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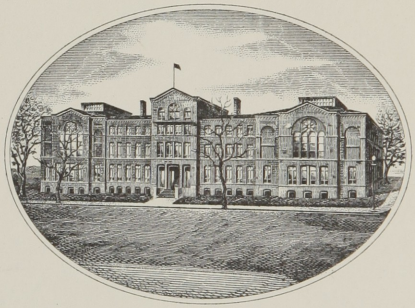

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Public Health Service

Bay (W.)

AN

INAUGURAL DISSERTATION

ON THE

Operation of Peſtilential Fluids upon the large Inteſtines, termed by Noſologiſts

DYSENTERY.

SUBMITTED TO THE PUBLIC EXAMINATION OF THE FACULTY OF PHYSIC, UNDER THE AUTHORITY OF THE TRUSTEES OF COLUMBIA COLLEGE IN THE STATE OF NEW-YORK,

WILLIAM SAMUEL JOHNSON, LL. D. Preſident,

FOR THE DEGREE OF

DOCTOR OF PHYSIC,

On the 3d of May, 1797.

By WILLIAM BAY,

Citizen of the State of New-York.

" *Hæc igitur subito clades nova, peſtilitasque,*
" *Aut in aquas cadit, aut fruges perſidit in ipſas,*
" *Aut alios hominum paſtus pecudumque cibatus,*
" *Aut etiam suſpensa manet vis aëre in ipſo;*
" *Et cum ſpiranteis mistas hinc ducimus auras*
" Illa quoque in corpus pariter sorbere necesse'st.
" *Consimili ratione venit bubus quoque sæpe*
" *Pestilitas, etiam pecubus balantibus ægror.*"

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—1797.—

TABLE OF CONTENTS.

INTRODUCTION.

CHAP. I. *Of the Physiology of the Alimentary Canal.*

Sect. 1. *Digestion.*
Sect. 2. *Chylification.*
Sect. 3. *The Properties and Use of the Bile.*
Sect. 4. *Pancreatic Juice.*
Sect. 5. *The Condition of the Alimentary Canal.*
Sect. 6. *An Examination of the feculent Matter of the large Intestines.*
Sect. 7. *An Inquiry how far Animal Diet is capable of imparting to the Fæces Qualities of exciting dysenteric Symptoms.*
Sect. 8. *Chemical Analysis of the Fæces.*
Sect. 9. *Arguments to prove that the Gases found in the Alimentary Canal are incapable of producing Dysentery.*

CHAP. II. *The Medical Consideration of the Subject.*

Sect. 1. *The Cause of the Disease, and its Connection with others.*
Sect. 2. *The Effects of Pestilential Fluids upon the Mesenteric Glands.*
Sect. 3. *Appearances on Dissection.*
Sect. 4. *A View of the Connection of Dysentery with the Intermitting and Remitting Fevers.*
Sect. 5. *An Examination whether, and under what Circumstances, the Dysentery, and Intermitting and Remitting Fevers are infectious.*
Sect. 6. *The Phenomena of the Disease arising sporadically, endemically, and epidemically.*
Sect. 7. *Method of Prevention.*
Sect. 8. *Method of Cure.*

CHAP. III. *Theory.*

APPENDIX.

INTRODUCTION.

PUTRID vapours have been conſidered, from the earlieſt ages of phyſic up to the preſent time, to be the cauſe of many of the diſeaſes which have wrought ſo much miſchief among the human ſpecies, and which ſtill continue their ravages and influence in deſtroying ſo many of the inhabitants of this globe: and as men applied particular terms to deſignate the different forms of thoſe diſeaſes which are produced by theſe vapours, an etymology of theſe may not, perhaps, be uninteresting to ſome of my readers, and more eſpecially as we are at preſent labouring under the influence of them; and by this means the fallacy and impropriety of them will more evidently appear.

The Egyptians, previous to their knowledge of the alphabet, preſerved their tranſactions by reducing them into pleaſing ſtories or allegories: theſe were handed down from generation to generation. "The allegory which refers to the preſent "argument is the one, mentioned by Ovid,* of the terrible "monſter *Python*, engendered from the putrid ſlime or mud "of the Nile, and ſlain by *Apollo*, the god of day. The "Mythologiſts generally agree that this is a beautiful phyſical "allegory. The term 'Python' is derived from the verb πυθῶ, "to putrify or corrupt; and the truth intended to be inculcated "is, that peſtilential vapours, the offspring of corruptions, "ceaſe to riſe and contaminate the air, after the ſun's rays "have dried the land. The rays or ſhafts of light, then, "darted to the earth, deſtroyed Python, that is, exhaled the "moiſture,

* Metamorphoſis. Lib. i. 438.

" moiſture, and put a ſtop to putrefaction and its deſtructive " conſequences. The Greeks, who borrowed much of their " knowledge from Egypt, interpreted *literally* ſome of theſe " philoſophical allegories. Hence the epithet 'Pythios' was " given to Apollo by ſome of his worſhippers; and under " this title the inhabitants of Megara erected a temple to his " honour.* His prieſteſſes, even at Delphos, were called " *Pythias*. And further to perpetuate this benevolent action, " the Pythian games were inſtituted, wherein the victors were " crowned with garlands of beechen leaves. This author's le- " gend alſo of the voyage of the god ÆSCULAPIUS to Rome,† " in the form of a ſerpent, with the committee of Roman " citizens ſent by the ſenate, during the rage of the plague in " Italy, between the 458th and 462d years of the city, to " fetch him from Epidaurus,‡ appears to be nothing more " than another allegory, or popular ſtory, expreſſive of the " method taken by the Roman government to procure, from " the better informed Greeks, all the information they could, " about preventing and ſtopping peſtilential diſtempers. As " Æſculapius was reputed the ſon of the Deity, to whom a " ſirname was given from the monſter or ſerpent he was al- " ledged to have killed on the banks of the Nile, it is proba- " ble, when the figurative meaning of the allegory was drop- " ped, the literal interpretation of 'Pythius' was transferred " from father to ſon, and thus a ſnake came to be the type or " emblem of phyſic. Some pleaſant remarks have been made " on this ſubject by Sir SAMUEL GARTH.§ I wiſh ſome " Apollo would deſtroy the PYTHON of the United States!

" From the ſame root whence Python is derived, probably " come πῦρ, fire, and πῦον, corruption; expreſſive of the de- " compoſition of natural ſubſtances by *combuſtion* and *pu-* " *trefaction*. It muſt have occurred to mankind, very ſoon " after

* Plutarch in Vit. Anton.
† Metam. xv. 622.
‡ 3 Rollin's Roman Hiſtory, 305.
§ Works, p. 153.

" after they began to make obſervations, that when vegetable " and animal bodies loſt their living energy, or died, they " ſoon underwent an alteration, and laid aſide their old, and " took upon themſelves a new form; and that ſuch of them " as were not changed by the operation of *fire*, would yield " ſooner or later to the agency of *corruption*. They muſt " ſoon have diſcovered, not only that theſe were the *two* " great deſtroyers, but that there was a conſiderable reſem- " blance in their manner of accompliſhing their reſpective " works; and that decaying bodies, which frequently evolved, " during their decay, a great quantity of heat, were, in ſuch " caſes, under the influence of both πῦρ and πῦον at once.— " Hence, in conſtructing their language, the Greeks, in this " inſtance, as in an abundance of others, moſt correctly " kept up an analogy *in words*, correſponding to what they " obſerved in fact.

" As long as they confined theſe terms to expreſs certain " changes incidental to *inanimate* objects, the ideas ſuggeſted " by this methodical language preſerved their correctneſs. " But, in ancient times as well as in modern, there has been " a conſtant diſpoſition to transfer the terms appropriated to " proceſſes or modifications of *dead* ſubſtances, to expreſs " the conditions and functions of *life*. This is a ſource of " much inaccuracy in ſpeech and ambiguity in ſcience. For " example, the noun πῦρ, which ſignifies fire, is ſometimes " employed by HIPPOCRATES to expreſs a diſeaſe in which " a *violent heat* was a leading ſymptom. From this ſprung " πυρέλος, a word often uſed by the old phyſicians, and alſo by " the four evangeliſts, (even by LUKE,* who, as Dr. FRIEND " obſerves, wrote the beſt medical Greek of them all) to ſignify " a diſorder in which *much heat* was accumulated. Thence, " likewiſe, came πυρέξις, which appears to have been a more " technical or profeſſional term, meaning a diſtemper in which " a *fiery heat* prevailed. The colonies of Greeks who ſet- " tled

* Chap. iv. 38.

" tled in Latium, called afterwards Latins, adopted different
" modes of expreſſing theſe ideas: for that form of ſickneſs
" wherein 'fire' was ſuppoſed to predominate, was called
" by names derived from 'fervor' and 'flamma,' which
" come from Greek radicals, ſignifying *to be boiling or burn-*
" *ing hot:* and hence the latiniſms *fever* and *inflammation*,
" which are ſo common at this day in our own tongue: and
" where 'putrefaction' was judged to prevail, they expreſſed
" the forms of it by putreo, putrefacio, putreſco, putridus, &c.
" all derived from πυθῶ, or πύθομαι, whence comes the hellen-
" iſm 'putrid,' and its kindred words.

" Such is the origin of a ſet of terms, which are too firmly
" eſtabliſhed for any authority on earth to alter, notwithſtand-
" ing they inceſſantly ſuggeſt falſe ideas to the mind. They
" have, from the time of their adoption to expreſs any thing
" reſulting from animation, perpetually bewildered thoſe who
" employed them as mediums of thinking and reaſoning on
" the cauſes of theſe kinds of diſeaſes; which have according-
" ly been pronounced to be either *inflammatory* or *putrid*,
" or of a *mixed ſort*; as if the body of a living animal, in
" which neither combuſtion or putrefaction can take place,
" was ſubjected to the ſame accidents which diſorganized a
" corpſe!—To complete the joke, as diſeaſes accompanied
" with *great* heat were called by a name ſynonymous with
" *fire*; ſo, where the heat was *ſmall*, they were expreſſed by
" a word ſignifying *ſmoke*; and ſuch is the typhus (τῦφος,
" fumus) of the preſent day! From the difficulty of making
" revolutions, or even reformations, this pernicious effect of
" words upon ideas, and of language on opinion, will pro-
" bably laſt for ages."*

The foregoing etymology is much confirmed by the following communication of the learned JOHN C. KUNZE, S. T. D. Profeſſor of the Oriental Languages in Columbia College, to

* Mitchill's letter to Thomas Charles Hope, M. D. publiſhed in the New-York Magazine for February, 1797, p. 64 and 65.

to Mr. MITCHILL, of 28th February, 1797. "Recollecting "our converſation of yeſterday, concerning the probable de- "rivation of πυρ, I juſt open my SCAPULA, and find under "πυθω, from which he derives πυοω, ſomething that favours "much your intimation. He derives from the mentioned verb, "the words πυος and πυον, coloſtrum or the *firſt milk*, but ſays, "that the ſame word is ſometimes found for *putrefied blood*. "Under that he has πυαρ, and gives the explanation, idem "quod πυος. HESYCHIUS calls that *firſt milk*, πυρίαλον; "others πυρίαλης; and in ſome, SCAPULA does not ſay where, "it is found πυαρ and πυαρίλης; πυρ therefore may have its "origin from πυαρ, and this from πυοω or πυθω.—It appears to "me a little remarkable, that the Hebrew word באש (baeſch), "which ſignifies to putrify, ſeems to admit of no other deriva- "tion. 'B,' being a prepoſition, moſtly rendered *by*, or *in*, or "*through*; and 'eſch,' *the fire*. Baeſch, therefore, ſignifies "*by fire*; the two words for *fire* being eſch and ur." Does not the πυρ of the Greeks come from the ur of the Hebrews?

It will appear from this etymology of theſe terms and their derivatives, which are ſo often uſed in medical language, that they are of an allegorical or metaphorical nature, and invariably ſuggeſt ambiguous or erroneous ideas to the mind.

A very erroneous concluſion has been drawn by phyſicians, that the diſeaſes ariſing from the exhalations of dead animal and ſome of the vegetable ſubſtances, during corruption, are putrid. They have not conſidered, with that attention which they ought, that, after putrefaction is paſt, or during its progreſs, the vapours produced are, with regard to inanimate matter, highly antiputreſcent. The carbonic acid gas (fixed air), which is extricated in great abundance during putrefaction, is known to be a powerful preventive of the corrupting proceſs; and the ſame is true of the ſeptic (nitric) acid and volatile alkali. It is impoſſible that ſubſtances which have undergone the putrefactive proceſs ſhould ſtill be putrid; we might with equal propriety ſay, that ſubſtances which

 have

have undergone combuſtion were ſtill burning. The operation of putrefaction and combuſtion both reſolves the compound body of the plant and animal into their ſimple elementary particles; and to aſſert that the products ariſing from putrefaction poſſeſs a power to putrify every thing in their neighbourhood, has juſt as much reaſon and propriety to direct them, as to affirm that the products of combuſtion poſſeſſed the power of ſetting fire to every thing with which they came in contact. But the fact is, that ſubſtances having undergone combuſtion, are ever afterwards incombuſtible; and bodies, after the proceſs of putrefaction, are ever afterwards antiputreſcent. Peſtilential fluids being produced by putrefaction, may be called *ſeptic*, as reſpects their origin and title, but are clearly antiſeptic in their effects.

