in his mouth and chest. I have myself felt the pulse of Mr. Sadler, the English Aero-naut, while he has inspired, for above a minute and half at a time, pure hydrogenic air from steam and heated iron. From the rate of eighty-four in a minute it increased to an hundred and ten in fifteen seconds, and became soft and weak. A stout florid young woman breathed the same air for two minutes, during which she made twenty-six inspirations. She was not in the smallest degree affected, till she had walked down a flight of stairs. She then felt some sickness, and her head became a little dizzy and continued so for two hours, after which she felt perfectly well. Two other per-

sions on the same occasion made several successive full inspirations of this air without the slightest inconvenience. It was inhaled through a tube, and in consequence of pressure on the reservoir, a strong current set into the mouth. The nostrils were not closed in any of these instances. A small quantity of atmospheric was therefore probably inhaled with the hydrogenic air.---Hydrogene is said, when animals are immersed in it, to be as suddenly deleterious as carbonic acid air: (*Priestly's Exp. New Ed. I. 229*) and as such experiments, if accurately made, are certainly the most decisive, I have perhaps expressed myself too strongly in asserting "that it seems pretty well ascertained that hydrogenic will not so soon produce asphyxia as other mephitic airs." Nevertheless in some instances which I have known of insensibility produced by the fumes of charcoal, I conceive that the sufferers must have breathed a mixture containing more atmospheric air than the persons above mentioned,

tioned. Carbonic acid air may be suspected somewhat to accelerate asphyxia by the irritation it produces. Nitrous air evidently does so by forming nitrous acid: When Dr. Priestly put fishes into water impregnated with nitrous and other airs, he found the former to have a more immediately deleterious effect. The difference, if any exists, might be ascertained by obvious experiments on some of the smaller of the warm blooded animals.

It is a curious, and to me an agreeable circumstance that animals may be gradually inured to air with less oxygene than usual. In the case of phthisis related above, the patient continually demanded more and more hydrogen air; and can you doubt that the human frame possesses the same power of adapting itself to a change of circumstances that has been discovered in inferior animals, which respire in the same manner? (*Priestly III. 257.*)

SINCE

SINCE MY APPARATUS has been at all fit for use, I have employed hydrogen air in one pulmonic case; and the result has been satisfactory. A person of fair complexion and dark eyes had been for some time past subject to attacks of hæmoptysis attended with dyspnœa, severe coughing, and pain in the thorax. On a late seizure of this kind I advised the use of modified air. The pulse was hard, from an hundred and four to an hundred and eight. The countenance much flushed; the skin dry and hot, with considerable febrile rigour. All her feelings the same as at the commencement of former seizures. She began by breathing three hundred and fifty-six cubic inches of air; of which forty-four (nearly one-eighth) we hydrogen from steam and red hot iron. This quantity she consumed in fifteen minutes. When she sat down to inspire, she had very acute pain under the sternum; which entirely subsided while she was breathing. The pain afterwards returned, but with less violence; and  
upon

upon inspiring from ten to fifteen minutes at a time several times a day for three days, it entirely disappeared with the other symptoms.-- It had before occurred to me that air of a reduced standard would be extremely beneficial in sthenic inflammation; and I am confirmed in the opinion by this instance.

I have several times seen the short dry cough stopped at once by air similarly modified. But without further experience I dare not affirm that it was owing to the medicinal power of the mixture, since we so frequently see morbid affections of the body suspended by a change in the state of the mind.

Should I find it necessary to substitute azotic in the place of hydrogene air, the accidental discovery (which I made a few years ago, and which is announced in Dr. CRELL's *Chemical Annals* for 1790) of a ready method of procuring this species of elastic fluid by effervescence will, I trust, prove serviceable. Nothing but the want

of a few more experiments to ascertain which of several variations of the process is the best, and what quantity is afforded by the different processes, has prevented me from submitting an account of my method to the Royal Society; and whether I shall have occasion for this air for medical purposes or not, I hope soon to be able to bring my experiments to a conclusion.