Exhalations from putrefying animal ſubſtances have been called putrid: this term appears to be very improper, and every where to have introduced much confuſion into medical reaſoning; the truth of which will be manifeſt from the following experiments of Alexander.

This accurate and able inquirer has proved that theſe vapours are not only not putrid, but highly antiſeptic in their operation. He found that the moſt naſty and offenſive water from ditches, puddles and ſewers, were capable of preſerving beef and mutton from putrefaction much longer than pure water. This was found to be true of the water of the North loch, the ditches in the meadows, and the drainings from the Connogate of Edinburgh, and the water of St. James's Park and Fleet ditch in London: that theſe waters contained putrid matter in ſufficient quantity to make them fit materials for ſuch experiments, no one will preſume to doubt. Raw meats put to macerate in theſe liquids, and hung in their vapours, were univerſally found to be leſs liable to corrupt than when expoſed to common air or common water. From the experiments the author concludes, that theſe antiſeptic vapours could not be the cauſe of thoſe kind of fevers termed putrid.*

Theſe

* Alexander's Experimental Inquiry, ch. vii. p. 62.

Theſe antiſeptic vapours, produced from putrefaction, which cauſe the diſeaſes that have been termed putrid, have been proved, by the profeſſor of chemiſtry, to be a combination of the principle of putrefaction (ſepton) with the principle of acidity (oxygene). And here too, a power of words, different in derivation and in ſignification, embarraſſes the inquirer. Term after term has been adopted to expreſs the radical of theſe deſtructive fluids. The term nitrogene is derived from the nitre from whence it is obtained by art, by means of decompounding that ſalt, which is formed by the union of this acid with pot-aſh: but as this word does not convey to the mind any idea of its real origin, it is diſcarded by him, and the word ſepton is ſubſtituted, as being a term which will excite in the mind a clear conception of its origin. The term ſepton is a neuter adjective from the Greek verb ſepo, to putrify, it being the production of putrefaction. The adjective is uſed as being a more elegant manner of expreſſing it, and ſtrictly coincident with true criticiſm, after the manner of Cicero, Longinus, and other authors who are juſtly conſidered as the models of elegance. And as the term ſepton, the principle of putrefaction, and its derivations, are uſed throughout this treatiſe, I ſhall annex a nomenclature in this place, in order that the terms ſo uſed may be underſtood by ſuch as are unacquainted with this innovation.

Septon, for azote or nitrogene.

Septous gas, for azotic gas or atmoſpherical mephetis.

Gazeous oxyd of ſepton, for dephlogisticated nitrous air.

* Septic gas, for nitrous gas

* Septous acid, for nitrous acid.

Septic acid, for nitric acid.

Septate, ſeptite, for nitrate, nitrite, &c.

* Chemiſts heretofore have principally confined their reſearches to the ſeptic gas and ſeptous acid, and in a good degree overlooked thoſe combinations of the principle of putrefaction (ſepton) with the principle of acidity (oxygene), which exiſt, naturally formed, during the ſpontaneous decompoſition of animal and certain vegetable matter. The ſeptic gas and ſeptous acid never exiſt

naturally formed, or at leaſt for a very ſhort time, but are always the products of art; and on this account chemiſts have neglected thoſe forms of peſtilential fluids which are produced in the laboratory of nature. This error has therefore cauſed ſome difficulty in comprehending the new doctrine of contagion, becauſe, if the nitrous acid was the cauſe, they argue, it would be perceptible to the ſight, as this acid emits red vapours; and as this does not appear during putrefaction, therefore it does not exiſt, and conſequently cannot be the cauſe of malignant diſeaſes. But they do not recollect that the ſeptic gas and ſeptous acid cannot exiſt long in their artificial forms, when expoſed to the atmoſphere; for ſuch is their attraction for oxygene, that they abſorb it from the common air until they are ſaturated with it; by which their volatility is in ſome degree diminiſhed, and their colour changed from orange to pale, forming the colourleſs ſeptic acid. This, and the gazeous oxyd are the only forms in which it exiſts, or can long exiſt naturally and in the open air. This is corroborated by the effect which takes place in obtaining the ſeptous acid: ſalt-petre is uſed for this purpoſe, being the ſeptite of pot-aſh: a ſtronger acid is added to the ſalt-petre in order to diſengage the ſeptic acid. There are two products from this, the one a portion of oxygene, in the form of vital air (oxygene gas) and the other, the ſmoking ſeptous acid of the ſhops. If it was not the ſeptic acid which was combined with pot-aſh to form the ſalt-petre, this oxygene gas could not be evolved; and conſequently, as ſalt-petre is found naturally formed in ſome countries, it follows, that the ſepton, or baſis of the acid, muſt have been ſaturated with the principle of acidity, and thus conſtituted the oxygenated ſeptic acid, before its junction with pot-aſh to form the nitre: and ſuch ſeems to be the natural progreſs of things.

AN

INAUGURAL DISSERTATION

ON THE

DYSENTERY.

CHAP. I. *Of the Physiology of the Alimentary Canal.*

SECT. I. *Of Digeſtion.*

PREVIOUS to the hiſtory, or any practical obſervations on the diſeaſe which I have choſen for the ſubject of this diſſertation, I ſhall, in the beſt manner I am able, conſiſtent with the limits of a diſſertation, deſcribe ſome of the functions of the alimentary canal: inaſmuch as health depends upon their being performed with freedom and eaſe, whatever, therefore, diſturbs or impedes theſe functions, becomes the cauſe of diſeaſe.—The digeſtion of the food is one of the moſt important operations in nature, for the maintenance of animal life: from ſome impediment or diſturbance of this proceſs, a great number of diſeaſes, and complaints of various kinds, ariſe. It may, therefore, be proper to conſider digeſtion firſt; for organs of digeſtion, of ſome kind or other, are common to all animals with which we are as yet acquainted.

Digeſtion, in the animal œconomy, is the decompoſition which the aliment undergoes in that viſcus called, by anatomiſts, the ſtomach, by the operation of a fluid ſecreted in that organ, to which phyſiologiſts have annexed the term of gaſtric juice.

juice. This liquor acts upon the food, by means of a ſolvent power peculiar to itſelf; fits it in ſuch a manner that the nutrient parts are eaſily ſeparated from the maſs, and taken up by the numerous abſorbent veſſels which are plentifully diſtributed throughout all the ſmaller inteſtines. The nutritive portion, called the chyle, is carried by the lacteals to the receptaculum chyli; whence it paſſes on, through the thoracic duct, into the left ſubclavian vein; there it mingles with the circulating maſs, and is converted into blood. By this means the bulk of young animals are enabled to grow until they have arrived to that ſize which nature has preſcribed to each particular ſpecies; and alſo to repair the waſte and loſs which the ſyſtem of the mature animal is conſtantly ſubjected to, from continual exerciſe, while in the full performance of its functions.

Preparatory for digeſtion, the ſolid food received in the mouth is divided into ſmall parts by the teeth, and blended with the ſaliva, a liquor ſecreted from the blood by the ſalivary glands, for the purpoſe of moiſtening the mouth, and alſo to mix with the food during maſtication, to form it into a pulp, by which means it is more readily ſwallowed. The ſaliva is neceſſary, in ſome degree, at all times, to moiſten the mouth and fauces, but in far greater quantities at meals, when it is required to be mixed with our aliment: on this account nature has taken care that the taſte, ſmell, and even the ſight of food, inſtantly excite a proper ſecretion of ſaliva.

The food thus divided, and, by the mixture of the ſaliva, air, and the mucus of the fauces, blended into a pulp, is ſwallowed, and deſcends into the ſtomach, where it mingles with a fluid of a more active nature, termed the gaſtric juice. This ſubject has, for a conſiderable time, agitated the minds of the medical world; and a variety of opinions prevailed among the ancients, reſpecting the manner in which digeſtion was performed in the human ſtomach. Similar controverſies have ſubſiſted among the moderns; many, in addition to trituration

and

and putrefaction, have imagined that fermentation takes place in the ſtomach for the purpoſe of digeſtion. About the end of the laſt, or the beginning of the preſent century, the ancient doctrine of trituration was revived. But Boorhaave conſidered none of the powers, ſuppoſed by phyſicians, both ancient and modern, to be the ſole agent of digeſtion ſingly; he ſuppoſed the energy of the whole were indiſpenſibly neceſſary in this proceſs. Thoſe who are the warm ſupporters of trituration, as being the true mode by which digeſtion is performed, bring in as a proof of their theory, that birds cannot digeſt their food but by this means. But the experiments lately made by the ABBE SPALLANZANI, *profeſſor of natural hiſtory at Pavia*, prove that the ſtomachs of thoſe animals require no ſuch auxiliaries; for he found from theſe experiments, that their food is digeſted by means of a ſolvent power in the gaſtric fluid, ſecreted by their ſtomachs. He incloſed the food unbroken, in perforated tubes, which were given to a turkey; it came away without being digeſted; but on breaking the food it was returned; when it was again voided, there were not the leaſt remains of food in the tubes.* Hence it appears evident, that trituration only accelerates digeſtion, but is not abſolutely neceſſary; for the muſcular power of the ſtomachs of thoſe animals have no more agency in digeſtion than the teeth of thoſe animals who are provided with them; conſequently trituration has no more the power to digeſt the food than chewing. By chewing the food the gaſtric juice acts more ſpeedily upon the maſs, from the greater number of points it has to act upon, than it would have were it a ſolid maſs. But whatever be the power of digeſtion in theſe animals, there is but little analogy between their muſcular, and the membranous ſtomachs of men; than for which nothing can be leſs calculated than for the breaking and grinding of hard ſubſtances. Had the human ſtomach ſeemed better formed for ſuch a purpoſe, and had its triturating powers been calculated at even a higher rate, ſtill

* Vide Spallanzani's Diſſertations, vol. i. ſect. 62. p. 64 and 65.

ſtill it would have been evident that it performed no ſuch function; for every day's obſervation would be a proof againſt it, from the ſwallowing whole currants, cherries, and ripe grapes, which burſt on the leaſt preſſure, and which are voided very frequently whole and unbroken. Theſe obſervations, with the experiments which have been adduced, will, I truſt, be ſufficient to overturn at once the doctrine of trituration. Theſe experiments with the hollow tubes, although deciſive proof againſt trituration in the human ſtomach, argue nothing inconſiſtent with the theory of a certain degree of fermentation being requiſite for digeſtion.

It ſeems difficult, however, to imagine how any degree of fermentation can take place, without our being put in mind of it in the moſt diſagreeable manner; yet it is only when people are in ill health, and digeſtion is weakened and diſturbed by diſeaſe, that any feeling or effect that can be imputed to fermentation is perceived. In good health, and while we avoid exceſs and improper food, the proceſs of digeſtion is carried on quietly, without our being informed of it by any diſagreeable ſenſation.

Chemiſts conſider three kinds of fermentation—the vinous, acetous, and putrid. Vomitings of a vinous ſmell, which ſometimes occur even when no wine has been drunk, and the frequent acid eructations with which people are ſometimes afflicted, are brought as proofs that the two firſt kinds of fermentation do exiſt in the ſtomach during the proceſs of digeſtion, and they therefore conclude, that they are neceſſary agents in this proceſs. Animal ſubſtances, however, in no circumſtance, not even in a ſtate of putrefaction, undergo the acetous or vinous fermentation: whenever ſour eructations, or ſpitting, therefore, happen, after eating animal food, they cannot, ſurely, be imputed to the acetous fermentation of the meat. This, with what has been remarked above, that no ſuch diſagreeable circumſtance attended people in good health, while the digeſtive organ is in its natural ſtate,

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renders it more than probable that those symptoms proceed from some other cause than the healthy digestion.

This, however, can be proved beyond a doubt, from the experiments of STEVENS. He collected the gastric juice of a dog who had been fasting eight hours: having put half an ounce of it into a phial with twelve grains of beef, and also the same quantity of water and beef in another phial, he placed them in a furnace heated to 102. 3. of Fahrenheit's thermometer: he examined the contents of the phials eight hours afterwards; the one that contained the gastric fluid was intirely dissolved, while the other had not undergone any sensible change. In twenty hours afterwards the whole was removed from the furnace, after having examined them attentively. The beef which had been immersed in the gastric juice, emitted a *rancid and pungent odour*, while the other had become *putrid, and emitted an intolerable stench*. During the intire solution of the beef in the gastric fluid there was not the least appearance of *air bubbles* arising to the surface, nor did it shew any *signs* of fermentation.* This experiment was repeated with the same effect. SPALLANZANI† added to some of the mass of digested substances the syrup of violets; but no change of colour took place, as might necessarily have been expected, had there been the least degree of acidity present in the mass. Hence, then, it appears, from the experiments adduced, that the acetous and vinous fermentations have no agency whatever in the process of digestion, further than in the imaginations of its advocates. This theory, then, like that of trituration, is founded upon hypothetical reasoning, and must, like all the other doctrines founded upon the same principle, give way to the more rational, formed upon the strong basis of experiment.

The opinion of those who support the doctrine of putrefaction, and consider that some degree of it is necessary to com-

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* Vide Stevens's Dissertation, experiment 23.

† Vol. i. p. 343.

plete digeſtion, and that it actually does take place in the animal part of our diet, before it leaves the ſtomach, has been combated by various arguments. It has been obſerved, that the ſaliva of thoſe who have faſted for a conſiderable time, is in ſome degree acrimonious; ſo are their other juices; and even their breath, though naturally ſweet, is then offenſive; but theſe diſagreeable ſymptoms ſoon diſappear after the taking of food. When a nurſe continues too long without taking any nouriſhment, her milk becomes *rank and bitter*, and the child rejects it with diſguſt; but no ſooner does ſhe take in a freſh ſupply of food, than theſe will diſappear, and her milk becomes as *freſh and ſweet* as before.*

It therefore appears, that no degree of putrefaction takes place in digeſtion for the converſion of our food into chyle; and if putrefaction was neceſſary for that purpoſe, it would of courſe, by means of the chyle, be communicated to all the fluids of the body; and the breath, ſaliva, and milk, inſtead of being ſweetened, would be rendered more offenſive in conſequence of eating. Hence, if what has been juſt related is true, as it is, of the ſaliva, breath and milk, then it is equally true that thoſe qualities are changed, and ſweetened in conſequence of eating; and if this is the caſe, then certainly the concluſion follows, that putrefaction has no agency in digeſting the food. Independent of the above arguments, this poſition can be proved from facts which neither can or do admit of a ſingle doubt.

SPALLANZANI† has, by experiments, found that animal food, ſo far from becoming putreſcent while under the operation of the gaſtric juice, will, if it has undergone a certain degree of putrefaction, be rendered ſweet and pure again. Hence, then, it will appear, that the gaſtric fluid, which is continually flowing into the ſtomach, ſo far from being ſeptic, is highly antiſeptic; conſequently, inſtead of promoting putrefaction,

* Moore's Medical Sketches, p. 83.

† Vide p. 349, 353, 355, vol. 1ſt.

trefaction, will retard it. That neither of the fermentations can have any agency in digeſtion is now certain; and as the favourers of this doctrine were obliged to conſider nature as deviating from her general plan of ſimplicity in this caſe only, while in all her operations we ſee her ſtrictly adhering to her principle, this would be abſurd: for the phenomena of digeſtion cannot be explained as produced by either of the three kinds of fermentation alone; conſequently two muſt be taken in, either the vinous or acetous, with the putrid; for, while we make uſe of vegetable diet, the acetous or vinous fermentation ought to take place according to this theory; and, on the contrary, when animal food is uſed, then the putrid muſt be the cauſe. But, from the experiments of modern phyſiologiſts, we find that nature, in this as well as in all her other operations, ſtrictly adheres to her firſt principle of ſimplicity, by endowing the gaſtric juice with a power which can act with equal force, whether the diet be vegetable or animal, by means of a menſtruum. For this diſcovery we are indebted to chemiſtry, which has taught us the knowledge of ſolvent powers in diſſolving bodies: it is by the aſſiſtance of this beautiful branch of ſcience, that we are enabled to account, in the moſt ſatisfactory manner, for the various phenomena which appear throughout nature's works. It is to this that mankind is indebted for that knowledge of contagious and infectious fluids, which has been communicated to the world by Profeſſor MITCHILL. It is to this ſcience that mankind is indebted for many improvements which medicine has experienced, and for a better underſtanding of ſome diſeaſes which had before eluded the reſearches of the ancients. That a ſolvent power in the gaſtric fluid is the means by which the food becomes digeſted, will readily appear from the facts already adduced to corroborate the arguments advanced: but, in order to diſpel any doubt which may yet remain, I ſhall bring forward a few more facts to ſubſtantiate the aſſertions. The experiment made by REAUMURE is deciſive and ſatisfactory to prove

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the point in queſtion, while, at the ſame time, it ſhews the falſity of the other three. He took a buzzard for the purpoſe of his experiment, becauſe that bird has a membranous ſtomach, and therefore can poſſeſs no great degree of triturating power; but, in order to preclude every mechanical power, he made uſe of tin tubes, perforated ſo as to admit free ingreſs for the fluid ſecreted by the ſtomach, to the matter which was uſed in the experiment: on examining the meat contained in the tubes, after they had remained twenty-four hours in the ſtomach of the animal, it was reduced to three-fourths of its original quantity: that which remained had the appearance of threads; it was neither *putrid*, *ſour*, nor *volatile*, *but totally inſipid*.

SPALLANZANI* gave to a dog a portion of bone, incloſed in tubes: when he came to examine the contents, he found that it had undergone a conſiderable diminution from the operation of the gaſtric fluid; the remainder was rendered ſoft, and eaſily cut with a ſharp inſtrument. He† made the ſame experiment upon himſelf, and proved that man is capable of digeſting the ſofter parts of bone, while the harder loſt alſo conſiderable of its weight. Hence, then, it follows, that neither trituration nor the different fermentations could be ſuppoſed to have any agency in producing the changes which the bones underwent in the ſtomach of the dog, or in that of the experimentaliſt; but that this change could only be wrought by the ſolvent power of the gaſtric juice. From the food's being digeſted by means of a ſolvent power in the gaſtric liquor, a queſtion will ariſe, how the ſtomach eſcapes this operation, being compoſed of the ſame materials with the food? This, the celebrated anatomiſt, JOHN HUNTER, has, with a great deal of ingenuity, proved, that the ſame living principle which reſiſts the putrid tendency in the blood and other fluids, prevents the ſtomach itſelf from being acted upon by the gaſtric juice; but as ſoon as the ſtomach loſes this principle, it is as liable

* P. 259, 278. † P. 340, 1.

liable to be acted upon by this fluid as any part of our food. In confirmation of this, it is only neceſſary to advert to the common circumſtances of worms in the ſtomach: while they retain the vital principle, they are a proof againſt the ſolvent power of the gaſtric juice; but no ſooner are they deprived of this reſiſting power, than they become as liable to the operation of this menſtruum as any other ſubſtance taken into the ſtomach. It was owing to this principle that JONAH remained three days in the ſtomach of a whale undigeſted; upon which infidels have founded ſo great an objection to the holy record, as being miraculous; but it only ſhews their ignorance of one of the greateſt laws of the animal œconomy, that, ſo long as the living principle remains in animal bodies, ſo long are they proof againſt the powers of digeſtion. From diſſections it appears, that the ſtomach becomes frequently digeſted; that the gaſtric fluid has been found to corrode it, and to have made its way through the coats of the ſtomach into the cavity of the abdomen. JOHN HUNTER* relates three caſes where he obſerved that the ſtomach had been acted upon by the gaſtric fluid: two of them died from blows which they received upon their heads, which fractured their ſkulls; they both died in a very ſhort time after the accident: the other was in a perſon who had been hanged. From the appearances of their ſtomachs, and the ſuddenneſs of their deaths, it cannot be attributed to any putrefaction that they could have undergone, or to any diſeaſe of the ſtomach; for in all the caſes the ſubjects were in perfect health previous to their deaths. Thus far have I endeavoured to ſhew the true proceſs of digeſtion, ſo far as it relates to the ſtomach, where digeſtion is only begun, and is afterwards completed in the ſmaller inteſtines. From the remarks that have been made on digeſtion, we find that the proceſs of concoction, which is only begun in the ſtomach, is afterwards completed in the ſmaller inteſtines, and there the aliment is converted into chyle.

SECT.

* Vide Animal Economy, p. 230, note.

SECT. II. *Of Chylification.*

CHYLE, in men and quadrupeds, is of a white colour, resembling milk; it is commonly of a saltish, sweet taste, but has not any sensible smell. In fish and birds it is transparent, like water. When it is effused out of the lacteals of a healthy person, it coagulates like milk. It has been found to curdle in the lacteals after death,* provided the animal was in full health and vigour.

HALLER was of opinion, that an acid prevailed in the chyle, which prevented the putrefaction of the blood. His words are, "utilas chyli proxima est, putriscibilem naturam sanguinis acido succo suppeditato contemporari. Absque chylo enim, ut ostensum est, omnes succi humani in summam acrimoniam transeunt, et fibris accenditur intra paucos Diis funesta." CRUICKSHANK† denies that there is an acid present in the chyle: from the variety of experiments which were made, he could not perceive any acid, either by taste or smell; nor, on adding the salt of tartar, did the least effervescence take place; neither was the colour of the litmus changed in any manner by being immersed in the chyle, which is considered a very delicate test to discover the presence of an acid. Further, it is impossible that an acid can exist in this fluid; for the bile, which is present and mixed with the substances to be formed into chyle, is an alkalascent fluid, consequently no acid can exist, because the instant the acid and the alkali come in contact, an effervescence will take place, and form a neutral salt.

Chyle is a fluid into which our food is changed in the stomach and small intestines, by means of the gastric fluid and the pancreatic juice, which is absorbed by a set of vessels plentifully distributed over the smaller, and also the two large intestines

* Cruickshank, p. 101. † P. 100.

inteſtines (the cœcum and the colon), but in greater numbers over the duodenum and ilium: theſe veſſels, from the reſemblance of the fluid they take up to milk, are called the lacteals; by means of theſe veſſels the chyle is brought to the thoracic duct, from whence it paſſes through that canal into the round of circulation. The importance of this fluid, and the neceſſity of it, in order to ſupport life, muſt be obvious to every phyſiologiſt, if, by means of diſeaſe or any accident, the animal is prevented taking in food; or even if the creature does take in food, and digeſtion is carried on completely, yet, if the meſenteric glands be diſeaſed, or the lacteals themſelves either debilitated or in a paralytic ſtate, even then the animal will ſtarve as certainly as if he had been faſting.

It was for a conſiderable time the received doctrine, that the function of abſorption of the chyle was performed by the red veins, together with their office of carrying the blood to the right ventricle of the heart.—JOHN HUNTER, to whom we are much indebted for the uſeful diſcoveries which he has made, poſitively denies this office to belong to the veins: he made a number of experiments to prove the falſity of this doctrine, which are concluſive: there are a number of them recorded in the work of CRUICKSHANK;* I ſhall tranſcribe one of them, for the ſatisfaction of my readers, as the works of the above-mentioned authors are ſomewhat rare in this country. "After one of the animals had been properly ſe-
"cured, and the abdomen opened, portions of the inteſtines
"were quickly emptied, by preſſure, of their contents, and
"warm milk was injected in their place, and confined by
"ligatures. The veins belonging to theſe portions of inteſ-
"tines were emptied of their blood, by punctures made in
"their trunks, and prevented from receiving more blood, by
"ligatures made on the trunks of their correſponding arteries.
"In this ſtate the parts were returned into the abdomen; and
"by their veins being left thus empty, even an abſorption of
"a ſmall

* Vide p. 22

"a ſmall portion of milk would have been detected, as the "coats of the veins are ſo thin, that they would have per-"mitted a white fluid to appear through their ſides as readily "as red blood. The parts having remained in the abdomen "a quarter of an hour, half an hour, or more, they were "again allowed to protrude, and carefully examined: the veins "were nearly as empty as when the parts were firſt returned, "and contained not one drop of white fluid; but the lacteals "were filled with it."

The precaution in emptying the veins was quite unneceſſary, for if the milk had mixed with the blood, it would have been eaſily detected; for the chyle is perceivable in the left ſubclavian vein, where the thoracic duct empties the chyle into it. Hence it appears, from this experiment, that the lacteals are the abſorbing veſſels of the chyle, and not the veins. Some will object to this experiment, becauſe the animal on whom it was made muſt have been under the operation of a conſiderable degree of pain during the experiment, and on this account not ſatisfactory; but, in anſwer to this, it may be conſidered, that the lacteals were not prevented from abſorbing the milk from the pain which the victim experienced during the time the experiment was making, and, conſequently, will be ſufficient to do away that objection. Nature, in all her works, has ſtudied the moſt ſimple poſſible manner in the ſtructure of her machinery, and has allotted to each its proper functions, ſo that no one has to perform more than one office at the ſame time; as ſhe has in no wiſe deviated from her plan, certainly ſhe would not in this inſtance be guilty of inconſiſtency, and wander from her original plan, by giving to the red veins the double office of abſorbing the chyle, and of returning the blood to the heart: ſhe has, therefore, provided the inteſtinal canal with a ſet of veſſels, whoſe expreſs purpoſe it is to take up the chyle, and ſee it ſafely lodged in the left ſubclavian vein. There are other abſorbent veſſels diſtributed over every cavity, and the ſurface of the whole body, which

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abſorb moiſture from the atmoſphere and the lymph which happens to be depoſited in the cavities: it is by means of theſe veſſels that the body is operated upon by contagion, together with the pulmonic organs, and the ſtomach; theſe veſſels take up the matter of contagion, and carry it into the circulation. This will be more fully explained in another part of this diſſertation.

SECT. III. *Of the Properties and Uſe of the Bile.*

PREVIOUS to my offering any remarks upon the ſecretion of the bile and its properties, it will not be foreign to my ſubject to give a brief anatomical deſcription of the organ deſtined for this purpoſe. The liver is the largeſt gland in the body: it occupies a conſiderable portion of the abdominal cavity: its figure is irregular in the human ſubject; it is ſomewhat flattiſh, convex on its anterior, and irregularly concave on its poſterior ſuaface: it is divided into two lobes, named the right and left, of which the right is the largeſt. Beſides theſe, there is another ſmaller, called lobulus ſpigelii: it is contained in the right hypochondrium, and part of the epigaſtric region. The peritonæum, which covers the liver in common with the other viſcera of the abdomen, doubling upon itſelf, is attached to the diaphragm, which forms the ligaments, for the purpoſe of retaining the liver in its proper ſituation. The falciform ligament is ſituated directly oppoſite the termination of the great fiſſure, which divides the liver into the right and left lobes; it is alſo frequently called the ſuſpenſory ligament, from its ſuſpending the liver from the diaphragm. There are two others, called, from their ſituation, the lateral ligaments. Beſides theſe, ſome reckon two others; the one is a portion of the peritonæum, which ſurrounds the blood veſſels called coronary; the other, the ligamentum rotundum: this

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is the remains of the umbilical vein: but there is no ground for believing that they perform any ligamentary functions.*

In a depreſſion on the concave ſurface of the right lobe of the liver is found the gall-bladder, to which it is attached by the peritonæum. It is of a pyriform ſhape; its neck, or ſmall extremity, being ſituated ſuperiorly; its fundus, or large extremity, inferiorly.