After securing a full supply of oxygene air, the first thing I undertook, was to attempt to throw some light upon the nature of Consumption by an experiment upon myself. Not having any thing of the phthical conformation or the slightest hereditary claim to the disease, I thought I might venture very far in oxygenating myself without any great risque; and it was impossible for me to observe the effects so minutely in another person. I accordingly respired air of a much higher than the ordinary standard, and commonly such as contained almost equal parts of oxygene and azotic air  
for

for near seven weeks with little interruption. I breathed it upon the whole sometimes for twenty minutes, sometimes for half an hour, and sometimes for an hour in the day, but I never continued breathing for above four or five minutes at any one time. I felt, at the time of inspiration, that agreeable glow and lightness of the chest, which has been described by Dr. Priestly and others. In a very short time I was sensible of a much greater flow of spirits than formerly, and was much more disposed to muscular exertion. By degrees, my complexion, from an uniform brown, became fairer and somewhat florid. I perceived a carnation tint at the ends of the fingers, and on all the covered parts of the body the skin acquired much more of a flesh colour than it had before. I was rather fat, but during this process I fell away rapidly, my waistcoats becoming very much too large for me; I was not sensible however, of any muscular emaciation, but rather the contrary. My appetite was good;

and I eat one-third or one-fourth more than before without feeling my stomach loaded. In no long time I observed in myself a remarkable power of sustaining cold. Except one or two evenings when I was feverish, I never once experienced the sensation of chilliness, though cold easterly winds prevailed, during great part of the time I was inspiring oxygene air. I not only reduced my bed clothes to a single blanket and cover-lid, but slept without inconvenience in a large bed-chamber, looking to the N. E. with the window open all night, and with the door and windows of an adjacent sitting room also open. About the expiration of the above-mentioned time, I perceived some suspicious symptoms. It was uncomfortable to me to sit in a room at all close. I frequently felt a sense of heat and uneasiness in my chest; and my skin was often dry and hot with burning in my palms and soles; my pulse, which had hitherto seldom exceeded eighty, was above ninety in the evening. At this time

I took

I took a journey of about 170 miles, the greater part in a mail coach in the night, the rest on horseback. The roads were uncommonly dusty, and several circumstances concurred to harass and fatigue me. On the way I met with a medical friend, who was much struck with the flushed appearance of my countenance, and upon feeling my skin and pulse, which varied from an hundred and four to an hundred and twenty, imagined that I was become hectic. I had now, though but seldom, a short, dry cough; but the sense of irritation to cough required an almost constant effort to suppress it; this sense of irritation was, as you will suppose, attended by dyspnœa. I had also frequent bleedings at the nose, an event almost unprecedented with me; the blood was of an unusually bright colour; which was also seen in blood forced from the gums. Whenever I pierced the skin in shaving, the blood flowed in greater abundance than usual, and was staunched with difficulty.

These symptoms indicate a tendency to hæmoptysis (*k*), and they, of course, so strongly corroborate my theory of Consumption, that I am almost afraid lest they should be considered as imaginary or fictitious. I am glad therefore to have it in my power to appeal, for all those circumstances which could fall under the notice of spectators, to testimony that will weigh so much with you as that of Mr. WILLIAM REYNOLDS, at whose house at *Coalpit Bank* I was when most indisposed, of his brother, Mr. JOSEPH REYNOLDS, and of Mr. W. YONGE. By keeping quiet and cool, and by the assistance, as I suppose, of a diet in which sweet oil, butter and cream bore a large proportion to the other articles, I very soon recovered my health. My insensibility to cold, as I had an opportunity of ascertaining, during the evenings we have lately had

(*k*) HÆMOPTYSIS: *genarum rubor; molestia aut doloris, et aliquando caloris, in pectore sensus; dyspnœa; titillatio faucium; tussis aut tussicula sanguinem floridum, sæpe spumosum rejiciens.* (Cullen Nosolog. II. 156).

had (June 21st---24th) still continues; and the change of complexion will probably be permanent; it may at least, I doubt not, be rendered so by inspiring small quantities of oxygen air from time to time.---Is there not also room to conjecture, as well from this experiment as from the remarkable tendency of oxygen to generate heat, whenever it enters into combination, that many invalids may be advantageously fortified against the cold of winter by breathing atmospheric improved by the addition of oxygen air? We shall not, I hope, be long without a convenient small apparatus for procuring and containing oxygen air; and such an apparatus, I should expect, would soon come to be ranked among the ordinary articles of household furniture. In this case I think it probable that oxygen air will supersede all other cosmetics; one decisive advantage it will certainly have over them all, for while it improves the looks, it will, if judiciously administered, amend the health

health also.---In true asthmatic fits its beneficial effects have been already many times experienced. No sooner does it touch the lungs than the livid colour of the countenance disappears, the laborious respiration ceases, and the functions of all the thoracic organs go on easily and pleasantly again.

As so many more diseases arise from the defect than the excess of vital energy, I expect essential benefit from oxygene air in a considerable variety of diseases; and I look upon it as fortunate that the inspiration should be attended with agreeable sensations. A mixture of air containing about thirty-five parts in an hundred of oxygene may be employed with probable advantage and with undoubted safety in the following diseases: 1. In Typhus, but not perhaps where the excitement of the vascular system is too great, as long as this symptom continues. 2. In Hysteria, and similar nervous affections. 3. In Anasarca and Hydrothorax, after the evacuation of the water; in these cases we  
find

find the extremities, especially the feet, to be habitually cold, almost to insensibility; oxygene, I think, would give life and activity to the remotest absorbents, and prevent a fresh accumulation of water. Indeed I suspect that in consequence of this operation it will be found the most powerful and salutary of all diuretics. 4. In Diabetes, may not an addition of the acidifying principle to the blood correct the tendency of the kidneys to secrete saccharine urine; and hence cure this infrequent but fatal disease? 5. I am not without hopes of being able to repair the injury sustained by the liver from too free a mode of life. In one instance where redness of the nose alternated with heavy internal pain about the region of the liver, the natural colour of the nose has been for some time permanent and the pain has disappeared; but a sufficient interval has not elapsed, since these changes took place, for any decisive opinion to be given upon the case. 6. In ill-conditioned Ulcers, especially

of the legs, and in some of the affections termed scrophulous. 7. In Palsy. 8. Does not the leaden complexion in Schirrus indicate a deficiency of oxygene? Superficial readers will perhaps be tempted to charge me with inconsistency for imputing diseases, marked by such different symptoms, as scurvy, typhus and schirrus to a deficiency of the same constituent part of animal bodies; but you will allow that it is perfectly consonant to analogy and therefore probable, that diseases, widely differing in form, should be produced as this principle is more or less withdrawn, and as it is withdrawn more or less rapidly.----Having mentioned schirrus, it is superfluous to say that oxygene air should be tried in cancer also. 9. In Hydrophobia and some other desperate diseases, no one, I suppose, would object to the trial of various mixtures of air, even though we are totally deserted by theory.

It is needless to continue this enumeration. Every person, who understands the principles,  
will

will be able to continue it for himself; and success in one will encourage to a trial in other diseases. In a future letter I hope to present you with a catalogue of diseases in which I have effected a cure. The power of the various elastic fluids, and of a diet and medicines calculated according to the theory, which prescribes a particular mixture of airs in any given case, will I hope, soon be determined. There are many diseases in which neither patients nor practitioners have much reason to be satisfied with the state of medicine; and multitudes will, no doubt, concur with me in endeavouring to put it upon a better footing. Many circumstances, indeed, seem to indicate that a great revolution in this art is at hand. We owe to PNEUMATIC CHEMISTRY the command of the elements which compose animal substances; Now it is difficult not to believe that much depends on the due proportion of these ingredients; and it is the business of PNEUMATIC MEDICINE to apply them with caution and

intelligence to the restoration and preservation of health.---And if you do not, as I am almost sure you do not, think it absurd to suppose the organization of man equally susceptible of improvement from culture with that of various animals and vegetables, you will agree with me in entertaining hopes not only of a beneficial change in the practice of medicine, but in the constitution of human nature itself.

THOMAS BEDDOES.

Hope-Square,

BRISTOL HOTWELLS,

June 30, 1793.