Every organ deſtined by nature for the purpoſe of ſecretion, is very plentifully furniſhed with blood, eſpecially thoſe that are intended to ſecrete fluids which are of the greateſt importance in the animal œconomy. The liver, from the great importance of the bile in aſſiſting in ſome of the higheſt functions, is accordingly copiouſly provided with blood, which is very different from what is carried to the other glands for the purpoſe of ſecretion: while the blood from which all the different glands ſecrete their fluids is arterious, that of the liver alone is venous. The liver, like the other parts of the body, receives its nouriſhment from the ſanguiferous ſyſtem. But blood of every deſcription is not fit for nutrition; that only which has received the change of reſpiration, and which circulates through the arteries, is adapted for the ſupport of the animal. The liver receives its nutriment, therefore, from the hepatic artery: this artery is the third and largeſt branch of the cœliac. The blood from whence the bile is ſecreted, is a collection of all the blood ſent to the peritonæal viſcera (the liver excepted), whoſe veins unite into one large trunk, called the vena portarum: after this veſſel arrives at the liver, it branches out into the ſubſtance of that gland: the blood which remains after the bile is ſeparated, is carried, by the hepatic veins, (formed by the union of the termination of the vena portarum and the hepatic artery) into the vena cava aſcendens.

The ſecreting terminations of the vena portarum are the beginning of the hepatic ducts, called pori biliarii; theſe uniting at length, form the hepatic duct; this, in its courſe to the duodenum,

* Poſt's Lectures.

duodenum, is joined by the cyſtic, there forming the ductus cholidochus communis. But, from the periſtaltic motion and diſtenſion of this inteſtine, the paſſage of the bile through the duct will be interrupted, by which means it will be diſtended; conſequently the bile will regurgitate into the gall-bladder through the cyſtic duct.

This fluid is of a deep green colour, more or leſs inclined to a yellow, eſpecially when diluted with any watry fluid; of a very bitter taſte, and of a pungent, nauſeous ſmell. It is of a gelatinous or ſlimy conſiſtence, by which means it is eaſily drawn out into threads, like a clear ſyrup, and froths like ſoap when agitated with water in a veſſel. When this animal ſoap is ſubmitted to diſtillation, it affords a yellow alkaline phlegm, an empyreumatic oil, a conſiderable quantity of the *carbonate of ammonia*, an elaſtic fluid united with carbonic acid and hydrogene gas, and the *carbonate of ſoda*.*

The bile is ſoluble in water: its colour is changed to a yellow, which will be brighter or darker, according to the quantity of water added. The bile is conſidered by phyſiologiſts to aid the digeſtion of the food of animals: this ſuppoſition is grounded upon the capability of this fluid to unite water and oil, by means of the alkaline ſalts which are found to be contained in the hepatic ſecretion. I am inclined, however, to doubt the uſe of this fluid in the proceſs of concoction. The food, after having undergone the operation of the gaſtric juice, is found to be a gelatinous, homogeneous maſs, and therefore needs not the operation of the bile to unite the different particles together; for thoſe who favour this ſuppoſition imagine the ſubſtance of our food, after having undergone the firſt proceſs in the ſtomach, conſiſted of oily and watry particles, and on this account needed the intervention of a third ſubſtance to combine them; but as this is not the fact, there can be no neceſſity for an alkaline ſubſtance to aid this union. It may be uſeful, when ſuch a circumſtance takes place

* Fourcroy's Chemiſtry, vol. iii. p. 195.

place from the powers of the principal digeſting organ being defective, and the aſſimilation incomplete; but this is very rarely or perhaps never the caſe, the food being always or not at all formed into this homogeneous fluid. From the quantity of this fluid ſecreted, and particularly in that ſeaſon of the year when *fevers* are moſt frequent, *I am led to conclude, that its principal uſe in the animal œconomy is to prevent diſeaſes ariſing from the putrefaction of animal and vegetable matter.* The product ariſing from the ſpontaneous decompoſition of animal and vegetable ſubſtances cauſing theſe diſtempers, is the ſeptic (nitric) acid; the alkaline nature, therefore, of this fluid, is admirably well calculated to prevent them.

This truly uſeful and important ſecretion has been ſcourged by the phyſicians of every age, and the greateſt abuſe has fallen from the pens of all the different authors who have undertaken to write upon autumnal diſeaſes. "The bile, (they ſay) during the warmth of ſummer and autumn, becomes putrid, and from this corruption ſpring the different autumnal fevers." In order, therefore, to ſhew the falſity of their doctrines, and to reinſtate this very valuable fluid to that rank among the animal fluids to which it is juſtly entitled, and from which it has been thrown, through ignorance of its qualities, I ſhall only deduce one experiment, which, I truſt, will be found ſufficient to overthrow the elaborate doctrines of the putridity of the bile being the cauſe of theſe diſeaſes. Equal quantities of blood and bile being expoſed under ſimilar circumſtances, the blood on the third day became putrid, while the bile ſhewed no ſigns of putrefaction until the ſixth day, when it began to putrify.* So far, then, from the bile becoming putrid, it is leſs liable to undergo this change than any of the other animal fluids, and poſſeſſes the power of preventing other ſubſtances immerſed into it from being decompounded.† From the above

* Saunders on the Bile, p. 110. Exp. 9 and 10.
† Saunders, p. 130.

above experiments, then, it is evident, that the blood has a greater tendency to putrefaction than the bile; and, consequently, in those diseases which are attributed to the putrid state of the bile, the blood must, agreeable to the above experiment, be in a high state of putrefaction; which, if it did exist, the animal must certainly die the instant that it took place, for these reasons: animal fluids, as well as solids, while they undergo the putrid fermentation, have a quantity of air extricated, by which means they are resolved into their elementary parts, which will form new combinations, according to the chemical laws of elective attraction; that is, the *septon*, *hydrogene*, *carbone*, and a portion of *oxygene*. These elementary principles, which enter into the composition of the blood, will, some of them, unite and form different compounds; while others will remain uncombined. Now, it is a well ascertained fact, that if the least quantity of air finds its way into the blood vessels of an animal, instant death is the consequence; therefore, air being generated during putrefaction of the blood, nothing is more certain, if this takes place in the blood vessels, than that the animal must expire in a few moments. Hence, then, it is certain, that putrefaction in the bile cannot possibly take place, for the blood possesses twice the appetency to become putrid that the bile does, and consequently the animal will die before that process can be entered upon by the bile.

Having proved that the bile is not the cause of those diseases called *bilious fevers*, I shall proceed one step further, by declaring that there are no *putrid fevers*, and that the bile, so far from producing or being the cause of this form of diseases, is, in a certain degree, a preventive. In order to prove this position, it will be necessary to discover what the true cause of those diseases are which have been termed bilious. It is found to be a combination of oxygene with septon. That this is the cause, we shall take for granted in this place, as will be proved in another part of this dissertation. This combination will form

form the ſeptous oxyd, or ſeptous or ſeptic acid, according to the degree of oxygenation. Here, then, is an acid which is the cauſe of thoſe diſeaſes termed *fevers*, for all *fevers* ariſe from the ſame cauſe, differently modified. The bile contains two different alkalies, the *ammonia* and *ſoda*, in combination with a weak acid; theſe alkalies have a ſtronger attraction for the ſeptic, than for the carbonic acid; and agreeable to the laws of elective attraction, the alkalies will let go the carbonic, and unite with the ſeptic acid, (the weaker being diſpoſſeſſed by the ſtronger) and will form the ſeptite of ammonia, and the ſeptite of ſoda; and this proceſs will continue until the whole acid becomes neutralized, or till the alkalies of the bile become ſaturated with the acid. Here, then, is a part, if not the whole of the cauſe of the diſeaſe taken out of circulation; and the ſyſtem will not become diſeaſed, but, from the quantity of the contagious matter being leſſened, its deleterious effects will be in a great meaſure deſtroyed.

They who contend that the bile is the cauſe of the numerous autumnal diſeaſes and *fevers*, are led to this concluſion from the quantity of this fluid that is ſecreted by the liver, and from the quantity which is ſometimes diſcharged in vomiting, appearing black and putrid. This, however, is a very wiſe proviſion of nature, to furniſh the ſyſtem with a large proportion of this health-reſtoring fluid, when the body is moſt liable to be operated upon by ſeptic acid vapours, ariſing from the vaſt maſſes of putrefying materials which ſurround them at this ſeaſon of the year, to prevent, or at any rate to leſſen the violence of the attack, which might otherwiſe carry the patient off. The change of colour in the bile thus thrown out, ſhews the operation it has undergone, by means of meeting the ſeptic (nitric) acid in the alimentary canal; for this acid, on being mixed with the bile, changes it into a dark colour, reſembling coffee grounds. Therefore, inſtead of finding fault with Providence for ſupplying the ſyſtem with this fluid, we ſhould never ceaſe in offering our moſt grateful acknow-

acknowledgments to HIM, for placing in the conſtitution of animals a fluid which is capable, in all ordinary circumſtances, of preventing this claſs of diſeaſes. They further reaſon, from the yellowneſs of the ſkin which takes place in certain diſtempers of this claſs, that its peculiar hue is lemon-coloured, and proceeds from a bilious ſuffuſion, as in that diſeaſe which ariſes from a diſeaſed ſtate of this organ. The fallacy of this, however, will readily appear, ſince, in the diſtempers called putreſcent or malignant, where a yellowneſs of the ſkin appears, it is not owing to a diſeaſed ſtate of the liver, but is a dye or ſtain occaſioned by the ſeptic acid (nitric acid) being applied to the ſurface; for it is a well known fact to thoſe who handle or make much uſe of this acid, that the parts of the ſkin to which it is applied will be turned yellow, and exhibit the particular colour which the ſkin puts on in thoſe perſons affected with yellow-fever. The abſorption of the bile which takes place in jaundice, will have an effect upon certain of the excretions which is not found in thoſe labouring under yellow-fever. The colour of the urine will be deeply tinged with the bile, the fæces will be of an aſh colour: but none of thoſe appearances take place in the yellow-fever. Further, the yellowneſs of the ſkin in this fever, never takes place but when the atmoſphere is highly impregnated with peſtilential vapours, and alſo not till the latter ſtages of the diſtemper. Now, if it was owing to an abſorption of the bile, this yellowneſs of the ſkin ought to take place in the beginning of the diſeaſe, and alſo to make its appearance in the urine, which is univerſally the caſe in the icterus; but this is not the fact. In order to prove that this ſtate of bile which is ſometimes diſcharged of a black and putrid appearance, is occaſioned by the ſeptic (nitric) acid will appear from the experiments made by Maclurg and Saunders; the former made his experiments upon human bile. A quantity of human bile, ſays Maclurg, being mixed with the nitrous acid, its colour

was

was changed to a turbed brown.* A quantity of the bile of an ox being mixed with concentrated nitrous acid, it was changed to a brown colour: on mixing them an effervescence took place.†

That the septic acid and the gaseous oxyd of septon are the causes of those diseases, and not the bile, will be evident from the appearances of the blood taken from patients by venesection, and from dissection. The blood is of a dark colour, sometimes thick, and frequently appears to be in a state of dissolution, liable to corrupt in a very short time; forming polypus concretions in the heart: the blood contained in this organ is black and grumous. Similar appearances take place if the septic acid be injected into the blood vessels, or if the blood be drawn into a vessel containing this acid, or the gaseous oxyd of septon.‡

SECT. IV. *Of the Pancreas.*

THE pancreas, or sweetbread, is a large conglomerate gland, of the nature of those which secrete the saliva: it is situated in the epigastric region, under the stomach, between the liver and the spleen: its figure resembles a dog's tongue. It is composed of a great number of small, soft, glandular bodies, combined in such a manner as to exhibit the appearance, on the outside, of one uniform surface, which is rendered uneven by numerous small convexities, more or less flattened. When these small glandular bodies are separated a little from each other, we find, in the center of the gland, a particular duct, in which several smaller ones terminate laterally on each side, like small rami in a stem. This is called the pancreatic duct, through which the pancreatic juice is conveyed to the duodenum:

* Maclurg on the Bile, p. 44.
† Saunders on the Bile, p. 43.
‡ Vide Appendix A.

duodenum: it is ſometimes double, but for the moſt part there is only one. The pancreas is chiefly ſupplied with blood from the ſplenic artery; but it alſo receives ſome branches from the duodenalis and pylorica, and a few ramifications from the meſenterica ſuperior and gaſtrica major.