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*It is proper to mention, and it may be satisfactory to some readers to be informed, that the preceding remarks on the varieties of consumption were printed before the receipt of the following letter: And as I had never any opportunity of knowing his sentiments on this point before, I could not but be gratified on finding that I had formed nearly the same opinion with a Philosopher, not less distinguished by the talent of observation, than that of invention.*

DERBY,

DERBY, Jan. 17, 1793.

Dear SIR,

Your treatise on Consumptions I have read with great pleasure, and am glad to find you are about to combat this giant-malady, which has hitherto baffled the skill, and withstood the prowess of all ages ; and which in this country destroys whole families, and, like war, cuts off the young in their prime of life, sparing old age and infirmity.

The few observations I have made on this disease, since you request them, are at your service ; as I wish to contribute even a mite to your great design. I hope you will be led to try a variety of experiments with mixtures of airs ; your very ingenious reasonings from the scarlet colour of the blood in consumptive patients, and from the inflammatory size or coagulable part of it, and from the delay of the progress of consumption in pregnant women, indicate indeed hyperoxygenation to

be the cause of this fatal disease. But by instituting other experiments with different kinds or proportions of airs, you will, at least, if your first experiments should not succeed to your utmost wish, hold out hopes to those unfortunate young men and women; who, if they knew the general fatality of their disease under the present modes of treatment, would despond at the commencement of it, or wish to try some new kind of medicine: For though catarrhs are sometimes mistaken for consumptions by the ignorant, or are designedly called so by the crafty, and are hence supposed occasionally to have been cured; yet it is well known to attentive practitioners, that those patients, who are truly consumptive from pulmonary ulcers, which have arisen spontaneously, (and are thus distinguishable from a single ulcer owing to violent peripneumony, or the wound of a sword)---whether they are kept on vegetable or on animal diet; and whether, with the usual quantity of wine and beer, or with water and milk

milk alone---at length submit to fate ; and that generally with many of their relations by hereditary predisposition, or with their nearest friend by contagion.

The immediate cause of Pulmonary Consumption consists in ulcers of the lungs ; these ulcers, whether they arise spontaneously, or from previous infection, may vary in respect to their seat, as well as to their remote cause ; but I suppose the immediate cause of these ulcers to consist in the inirritability of either the lymphatic or of the venous system. First, if the mucaginous fluid, which is poured into the cells of the mucous membrane of the lungs be not perfectly absorbed, it will produce ulcers by its accumulation, or by its chemical change. Secondly, if the blood brought to the internal surface of the bronchia by the bronchial arteries be not perfectly absorbed, or taken up by the correspondent bronchial veins, hæmoptoe will be induced, and small ulcers succeed in consequence.

Hence

Hence there has always appeared to me to be two kinds of Pulmonary Consumption, one which begins with slight hæmoptoe and which is generally seen in dark-eyed people with large pupils; and the other, which commences without hæmoptoe, and which is generally seen in light-eyed people with large pupils. The aperture of the iris in both these kinds of Consumption is generally large, which evinces the inirritability of the eye, and thence perhaps in consequence the inirritability of the whole system. The former of these consumptions is generally hereditary without any appearance of scrophula; and the latter with appearance of scrophula in the present, preceding, or third generation upwards. The former commences more certainly between seventeen and seven and twenty; the latter attacks people of all ages.

I believe both these Consumptions to be infectious to those who sleep with such patients in the last stage of the disease; as I have  
observed

observed a husband in two cases begin to be diseased soon after the death of his wife ; and in one a wife, who became consumptive soon after the death of her husband ; in all which cases there was no reason to suspect hereditary predisposition.

The hæmoptoe generally begins at its first attack during sleep, for as respiration is in part a voluntary action during our waking hours, and as the power of volition is totally suspended in perfect sleep, the blood in the lungs of irritable or weak people is liable to accumulate for want of the aid of the voluntary power at that time, and hence hæmorrhage ensues ; and the ulcers are produced in consequence of the rupture of the bronchial veins, and of some part of the effused blood stagnating in the air-vessels, and undergoing a chemical change.