Anatomiſts and phyſiologiſts have obſerved a great reſemblance between the pancreas and the ſalivary glands. Chemiſtry has not as yet thrown any great light upon the qualities and properties of the fluid ſecreted by the pancreas, from the difficulty of obtaining a ſufficient quantity of this fluid; but from the obſervations which have been made from the ſtructure of it, its great reſemblance to the ſalivary glands, and the great likeneſs of the fluid to that of the ſaliva, it has been conſidered of the ſame nature, and very probably of the ſame uſe with that of the ſaliva. It is a watery, inſipid, thin fluid; neither acid nor alkaline, and is poured into the ſame place with the bile. The quantity of the juice ſecreted by the pancreas we are alſo unable to aſcertain: if, however, we compare the ſize of it with the ſalivary glands, and the number and reſpectability of the blood veſſels of each, [it is ſuppoſed to be three times as large as the ſalivary glands] the quantity will at leaſt be in the ſame proportion: and further, its ſituation is much warmer than the ſalivary glands, being encompaſſed by the larger viſcera of the abdomen. The uſe of this fluid will appear from this glandular ſubſtance being found not only in man, but in almoſt all the other animals: nor is its uſe to be judged of from the experiment, which ſhews that a great part of the pancreas may be deſtroyed in robuſt animals without occaſioning death; becauſe, in ſuch experiments, a part of it muſt be left adhering to the duodenum.

With the uſe of this fluid we are no better acquainted than with its component parts. We therefore cannot ſpeak with any certainty: it appears, however, to be principally of uſe in diluting the diſſolved food, uniting with it in the duodenum, whereby it is rendered ſo fluid as to be circulated with

greater facility through the abſorbent veſſels; alſo to correct and dilute the viſcid cyſtic bile, and to moiſten the fæces, in order that they may not injure the inteſtinal tube, by their becoming hard and indurated, which they would if they were not prevented by this and ſome of the other fluids which are conſtantly poured into this canal: in ſhort, it performs, in the lower part of the inteſtinal paſſage, all the offices which the ſaliva does in the upper part of it. This fluid, in uniting and mixing with the bile, makes it more active, in the ſame manner as water does ſoap; for without water common ſoap would be incapable to remove foreign matter from thoſe things in which it is uſed ſo effectually as with it.

SECT. V. *The Condition of the Alimentary Canal.*

THE condition of the alimentary canal, which is compoſed of the œſophagus, the ſtomach, ſmaller and larger inteſtines, is the next to be conſidered, as it appears in the healthy ſtate. The œſophagus is the tube which conducts the food into the ſtomach; its inner ſurface is lined with a great number of ſmall glandular bodies, which ſecrete a mucus fluid, which ſerves to make the pulpy ſubſtance paſs down with great facility, and, at the ſame time, affords a ſheath againſt irritating food: the aliment is brought into this ſtate by the operation of maſtication in the mouth: after having been reduced into ſmall parts by the teeth, it mixes with the ſaliva, forming a ſoft maſs; it then deſcends into the ſtomach, and there undergoes the firſt operation of digeſtion, by means of the action of the gaſtric fluid, (which has been ſpoken of before, when upon the ſubject of digeſtion:) here it is changed into an inſipid aſh coloured ſubſtance. Having undergone the operation of the gaſtric menſtruum, it paſſes through the pylorus into the duodenum, there to undergo the operation of chylification, which is continually abſorbed by the lacteals.

Here,

Here, then, the digeſting proceſs is completed. After the lacteals have ſelected their food, there will remain the indegeſta, or a reſiduum of the food which is incapable of digeſtion, and conſequently of no uſe in nouriſhing the animal. The fæces contain a portion of bile, pancreatic juice, and the mucus of the inteſtines for the purpoſe of diluting them, and ſheathing the coats of theſe tubes from the ſtimulant and irritating quality of the feculent matter.

The alimentary fæces of the human body are moſt generally of a yellowiſh bilious colour, and of a ſoft texture, upon its arrival into the large inteſtines; there the proceſs of abſorption ſtill goes on, and becomes more complete here than in the ſmaller inteſtines, from the ſlower motion of theſe inteſtines; and during the ſtay of the fæces, the putrefactive fermentation begins to take place; as is evident from the fœtid odour of them when evacuated during the healthy ſtate of the body. They are, after the ſecond abſorption, thrown out of the body by means of the periſtaltic motion of the inteſtines, together with the preſſure of the diaphragm and the abdominal muſcles. The periſtaltic motion is occaſioned by the fæces accumulating and irritating the inteſtines, and by the ſtimulant qualities of the bile acting upon the muſcles of theſe tubes. I need not make any remarks upon the neceſſity of the feculent matter being evacuated from the inteſtines, as their retention would greatly affect the health of the animal, and be productive of the moſt ſerious conſequences.

SECT. VI. *An Examination of the feculent Matter of the large Inteſtines.*

ON examining the feculent matter of the large inteſtines, we are neceſſarily led to conſider, in the firſt place, the abſorption of the more fluid parts of the fæces. The cœcum and

and the colon, the two firſt of the large inteſtines, are, like the ſmaller, ſupplied with abſorbing veſſels,* to take up the nutrient parts of the food, which are not completely abſorbed from the feculent matter in the ſmaller canal, by means of the rapid motion of the contents of this tube; it was therefore neceſſary, that, in ſome part of the canal, a ſlower motion ſhould take place, ſo that no part of the nouriſhment of the animal ſhould be loſt: in order, therefore, to fulfil this grand object, nature has provided the two large inteſtines with valves, by which means this intention is completely anſwered.

In this part of the inteſtinal canal, after the abſorption of the fluidity of the fæces, a certain degree of putrefaction takes place in the dregs of the aliment themſelves, from the length of time that they are retained there to accompliſh an intire abſorption of the nutrient parts: this is evident from the quantity of gazeous fluid which is emitted from the rectum: theſe airs are found to be thoſe which are produced during the decompoſition of animal and vegetable ſubſtances. The neceſſary promoters of putrefaction being preſent in theſe tubes in ſufficient abundance to produce this effect, (air, heat and moiſture being continually preſent) there can be no doubt of this proceſs going forward in this canal; and further, the contents of theſe tubes being compoſed of ſuch materials as undergo this proceſs with great facility; nay, in their inanimate ſtate they have a great tendency to burſt forth from their compound to their elementary principles; for the living principle is, no doubt, the powerful agent in keeping thoſe refractory companions from diſſolving their confederacy: therefore, as long as bodies poſſeſs the living principle, ſo long will they reſiſt the putrefactive proceſs. That the fæces do undergo the putrefactive fermentation in the alimentary canal will further appear from the effect which takes place out of the body under ſimilar circumſtances. Putrefaction will take place out of the ſyſtem in a degree of heat much leſs than that of the human body; and experiments ſhew, that putrefaction

* Vaughan's Anat. vol. i. p. 417.

faction goes on more rapidly in a confined place, than where the ſubſtances undergoing putrefaction are expoſed to a free and more open ſituation. The extreme fœtor of the fæces is owing to this ſtate of them; hence, then, will it be eaſily to account for the extreme fœtid and nauſeous ſmell of the ſtools of dyſenteric patients, together with an experiment which will be related hereafter, why this phenomenon ought to take place. We have ſhewn that putrefaction does take place in the fæces; it now remains to ſhew, that, during their decompoſition a combination of ſepton with oxygene is formed. The putrefaction of ſubſtances is the decompoſition of their organic ſtructure, and an arrangement of them into new combinations, according to their relative attractions; the ſepton (azote) having a great attraction for oxygene, they will unite and form the ſeptic (nitric) acid. This proceſs will continue if the degree of heat is not ſo great as to change theſe ingredients into an elaſtic aerial form. Now, then, the ſeptic (nitric) acid, uniting with the fæces, will contribute to produce their nauſeous and fœtid ſmell. This ſeems to be proved from the experiments of Pringle;* he united the nitrous (ſeptous) acid to the fæces, in order to prove that it would take off that diſagreeable ſmell which they poſſeſſed, but he found that inſtead of making them leſs fœtid, it greatly increaſed the fœtor of them.

The fæces ſometimes put on an indurated form, which is certainly owing to the feculent matter remaining ſtagnant too long, by which means they loſe their fluidity through the activity of the abſorbing veſſels, which are never at reſt as long as they have any matter to take up: they have been found even to take part of the fæces.

This ſtate of the alimentary canal is produced by a weak and lax ſtate of the muſcular fibres of the guts, they having loſt their irritability from the too long continuance of the ſtimulus of diſtention.

Scybala

* Vide Pringle on the Diſeaſes of the Army, p. 339.

Scybala are alſo frequently found in the inteſtines, from their contents becoming acrid, forming an exceſs of ſtimulus, which, operating upon their muſcular fibres, produce a convulſive affection in theſe muſcles, and occaſion an irregular motion in them, whereby the fæces become formed into theſe ſcybala, or round balls. From their mechanical operation upon the inteſtines and the mouths of the blood veſſels, theſe are irritated to ſuch a degree, that, when evacuations are produced, ſome blood is frequently diſcharged with them; whence, and from the teneſmus, prolapſus ani and hæmorrhoids are produced. Theſe ſcybala have, for a long time, been conſidered as the cauſe of dyſenteric affections; but, ſince the doctrine of contagion lately publiſhed by MITCHILL, Profeſſor of Chemiſtry, Natural Hiſtory and Agriculture in Columbia College, the cauſe of this diſeaſe, as well as all thoſe which come under the common denomination of fever, is much more ſatisfactorily accounted for, nay, it is reduced to a certainty. We have ſeen that putrefaction does take place in the fæces: this proceſs of decompoſition in the alimentary canal forms a new combination between the elementary parts: the oxygene and the ſepton (azote) unite to form the ſeptic (nitric) acid, the carbone and hydrogene to form fat, the hydrogene and oxygene to form water, the oxygene and carbone, together with the matter of heat, to form carbonic acid gas, and the ſepton (azote) and hydrogene to form the volatile alkali. Theſe are ſometimes the product of putrefaction, but moſt generally the ſeptic (nitric) acid is formed.

This chemical union of ſepton (azote) with the principle of acidity (oxygene) forms a very active fluid, which, coming in contact with the inteſtinal tubes, produces inflammation and excoriation. This corroding fluid is the cauſe of the vaſt quantities of blood which is voided by ſome dyſenteric patients, from its deſtructive quality acting upon the blood veſſels: it is ſo very active, that, during the time of evacuation,

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the anus will become excoriated. If the action of this deleterious fluid be ſuffered to remain, gangrene and all its concomitant evil will follow. This matter of contagion will enter the maſs of blood, and produce that conſtant attendant on this diſeaſe, called the dyſenteric fever. How this peſtilential fluid ſhould get into the blood will be eaſily underſtood: its miſcibility with watery fluids enables it to be taken up by the abſorbent veſſels, and paſs with the chyle into the circulating maſs. But this diſeaſe does very frequently originate from a peſtilential ſtate of the atmoſphere, and from the poiſon taken in with the drink, and mixing with the ſaliva, and by the abſorbing veſſels on the ſurface of the body: if to theſe external cauſes be added thoſe produced or generated in the inteſtines, the violence of the diſeaſe will be increaſed. The appearances of the blood are alſo very remarkable: there is a large proportion of ſerum, of a yellowiſh green colour; the blood is of a dark colour; the right ventricle of the heart is generally filled with blood of a more fluid conſiſtence than the left, the left ventricle is found nearly empty with polypi. The peſtilential matter circulating with the blood operating upon the heart, by its ſtimulating power wears out the excitability, and produces death, by indirect debility. This is evident from the ſtate of the pulſe; in the beginning of the diſeaſe the pulſe is hard and full, as it ought to be from the operation of ſtmuli upon the heart; but, as the diſeaſe proceeds, the pulſe grows ſmaller and weaker, and begins to intermit, until death is uſhered in to cloſe the ſcene: this will take place in proportion to the virulency of the infectious matter, and alſo in proportion to the degree of excitability in the heart.

In weak and emaciated bodies, another ſtate of diſeaſe in the alimentary canal is produced. Coſtiveneſs is generally occaſioned by an impaired or weakened digeſtion. When this is the caſe, all the ſecreting organs will be more or leſs affected. The bile, which is a great aſſiſtant in digeſtion, being in leſs proportion than in health, the inteſtinal tubes

loſe

loſe a powerful ſtimulus. This ſtate of the bowels is always found in perſons addicted to ſpirituous liquors, and more eſpecially in thoſe whoſe occupations oblige them to lead ſedentary lives: on this account we find that the female ſex, whoſe daily employments are ſuch as compel them to this kind of life, are more frequently afflicted with this habit of body than men, whoſe avocations are of a more active nature. This ſtate of the bowels may proceed either from direct debility, from its uſual ſtimulus being ſubducted, or of the indirect kind, from an exceſs of ſtimulus. From this view of the different appearances which the alimentary canal exhibits, it muſt be evident in what a variety of ways they are liable to be acted upon by certain cauſes; and, conſequently, the variety of diſeaſes which are produced for want of proper attention to theſe functions of the inteſtines. How very neceſſary, then, is it for the preſervation of health, to attend to this part of the animal œconomy! and how very much will the ſucceſs of the practitioner depend upon the care which he beſtows on theſe circumſtances, in keeping the alimentary organs in their healthy operation!