Large abscesses frequently exist many weeks---  
so long as they are precluded from any access

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of

of air without occasioning hectic fever; but on their surfaces being exposed to the contact of the air by opening them, hectic fever is occasioned in a very few hours. From this cause arises the advantage of opening large abscesses by means of a seton passed through them. Hence where a wound is required to heal by the first intention (as it is called) as in compound fractures, it must carefully be confined from any access of air. And hence lastly the reason, why ulcers of the lungs are so difficult to heal, viz. because they are perpetually exposed to a current of air. What part of atmospheric air is hurtful to ulcers, whether it be the oxygene in too large a quantity, as your ingenious reasonings seem to countenance; or too great a proportion of azotic air, I hope your cautious experiments and your particular attention to consumptive patients will soon decide.

One agreeable circumstance attending your application of different kinds of air to consumptive

sumptive people is, that they may at the same time persist in any plan of medicine or diet, which themselves or their friends for them are solicitous to pursue, without interfering with your remedy which is immediately applied to the seat of the disease, and the ulcerations of the lungs.

Go on, dear Sir, save the young and the fair of the rising generation from premature death; and rescue the science of medicine from its greatest opprobrium.

Your's, &c.

To

E. DARWIN,

Dr. BEDDOES.

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P. S. Dr. Wood of Newcastle has just published a theory of Typhus, varying but in terms from that which I had before given in the book so often quoted. He thinks that typhus is produced by "the *accumulation* or *over-pro-*  
" *portion* of carbone and hydrogene, and an exhausted state  
" of irritability." I suspect that such an accumulation would require more time than the production of this fever

ever takes; and I still think it much more probable that the oxygene is suddenly diminished by the action of contagion, or of the stimuli, that operate like contagion. This physician from experience recommends nitre in typhus. We know how much nitre was a favourite medicine with the Stahlian school; and though it has been of late almost entirely disregarded, I have reason to believe that it will prove a medicine of great use, now we have a rule for its administration; and I will not lose the present opportunity of repeating the wish I formerly expressed, that nitre and acid of tartar might be both employed in sea scurvy.

*Carbonic matter* long since presented itself to my mind as likely to be serviceable in diseases, where we should desire to deprive the system of oxygene. Its great attraction for oxygene in high temperatures has long been known; and the experiments of Mr. Lowitz, and still more the very surprising ones of Dr. Kels (*Crell's Annalen St. 3, 1792*) and of Dr. Buchholz (*Gren's Journ. der Physik B. v. p. 3.*) shew that at a temperature considerably below that of warm-blooded animals, carbonic matter is by no means so inert a substance, as it has hitherto been reputed. Dr. Moench (*V. d. arzney-mitteln p. 221*) assures us that he has given it largely with success; and the *spongia usta*, though in my opinion a bad preparation and in general too sparingly administered, has been thought serviceable

viceable in scrophula. I have lately given it in a form more capable of being acted upon by the powers of digestion than that in which it commonly appears: And, as I believe, with effect. One patient in this neighbourhood had a short, dry cough, pain in the thorax, heats with occasional shiverings, amenorrhœa, flushed countenance at times, quick pulse, and with other signs of tubercles threatening suppuration---at least of imminent phthisis; of which disease some of the family had died. I proposed the inspiration of modified air; but as the apparatus was not ready for use---and it will not indeed be *perfectly finished* before the end of the present week---I attempted to retard the approach of the disease by carbonic matter. The patient grew gradually better, and for some weeks has had no phthical symptom. I am now employing the same means in confirmed phthisis; and as soon as I can form an opinion concerning the best mode of preparation, and the efficacy, of the medicine, I will publish it.