SECT. VII. *An Inquiry how far Animal Diet is capable of imparting to the Fæces the Power of exciting Dyſenteric Symptoms.*

HOW far animal diet poſſeſſes qualities capable of exciting dyſenteric ſymptoms, or to what degree this quality is inherent in animal food, I ſhall, in this place, endeavour to ſhew.—When I make uſe of the term animal diet, I wiſh to be underſtood as meaning the lean part, and not the fat, as this latter ſubſtance does not poſſeſs the dyſenteric quality, from its containing no ſepton in its compoſition, but conſiſts chiefly of carbone and hydrogene. In order to eſtabliſh this poſition, it will be neceſſary to take a view of the muſcular fibres reduced

duced to their elementary principles, viz. ſepton (azote), carbone, hydrogene, oxygene, a ſmall proportion of ſulphur and phoſphorus. Here, then, is found, in the compoſition of the lean part of animals, the two ſubſtances which, when combined, form the peſtilential fluid. Septon (azote) is found to exiſt in a very large proportion, and the oxygene in no ſmall quantity. During the ordinary proceſs of ſpontaneous decompoſition, they combine together with great fecility and eagerneſs. It may be aſked, however, how it happens that theſe ſubſtances do not remain, after their reſolution in their ſimple uncombined ſtate? This is a wiſe law in the œconomy of nature, that, during the decompoſition of bodies, there ſhall be between certain principles a ſtrong predilection to unite and form new compounds; in this manner to prevent the waſte of thoſe parts. Now, ſo great is the diſpoſition of ſepton (azote) to combine with the principle of acidity (oxygene), if the heat be properly proportioned, that they inſtantly, on being free, ruſh together, and form a chemical union, which produces the ſeptic (nitric) acid. Nay, ſuch is the deſire or prediſpoſition of ſepton (azote) to combine with oxygene, that, in the form of ſeptous gas and acid, it will abſorb it with avidity from the atmoſphere until it becomes ſaturated with the principle of acidity.

That the decompoſition whereby this combination is formed does take place in the alimentary canal, has been ſhewn in ſect. 6; and that the acid is formed during the decompoſition of animal ſubſtances, will appear from the uſe to which ſubſtances, when undergoing the putrefactive proceſs, are put by the manufacturers of the ſeptite of pot-aſh, (nitre). Hence, then, it is evident why this diſeaſe is of ſo frequent occurrence in armies and on board of ſhips of war, where the chief diet of the ſoldiery is meat, and that not of the beſt kind; for it is a well eſtabliſhed fact, that meat cured with ſalt to keep it from becoming putrid, is more or leſs tainted in that ſeaſon of the year when this diſeaſe is moſt frequent among the com-

mon ſoldiers. The concocting proceſs of theſe men becomes debilitated, from the fatigue and hardſhips to which they are expoſed, together with the too free uſe of ſpirituous liquors: from this debilitated ſtate of the organ of digeſtion, the food remains in the ſtomach unconcocted, putrefaction takes place, and in this ſtate it is ſent forth into the inteſtinal tubes; but, from the quick motions of the ſmall inteſtines, it is prevented from producing any bad effects there, and it is with rapidity ſent to the large inteſtines; there, by means of the ſlow motion which theſe parts are endowed with, the putrid maſs remains ſtagnant for a time, and the putrid fermentation takes place with great rapidity; and during the proceſs, this peſtilential fluid is formed, and continues to receive additions as long as there remains matter to undergo this ferment. Further, that animal diet is capable of imparting this deleterious quality to the fæces, is proved from what happens to perſons in different grades in the army; for, during the time this diſeaſe is found among the ſoldiers, the officers are rarely attacked with it. This, then, is juſt as it ought to be, agreeably to the doctrine I have been endeavouring to eſtabliſh; that perſons, from their peculiar ſituations, ſhould be more ſubject to a viſitation of this diſeaſe than others, according to their ability of procuring the neceſſaries of life. The officer, from his ſituation, is not ſo much expoſed to thoſe cauſes which have a tendency to impair or interrupt digeſtion, as the common ſoldier, who is expoſed to the viciſſitudes and inclemency of the weather; conſequently, if he does not lead a debauched or irregular life, the concocting organs will digeſt the food with great alacrity, and thereby prevent putrefaction. Officers have it alſo in their power, from the high wages they receive, to procure and ſelect the beſt proviſions; they likewiſe make more uſe of vegetables; and while they have their tables ſerved with freſh meats, the ſoldiers are obliged to eat thoſe provided by their country, which, in the ſeaſon of the year when this diſeaſe is moſt prevalent, is more

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or leſs advanced to the firſt ſtages of putrefaction. Beſides animal food there are alſo ſome of the vegetable productions which contain this deleterious ſubſtance, particularly wheat, but in a leſs degree than meat, and yet conſiderably more than the vegetables in general, though they all contain more or leſs of this principle. For wheat-flour, being frequently waſhed and ſuffered to paſs through a ſtrainer, will leave behind a gelatinous matter, from which the volatile alkali (ammonia) may be produced: this ſubſtance is denominated vegeto animal gluten. Ammonia is found, from analyſis, to be compounded of ſepton (azote) and hydrogene.* HOMBERG, a German chemiſt, found that the fæces of men fed upon coarſe bread contained a *ſalt*, which, when expoſed to fire, detonated like nitre. GARDINER obſerves, that perſons who were convaleſcent, and who had been attacked with dyſentery or intermitting fever, on eating animal food had a relapſe.†

SECT. VIII. *A Chemical Analyſis of the Fæces.*

AFTER having examined how far animal diet is capable of imparting to the fæces qualities of exciting dyſenteric ſymptoms, we are neceſſarily led to conſider the qualities of the fæces, as appears from a chemical analyſis, by their emitting *hydrogene gas*, *ſulphurated hydrogene gas*, *phoſphorated hydrogene gas*, *carbonic acid gas*, and *ſeptous (azotic) gas.*

Hydrogene gas (inflammable air) is ſo great an ingredient in our daily nouriſhment, that this circumſtance of itſelf is a ſufficient evidence of its exiſtence in the human body, but more eſpecially in the inteſtinal canal; for it is a principal ingredient in water and ſpirits, and a portion of it is continually floating in the atmoſphere; even meats contain a conſiderable part of the radical of this gas. Water is very readily decompounded

* Fourcroy's Chemiſtry, vol. i. p. 339.
† On Animal Economy, p. 360.

pounded in a temperature leſs than that of the body of animals who breathe the common air of the atmoſphere, and more eſpecially if the animal be fed with fleſh, and a degree of putrefaction takes place in the alimentary canal: the ſepton (azote) of the fleſh having a greater attraction for the oxygene of the water than the hydrogene; conſequently the oxygene and ſepton (azote) will, agreeable to the laws of elective attraction, unite and form the ſeptic (nitric) acid, while the hydrogene will combine with the caloric of the water, and paſs off in the form of hydrogene gas. That the ſepton (azote) has a greater attraction for the oxygene than the hydrogene, and conſequently that it will decompound water, is evident from the phenomenon of lean meat, immerſed in a running ſtream of water, being turned into fat; for the ſepton of the meat, uniting with the oxygene of the water, eſcapes in the form of ſeptic (nitric) acid; while the hydrogene of the water, uniting with the carbone of the fleſh, forms the carbonate of hydrogene, or fat.*

This gas has frequently manifeſted itſelf to perſons engaged in diſſecting human bodies in the night: in coming to open the abdomen, it has ruſhed out, and taken fire by the candle. Hydrogene gas is inflammable, burning with a pale blue flame; it has no ſenſible ſmell in its pure ſtate. Flatus is frequently diſcharged from the inteſtines without any ſenſible ſmell. Air, thus emitted, has been found to burn by being brought into contact with an electric ſpark.

Sulphurated hydrogene gas is a frequent occurrence in the alimentary canal, even more ſo than the hydrogene gas itſelf; for it is a well eſtabliſhed fact, that, if there be any ſulphur in the neighbourhood of hydrogene, the ſulphur will be diſſolved by the hydrogene, and remain ſo even if the hydrogene be changed to the form of hydrogene gas, and form the ſulphurated hydrogene gas. The ſulphur is furniſhed by animal and vegetable ſubſtances taken as food. The impreſſion which

* Vide Gibbs's paper in the Repertory of Arts and Manufactures, vol. ii. p. 108 and 109.

which the flatus emitted per anum makes upon the olfactory nerves, corroborates this fact; it resembles the odour arising from putrid or rotten eggs, which is known to hold a quantity of sulphur in solution. The sulphur may be obtained from the atmosphere also, from the solubility of this substance in hydrogene gas, which, arising in and occupying the upper stratum of our atmosphere, from the hydrogene being specifically lighter than common air; and during a thunder-storm, the electric fluid coming in contact with this gas, it takes fire and burns; the sulphur is set loose, and is again precipitated to the earth; and during this time it may be taken into the stomach, and this sometimes may be one of the means of its origin. Phosphorated hydrogene gas is also sometimes found to exist in the intestinal tubes. The phosphorus enters into the composition of the bones of animals; for this substance, being united to the principle of acidity, forms the phosphoric acid, which, uniting with lime, forms the phosphate of lime or bones. This principle does also exist in animal substances, especially fish; for these animals, during putrefaction, will exhibit a shining appearance in the dark, like the brilliancy of a diamond; and it is also sometimes found in the fat part of animals. Vegetables likewise contain some of the phosphorus, as mustard, and all the plants belonging to the same class. During the decay of wood, this luminous appearance is very striking, and is a circumstance well known, and therefore needs only to be mentioned. The gas emitted, which has phosphorus in solution, will also be evident to those who have had an opportunity of smelling the peculiar odour of this substance, and can be easily distinguished from the sulphurated hydrogene gas. The disagreeable smell of the breath of persons whose teeth are decayed, is owing to this substance being set loose from its union with lime, which enters into combination to form the teeth. This peculiar smell of the teeth will enable us to determine whether the disagreeable smell of the gas emitted per anum, is owing

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to ſulphur being diſſolved in the hydrogene gas or phoſphorus; for either the one or the other it muſt be to produce any ſenſible effect upon the olfactory nerves; for the hydrogene has no ſenſible ſmell in its ſimple ſtate.

Carbonic acid gas is another fluid which is contained, in great abundance, in the alimentary canal. Carbone is one of the principal ingredients in our food; all the animal and vegetable ſubſtances contain this principle; theſe, undergoing decompoſition, evolve this ſubſtance, which, combining with caloric, or the matter of heat, and the acidifiable principle, oxygene, forms this acid gas; for ſuch is the attraction which carbone has for oxygene, that the former cannot be brought into the ſtate of gas without its combination with the latter. This fluid alſo exiſts, in a ſmall proportion, in the atmoſphere, and it may be derived from this ſource by its mixing with our food, drink, and the ſaliva; and it may be carried with them, in this way, into the ſtomach. From the univerſality of this ſubſtance, and the great proportion of it which is daily taken into the ſyſtem, there can no doubt remain of its exiſtence in the inteſtinal tubes. It is alſo found, in great abundance, in drinks, which are very generally in uſe in this country, the fermented or malt liquors: from this ſource it may be conſidered as derived in the greateſt quantity.

There is yet one other gaſeous fluid which may exiſt in the alimentary canal; for it is one of the principal ingredients compoſing the food of thoſe who make uſe of animal ſubſtances. It alſo exiſts, in a leſs proportion, in the compoſition of ſome vegetables. Septous (azotic) gas is produced from the decompoſition of animal and vegetable ſubſtances; it is the principle of putrefaction. This ſubſtance takes on the form of an elaſtic fluid, or gas, in the ordinary temperature of our atmoſphere. This gas is alſo one of the principal ingredients in compoſing our atmoſphere, it being compoſed of $\frac{71}{100}$ of ſeptous gas, $\frac{27}{100}$ of oxygene gas, and $\frac{2}{100}$ of carbonic acid gas. Here, then, may be a principal ſource whence this gas

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may be derived; from the miſcibility of the enumerated aerial fluids with water, ſaliva, and our diet, they may be carried along with them into the ſtomach. From theſe remarks, and the great abundance of ſome of theſe gaſes in the articles which are daily uſed, I am led to conclude, that all of them do more or leſs occur in the inteſtinal canal.

SECT. IX. *Arguments to prove that neither of thoſe Gaſes have the Power of producing Dyſentery.*

THAT hydrogene gas has no agency in producing this diſeaſed ſtate of the large inteſtines, will appear from the great uſe made of ſubſtances which have this principle for its baſis, and which make chiefly the fluid parts of our aliment; and from the frequent occurrence of this gas. We ſhall next ſee, that this gas, combined with other ſubſtances, will be nearly as inoffenſive as in its ſimple form. In combining carbone with its baſis, hydrogene, a very mild and nouriſhing compound is formed, one that is greatly in uſe as an article of diet. This compound is fat, which no perſon will contend to be deleterious to the conſtitution, but contributes greatly to nouriſh the animal. In combining hydrogene and oxygene, we ſhall have water formed, which is much uſed as a drink. Hydrogene and ſepton (azote), when united, form the volatile alkali (ammonia). This is uſed, in medicine, with great ſucceſs in ſome diſeaſes, and given in large quantities, without dyſentery ever occurring from its liberal uſe. Similar compounds will be formed with the combinations of the different elementary principles united to the ſulphurated hydrogene gas, and the phoſphorated hydrogene gas; with this difference, that the two latter will, in ſome of theſe compounds, eſpecially when united with oxygene, have a quantity of ſulphur in ſolution; while, in the others, the ſulphur and phoſphorus will be precipitated; and theſe two ingredients, whether combined with

with the above principles or in a ſimple ſtate, are equally innocent with the other, as they are found in the body in a combined ſtate, with ſome one or all of the above principles.

In the ſame manner is the carbonic acid gas equally innocent with the hydrogene gas, it being always preſent in the animal conſtitution: it is emitted from the lungs in large proportions during expiration; and the frequency of its occurrence in the alimentary canal, without producing this ſort of ſickneſs, is a ſufficient fact to prove that this cannot be the cauſe of the diſeaſe. In its combination with other ſubſtances it will be found equally inoffenſive.—Further, it is well known, that at preſent it is conſidered a very valuable remedy in certain diſeaſes, and preſcribed in large doſes; as is evinced by the late diſcoveries and experience of BEDDOES, and other pneumatic phyſicians; which is a ſtrong corroboration of the reaſoning deduced, that the carbonic acid gas is incapable of exciting dyſenteric ſymptoms.

Septous gas is alſo as incapable of producing dyſentery as any of the other gaſes: it is continually preſent, in ſome degree, in the alimentary canal: being one of the moſt abundant ingredients in the atmoſphere, it finds its way into the ſtomach and inteſtines by mixing with the food, water and ſaliva; and, conſequently, if this gas was the cauſe of the diſeaſe, the human ſyſtem would never be without an affection of the large inteſtines.—I have given a combination of the principles which are the baſis of the different gaſes enumerated, as found to exiſt in the alimentary canal, in order to ſhew that theſe combined poſſeſs no qualities more deleterious to animals, than in their ſimple ſtate, or that of gas: but theſe ſubſtances never combine together after they are united with caloric (or matter of heat) to form new compounds, on account of the repelling power of caloric, which is continually operating in oppoſition to the power of attraction; therefore they cannot come in contact with each other to form theſe compounds according to the laws of affinity or elective attraction.

CHAP.

CHAP. II. *The Medical Conſideration of the Subject.*

SECT. I. *The Cauſe producing Dyſentery, and the Connection between this Diſeaſe and others ſhewn.*

HAVING ſhewn that the different gaſes found to exiſt in the alimentary canal are not the cauſe of dyſentery, we further have ſeen, that theſe, combined together according to the laws of affinity, are alſo incapable of exciting this diſeaſed ſtate of the large inteſtines. We ſhall next ſhew that ſepton (azote), combined with the principle of acidity (oxygene), is capable, and, moreover, is the only true cauſe of this diſeaſe. The facts, however, ſhewing that an acid is the cauſe of dyſentery, are of the indirect kind: no experiment as yet has been made to aſcertain the fact; though, from the analyſis of matter taken in as food, producing an acid, under certain circumſtances, and alſo excrements being uſed for the purpoſe of obtaining the acid for the formation of nitre (ſeptite of potaſh), we are led to conclude that this is the caſe; and the ſame operation which produces this acid out of the body, is found frequently to take place in the inteſtinal tubes.—PRINGLE poſitively declares, that an acid exiſts in the fæces, which he calls "the feculent acid."* The ſeptous acid, on being united with the fæces, inſtead of allaying the fœtor, increaſed it, contrary to the expectation of the experimentor.† This acid is called, by him and other writers, the mineral acid.‡ Hence the increaſed fœtor of the ſtools of patients in this diſeaſe; and hence alſo a ſtrong proof that the acid of ſepton is the cauſe of this diſeaſe. From the analogy of the food made uſe of by the human ſpecies, it is found to contain the baſis

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* Diſeaſes of the Army. Appendix, p. 385.

† Pringle, p. 339.

‡ The ſeptous (nitrous) acid has, for a long time, been ſuppoſed to be a mineral production, but has lately been found to be of animal and vegetable origin, produced by putrefaction.

of this acid in a large proportion, for animal diet is much more uſed than vegetables among that part of the human ſpecies which ſuffers moſt from dyſentery. The fæces of a man fed upon coarſe bread has been found to contain a ſalt, that detonated like nitre, when expoſed to fire, as made by HOMBERG. MACQUER,* in his remarks on HOMBERG's experiment, ſays, "that its nitrous character is by no means "ambiguous: its deflagrating on live coals convinced Mr. "HOMBERG of its being nitre. But its conſtantly taking "fire in the retort, as often as diſtilled, is a ſure proof that it "is a nitrous ſalt."

This alſo is a certain fact, and one in point, to prove that the ſeptic acid is produced or generated in the alimentary canal; and alſo proves the great uſe of the bile in preventing thoſe diſeaſes, by ſaturating the acid with the alkali, and thereby preventing the miſchief which would otherwiſe have been the conſequence.

The ſeptic (nitric) acid formed in the alimentary canal, in this experiment, is ſaturated by the mineral alkali of the bile forming the ſeptite (nitrite) of ſoda. If, then, this acid is produced in the alimentary canal of a man fed upon bread, in what greater proportion ought it to be found in thoſe who are fed upon lean or muſcular animal matter, which contains the baſis of this acid in a greater proportion than bread or corn! There is no doubt but this acid is more or leſs conſtantly formed in the inteſtinal tube, as proved by the experiment of HOMBERG; the alkali contained in the bile being in ſufficient quantity to neutralize and form a ſeptic (nitric) ſalt.

MASSEY,† in his paper on ſalt-petre, declares, that the ſtrongeſt ſeptic (nitric) acid is formed in the ponds and tanks, or ſhallow ponds of water, in the Eaſt-Indies, by the ſpontaneous decompoſition of animal and vegetable matter in thoſe tanks or ponds. Animal ſubſtances, ſays PRINGLE,‡ will putrefy

* Chemiſtry, vol. ii. p. 372.

† Vide Repertory of Arts and Manufactures, vol. i. p. 322.

‡ Diſeaſes of the Army, p. 339.

putrefy quicker in a confined than in a free air. MASSEY* further afferts, that the putrefaction of manures, ſtinking pits and ditches, produce the nitric acid. Having proved that an acid exiſts in the alimentary canal, and that this is the ſeptic (nitric) acid, I ſhall ſhew from what other ſources this acid is derived beſides being generated in that canal.

Having eſtabliſhed the fact, that an acid is formed in the inteſtinal canal, and that this is the ſeptic (nitric), it will appear evident, from thence, how it comes to paſs that this diſeaſe is produced, while no cauſe from without the body can be diſcovered, and eſpecially in that ſeaſon when a few ſporadic caſes are met with. It does not follow from hence, that all the dyſenteries ariſe from an internal cauſe; but a much greater proportion proceeds from the gaſeous oxyd and volatile acid of ſepton (azote), taken in the body from without. In an atmoſphere that is incumbered with peſtilential fluids, theſe may affect the ſyſtem of ſuch perſons as are expoſed to their operation by entering in the pulmonic organs, there mixing with the blood, and exerting its influence on the heart; and as the blood paſſes in its rotine of circulation, give to the contents of the alimentary canal a part of its deleterious quality, or may be taken into the ſtomach during the time of our meals, and be ſwallowed with the food. From their miſcibility with water and fluids in general, the ſaliva becomes another mode of carrying it into the alimentary canal; and laſtly, it is abſorbed from the atmoſphere by the numerous abſorbing veſſels ſpread over the whole ſurface of the body, in the ſame manner as mercury and other ſubſtances are taken up by theſe veſſels, when applied to the ſkin. From theſe different modes in which peſtilence penetrates the body, it will appear what vaſt quantities of the matter of contagion may be taken in, and why it happens that the patient is ſo frequently attacked in the ſpace of a few hours after being expoſed to ſuch air; provided that the atmoſphere which he breathes be highly

* Vide Repertory of Arts and Manufactures, vol. i. p. 321.

ly charged with the matter of contagion. It is owing to peſtilence, alſo, that a fever is produced, which is termed dyſenteric fever: ſo ſtrong is the connection of fever with dyſentery, that it is reckoned a neceſſary ſymptom by writers on this diſeaſe; but a dyſentery, or, at leaſt, the affection of the large inteſtines, which, when united with fever, is called dyſentery, may exiſt, for a ſhort time, without fever: this, however, is only in ſporadic caſes, where there is no vitiated ſtate of the atmoſphere: but ſo quick is the abſorption of this fluid from the large inteſtines, that it is taken into the circulation, and, operating upon the heart and arteries, produces that particular action of the ſanguiferous ſyſtem termed fever, almoſt as quick as the operation of its effect upon the alimentary canal. On the contrary, the fever may exiſt previous to any affection of the large inteſtines, provided the exciting cauſe be taken to the blood veſſels by the pulmonic organ, and, through means of the blood, impart it to the large inteſtines.

Marſh-miaſmata have, for a long time, been conſidered as the cauſe of this diſtemper, together with putrid fumes. Let us conſider what theſe cauſes are, and wherein they differ. Marſh-miaſmata are the fumes ariſing from ſwampy and marſhy ſoils, wherein are found vaſt quantities of frogs, newts, inſects, and other animals of the like kind, together with vegetable ſubſtances, which are continually undergoing ſpontaneous decompoſition by putrefaction: theſe impart to the water and ſoil a ſtrong ſeptic (nitric) tincture, which, evaporating by the heat of the ſeaſon, imparts its deleterious quality to the atmoſphere, where it floats, and is waſted by the wind in every direction, and affects ſuch perſons as are in its neighbourhood. This will appear the more certain by a fact taken from MASSEY:* his words are—"But it muſt not be forgotten, that their [ſpeaking of the Eaſt-Indies] ſtrongeſt nitrous (ſeptous) earths are found at the bottom of their tanks and ſhallow ponds of water, which, in that country, are often

* Vide Repertory of Arts and Manufactures, vol. i. p. 323.

" often of great extent, and in which, the water being eva-
" porated by the heat of the ſun, large quantities of fiſh are
" left to corrupt, which furniſhes a mud of the *ſtrongeſt ni-*
" *trous* (ſeptous) *quality*." Hence marſh-miaſmata, or the fumes ariſing from marſhes, are nothing but the gaſeous oxyd of ſepton (azote), and ſeptic acid gas; and the dyſentery produced by marſh-miaſmata is, conſequently, owing to the ſeptic (nitric) quality of the water with which it is made to exhale by heat; for, the evaporation of the pure water certainly would not have the ſame effect, as there is nothing deleterious in this fluid. PRINGLE* ſays, " the intermitting fever, cho-
" lera, and dyſentery, may as properly be called the endemics
" of camps as of low and *marſhy* countries."

Fumes from corrupting animal and vegetable ſubſtances are another cauſe capable of producing dyſentery, and as ſuch are enumerated by ſome authors. Let us alſo examine what putrid vapours are, and wherein they differ from marſh-miaſmata. The product of putrefaction has been fully ſtated [in ſect. 7] to be the formation of certain new compounds, from decaying organic matter. The oxygene and ſepton (azote), combining during this proceſs, form the ſeptic (nitric) acid. " Pu-
" trid juices and vapours are diſperſed through the earth and
" air, ſo that there are few earths, of an abſorbent kind, that
" are not, in ſome degree, nitrous."† All theſe ſeptic vapours which are enumerated, and which have been ſuppoſed to be of different kinds, are capable of producing dyſentery, and are in reality ſimilar; excepting, that, in the one, this peſtilential fluid is formed in low and marſhy ſituations, while the other undergoes the ſame proceſs in any ſituation favourable to putrefaction. Dyſentery may ariſe from two cauſes; from acrimony generated in the body, and from putrid ſteams. " A
" remarkable caſe occurred to me, of a perſon ſeized with
" dyſentery, upon ſmelling of human blood become putrid
" by

* Diſeaſes of the Army, p. 10.

† Vide Repertory of Arts and Manufactures, vol. i. p. 324 & ſeq.

"by ſtanding ſome months in a cloſe phial."* Now, it is known, that the vapours of putrid blood, attracted by chalk, form calcarious nitre, and are conſequently of a ſeptic nature. How far, and what agency or qualities animal diet poſſeſſes capable of exciting this diſeaſe of the large inteſtines, has already been ſhewn in ſect. 7. I intended to have ſhewn further, that it poſſeſſed, in ſome degree, this quality, by comparing the diſeaſes of the inferior order of animals with thoſe of the human ſpecies; but the diſeaſes of the domeſtic, as well as thoſe of wild animals, are as yet hidden behind the curtain of obſcurity. No perſon has conſidered it of much moment to note the diſeaſes incident to brutes, not even thoſe of that majeſtic and uſeful animal the horſe. I truſt, however, that when we come to pay more attention to the diſeaſes of the brute creation, we ſhall find that thoſe who make uſe of ſuch diet as contains ſepton, whether animal or vegetable, will be found to be ſubject to this diſeaſe, and to all the other diſtempers ariſing from the ſame general cauſe.

SECT. II. *The Effects of Peſtilential Fluids upon the Meſentery and its Glands.*

BESIDES the affection of the large inteſtines, by the operation of peſtilential fluids, other parts in the neighbourhood of them will be liable to become diſeaſed by its influence. The parts that are moſt frequently affected by them, will be the meſentery and its glands, as the deleterious fluid will be more immediately applied to them by means of abſorption. The ſeptic (nitric) compounds, paſſing through the lymphatic veſſels, produce a degree of inflammation, which will be communicated to thoſe glands through which they paſs in their courſe to the thoracic duct, and excite in them an inflammatory action, which will induce a ſchirrous or indurated ſtate of

* Pringle on the Diſeaſes of the Army, p. 227.

of them. It is alſo frequently communicated to the whole of the meſentery, as appears from the diſſection of a perſon who has died of dyſentery.* That this matter of contagion is abſorbed by theſe veſſels, is evident from the production of fever in ſporadic caſes of dyſentery; for the matter of peſtilence, being firſt produced or generated in the large inteſtines, is afterwards abſorbed and carried into the blood veſſels, and, by the operation of its ſtimulus, occaſions an increaſed action of the heart and arteries.