Since this letter has been in the press, a patient whose principal symptoms are too great secretion of bronchial mucus, and dyspnœa on walking up even a slight ascent has been respiring air containing about thirty-six parts of oxygene air in an hundred. He is already sensible of some relief in his breathing, though he has hitherto respired only for five minutes at a time twice a day. And the hands and covered skin, which were before too pale, are, he thinks,

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becoming

becoming more coloured. There can scarce indeed be a doubt concerning this effect of oxygene air. Dr. Fourcroy expressly mentions the heightening of the complexion in the patients who breathed it under his inspection; and this might have been fully expected from the change which blood undergoes, when brought into contact with oxygene air; which, if such an expression were allowable, deserves to be considered as the true *sweetner* or *purifier* of the blood. Mr. Chaptal experienced great benefit from this air in a case of humoural asthma\* similar to that which I have mentioned last.---To what I have before said of the convulsive cough preceding phthisis, it may be added that in Dr. Fourcroy's patients when the disease returned with increased violence, the first symptom was a dry, convulsive cough: It is remarkable that both Fourcroy and Chaptal used oxygene air unmixed with atmospheric. This can scarce be proper in any case---Instances may occur in which an easy method of oxygenation might be practised. We draw in at every inspiration about twelve cubic inches of air at a medium. By a full inspiration after a careful

\* Believing that this air would be beneficial whenever *le p<sup>ou</sup>mon est engorgé par des humeurs pituiteuses*, J'ai essayé, says Mr. Chaptal *de le faire respirer à un asthmatique qui en effet a été* PRODIGIEUSEMENT SOULAGE. (*Annales de Chimie* iv. 22.) It should not be omitted that in one of Mr. Chaptal's phthisical cases, the first effect of oxygene air was such that in three weeks the patient was able to take *pretty long walks*, though before so weak that he could not quit his bed. In this and another case it produced great animation and gaiety (*l. c.*).

careful expiration we can inhale two hundred cubic inches. Hence by a moderate effort we can take in from sixty to an hundred cubic inches. Thus we shall bring more air than usual within the attracting distance of the blood; and by continuing this process, oxygenate the system. The effect will be promoted by slow inspirations and quick expirations. I have thus in a few minutes often produced a more general glow and higher colour on the cheeks than I could impute to the mere increase of muscular exertion.----I subjoin a few queries.---1. Does not the iris generally become more contracted just before and just after phthisis? 2. Though it is impossible not to perceive the acuteness of the argument from the habitual dilatation of the pupil to the inirritability of the system, do not some appearances shew more decisively still that the system about the beginning of consumption is highly irritable? Do we not for instance find that stimulants, as fermented liquors, set such persons all on fire? I have sometimes observed a meal of solid food without even small beer produce a flow of spirits apparantly greater than a moderate quantity of wine would in health. In florid consumption in short, before great debility comes on, do not weak stimuli induce disagreeable burnings, hard pulse, &c.?---Even so, I do not understand why in an irritable state of the body, the iris should be unirritated. 3. Do not Dr. Fourcroy's cases compared with those above related render it probable that the atmospheric oxygen, and not its azote, is prejudicial

cial to ulcerated lungs, and so far solve Dr. Darwin's problem? 4. It is common in France, and, I believe also in Ireland, to lodge phthifical patients in cow-houses, on the supposition that the sweet breath of the cow is healing and balsamic. *L'air des etables de bêtes à cornes*, says Dr. Methuë, *est assez pur pour que la médecine ait cru pouvoir le conseiller dans les maux de poitrine* (*Airs. 1788. II. 13.*) But if it be beneficial, is not the effect much more probably owing to the subtraction of oxygen by the respiration of the animals?

T. B.

5th JULY, 1793.

*N. B. The few typographical errors in the preceding pages are such as every reader will be able to correct.*

Of the Booksellers named in the title page may be had,

1. SPALLANZANI'S DISSERTATIONS on DIGESTION, &c. 2 vols. translated from the Italian; with additions, by THOMAS BEDDOES, M. D. Second Edition.
2. CHEMICAL EXPERIMENTS of a Philosopher of the last Century, being an account of MAYOW'S Discovery of the Principal Properties of Elastic Fluids, by THOMAS BEDDOES, M. D.---Price 2s. 6d.
3. OBSERVATIONS on the Nature and Cure of Calculus, Consumption, Sea Scurvy, Fever, &c. 8vo. by the SAME.
4. The HISTORY of ISAAC JENKINS and SARAH his Wife, and their Three Children.---Price 3d. by the SAME.