The waſting of the body, called maraſmus, which ſometimes takes place in this and other ſimilar diſeaſes, depending upon peſtilential vapours for their cauſe, can alſo be explained upon the ſame principle. As the glands become indurated by the application of theſe ſeptic (nitric) combinations to them, it will appear evident, that, during the operation of the matter of contagion upon them, the chyle will be in ſome meaſure obſtructed in its circulation through theſe glands, and, conſequently, the body will not receive its accuſtomed quantity of nouriſhment, or what is adequate to the quantity waſted in the performance of its healthy functions: the natural concluſion, therefore, will be, that the body muſt waſte away, and occaſion the phenomenon of the diſeaſe termed maraſmus.—Further, it will appear evident, that this ſtate of the meſenteric glands does take place, by comparing them with the effect which peſtilential fluids are known to have upon the glands which come more immediately under our view. The axillary and inguinal glands we know to be operated upon in this manner, by theſe vapours: for it is a well authenticated fact, that induration of the axillary and inguinal glands takes place in the plague, ſmall-pox, and all the other diſeaſes produced from an highly concentrated peſtilential ſtate of the atmoſphere. The abſorbent veſſels are capable of being traced from the part where this deleterious fluid has been applied, quite to their termination into theſe glands. As a further corroboration

* Vide ſect. 3, on Diſſections.

roboration of what has been ſaid, it will appear, from the ſimilar effects which are ſometimes found in the glands contained in the inteſtines, for the purpoſe of ſecreting a fluid for the lubrication of them, that they are found to be indurated, or ſchirrous, in perſons who have died of the dyſentery.*

Theſe remarks will be further confirmed by the frequent dropſical affections which follow long-continued dyſenteries, intermittent fevers, and all the other diſeaſes produced by the ſame cauſe. The obſtruction of theſe glands is, in many inſtances, the cauſe of dropſy; for the lymph, being incapable of paſſing through theſe glands, is depoſited in the different cavities and cellular textures of the body producing the phenomenon of this malady; and the generality or locality of the diſeaſe will be in proportion to the univerſality of the obſtruction. That dropſies are frequently occaſioned by a ſchirrous ſtate of the meſenteric glands, will appear from the obſervations of BROOKS.† Intermittent fevers alſo ſometimes produce a ſchirrous or indurated ſtate of the viſcera, as appears from the remarks of the Baron VAN SWIETEN.‡ Dyſentery, ſays M'BRIDE, changes frequently to a ſerous diarrhœa.§ The diarrhœa following dyſentery depends, no doubt, upon an obſtruction of the meſenteric glands, occaſioned by the inflammation excited by the peſtilential fluid, which prevents the lymph of the inteſtines from being depoſited in the receptaculum chyli, and cauſes this ſerous fluid to paſs off by the bowels, and produce what the authors above-named call a ſerous diarrhœa. That this is the caſe appears from the obſervations of BROOKS,‖ that diarrhœa is produced from a ſtimulus which irritates the viſcera, occaſioning the expulſion of their fluids from the veſſels of the liver, pancreas, meſentery, and inteſtines: when, at the ſame time, the mouths of the meſenteric

* Vide ſect. 3. chap. 2.

† Practice of Phyſic, vol. i. p. 301.

‡ Vol. vii. p. 198.

§ M'Bride's Practice of Phyſic, vol. ii. p. 233.

‖ Practice of Phyſic, vol. i. p. 340.

ſenteric veins and the lacteals are obſtructed. This author further adds, that dropſies are produced by a long-continued lienterious dyſentery, and ſchirrous of the meſentery.* Hence, then, it appears, from the above conſideration, that an obſtruction of the meſenteric glands may take place in a long-continued caſe of dyſentery, and other diſeaſes depending upon the ſeptic (nitric) compounds for their exciting cauſe.

SECT. III. *The Appearances from Diſſection.*

THIS is further confirmed from the appearance, on diſſection, of patients who had died of dyſentery. This diſeaſe always manifeſts itſelf in the large inteſtines, but moſt generally the colon and rectum are only affected; they have a black and putrid appearance; the coats are preternaturally enlarged, much ulcerated on the inſide, and gangrenous; the villous coats are either wholly abraded, or changed into a corrupted and ſlimy ſubſtance, of a greeniſh colour. The ſtomach and ſmall inteſtines are neither mortified, nor diſcoloured: ſometimes, however, they are diſtended with air. The meſentery is alſo affected, eſpecially the glands; ſo is the omentum, which puts on a greeniſh colour. The liver has been found to be affected; but this is a very rare occurrence. The bile is ſometimes found to be ropy, thick, and of a dark hue. That part of the vena cava aſcendens which lies upon the vertebræ, is alſo affected, and is very tender. The ſpleen has alſo been found affected.

PRINGLE† found the large inteſtines ulcerated, black, and putrid; the heart in this patient contained clotted blood: the blood in the veſſels was fluid, but of a blackiſh colour; while the ſtomach and ſmall inteſtines were found in a healthy ſtate.

* Brooks's Practice of Phyſic, vol. i. p. 301.
† On the Diſeaſes of the Army, p. 227.

RICHTER* obſerves, in giving an account of the diſſection of a young lady who died of a dyſenteric affection, that he found the large inteſtines gangrenous.

HOFFMAN† found, on diſſecting dyſenteric patients, that the large inteſtines were deprived of their villous coat; that they were inflamed, ulcerated, and mortified.

DONALD MONRO never has ſeen ſimilar eroſions of the villous coats of the ſmall inteſtines in any of the bodies of thoſe who died with dyſenteries.‡

CLEGHORN, in his obſervations on the diſeaſes of the Iſland of Minorca, treating of dyſentery, ſays, "upon opening "the bodies of the dead, I have conſtantly found the great "guts either entirely mortified, partly inflamed, or partly "mortified: in many I have ſeen ſchirrous tubercles ſtraitening the cavity of the colon in ſeveral places; in a few "there were ſmall abſceſſes in the cellular membrane of the "peritonæum, contiguous to the colon and rectum; ſometimes "the ſmall guts were perfectly ſound in appearance, but more "frequently the lower part was inflamed, the convolutions "being often preternaturally connected to each other by "membranes, as the lungs ſometimes are to the pleura. In "two people the omentum was almoſt entirely waſted, the "ſmall remains of it being quite black; while purulent water was found in the cavity of the abdomen. In ſeveral it "was inflamed, and adhered both to the guts and peritonæum. "For the moſt part the gall-bladder was full of dark bile, "and the ſpleen more or leſs in a putrid condition."§

PRINGLE‖ gives an account of the diſſections of the bodies of ſome patients who died of dyſentery, which was epidemical, in London, in the fall of 1762, where, beſides the common appearance of the rectum and colon, he obſerved, on

* Medical Obſervations, p. 103.
† Practice of Medicine, p. 176.
‡ Diſeaſes of the Army, vol. i. p. 330.
§ Cleghorn, p. 227.
‖ Diſeaſes of the Army, p. 251.

on the inſide of the lower part of the colon, and the upper part of the rectum, a number of ſmall tubercles or excreſcences, which reſembled the ſmall-pox, of a flat ſort, differing from them in this, that they were of a firm conſiſtence, and without any cavity.

From theſe appearances of the contents of the abdomen, we find that the colon and rectum are the ſeat of this diſeaſe, as they were always found to be diſeaſed, while the other parts in their neighbourhood remained ſound; yet, we find, that ſometimes, however, the parts near them are affected; and it is what we ought to expect, from the nature of peſtilential fluids ſpreading, in the more malignant form, through a great part of the contents of the abdomen; conſequently we find it to affect the lower part of the ſmall inteſtines, the omentum, liver, gall-bladder, ſpleen, ſtomach, peritonæum, and the meſentery, and producing in them ſimilar appearances with thoſe of the original ſeat of the diſeaſe.

SECT. IV. *A View of the Connection of Dyſentery with the Intermitting and Remitting Fever.*

THIS principle is further confirmed, from the connection between dyſentery and the intermitting and remitting fever. That there ſhould be ſuch an intimate connection between thoſe diſeaſes, is evident from the ſimilarity of the cauſes producing them. It has been proved that dyſentery ariſes from marſh-miaſmata and putrid vapours: theſe two cauſes have alſo been ſhewn to be the ſame; producing, when collected or condenſed, the ſeptic (nitric) acid. The intermitting fever is alſo produced by theſe cauſes, as is alſo the remitting. Hence, then, it follows, that theſe diſeaſes ariſe from the putrefaction of animal and vegetable ſubſtances, producing, by this ſpontaneous decompoſition, peſtilence (the gaſeous oxyd and acid of ſepton). The peſtilential fluids being ſo abundant, in nature, produced from the reſolution of animal and vegetable

table matters into new combinations, by means of the putrefactive fermentation, that it is easily accounting for the frequency of these diseases, and especially in camps, ships of war, and transports, where great numbers of people are crowded together, and many corrupting materials are accumulated, by reason of the filth and nastiness incident to such situations, through negligence of their commanders and owners; and to these being also united the effluvia arising from each other.

WADE* is of opinion, that fevers and dysentery are ailments of a kindred nature, prevented and cured in the same manner; and that they do, in every case, arise, in those climates, from the bowels and their contents.

GARDINER† observes, that marshy and fenny grounds emit the greatest abundance of this miasma, from the immense quantity of animal and vegetable matter, which is continually undergoing decomposition, and which, consequently, emits large portions of putrid exhalations; the activity of which is increased in proportion to the quantity or degree of putrefaction.

HUNTER‡ observed, that the dysentery and remitting fever ran into each other, from the similarity of the causes producing them, in Jamaica.

PRINGLE§ observed, that intermitting, or marsh fevers, during the warm season, were very apt to put on a double form or paroxysm, or to change into a continued form, rather than to remain in the intermitting shape: he also found the putrid and contagious fevers changing into dysentery.

But marsh-miasmata are not the only cause of these diseases, says GARDINER:‖ they are also found to be produced in jails, hospitals and ships; and also in private families, especially

* On the Diseases of the East-Indies, p. 130.
† Animal Economy, p. 18.
‡ Medical Commentaries, vol. xiii. p. 195.
§ Diseases of the Army, p. 210, 211.
‖ Animal Economy, p. 185.

cially among people of the poorer claſs. This ſtrongly proves the ſimilarity of the marſh-miaſmata to the human or putrid vapours which are conſtantly exhaling from the bodies of men who do not pay proper attention to the cleanlineſs of their perſons; they both producing the ſame effect, as appears from the reſpectable authority juſt quoted.

ZIMMERMAN,* in his deſcription of the dyſentery in Switzerland, in 1765, obſerves, that there exiſted a great connection between dyſentery and putrid fevers.

SAUNDERS† found a relation between the bilious yellow fever, intermitting, and the bloody-flux.

Several caſes, during the laſt ſeaſon, appeared in the New-York hoſpital, of dyſentery changing into the intermitting fever, and the intermitting fever changing into dyſentery. In the one, a perſon came into this inſtitution, with an intermitting fever; after a few days it changed into a dyſentery; and two or three days after, it again changed into the intermitting; and continued to alternate, in this manner, two or three times, when he became cured. The others were perſons who had contracted dyſentery in the houſe from the privy, as was ſuppoſed by the attending phyſicians,‡ (after they were convaleſcent from other diſeaſes). The dyſentery changed into the intermitting, and, as before, changed again into dyſentery; from which affection they were cured.

JACKSON§ obſerved, that, in the firſt ſtages of the yellow fever, ſymptoms occurred which would lead the phyſician to conclude that it was a dyſenteric affection.

JOHN MILLER‖ conſiders dyſentery as only a more malignant remitting fever.

It appears from GARDINER'S¶ treatiſe on bilious remitting and

* In his Treatiſe on Dyſentery, chap. 2.
† Medical Commentaries, vol. vi. p. 511.
‡ Mitchill and E. H. Smith.
§ Fevers of Jamaica, p. 179.
‖ Vide Bird on the Army, p. 285.
¶ Animal Economy, p. 335.

and intermitting fevers, that he ſuppoſes them to be produced by the ſame cauſe, only differing in the virulence of the contagious matter producing them. He obſerves, in ſpeaking of the bilious remitting and intermitting fevers, that the different forms in which theſe diſeaſes ſhew themſelves, in encampments, are thoſe of the moſt malignant kind; they are quotidians, tertians, quartans, diarrhœas, dyſenteries, &c. This laſt is the moſt frequent in camps and military hoſpitals. This author further ſays,* that it is common for continued fevers to remit, intermit, and at laſt to end in dyſentery.

CARMICHAEL SMITH† is of opinion, that all kinds of contagious fevers, as well as the jail, have their cauſes ariſing from the putrefaction of animal and vegetable ſubſtances.

The ſame author declares,‡ that fevers ariſing in conſequence of expoſure to putrid vapours or contagion, aſſume a variety of types and forms, according to the various combinations and degrees of putridity. From the ſlighteſt vernal intermittent to the true plague, are only different ſhades of the ſame diſeaſe, and are the production of one common cauſe, viz. putrefaction.

JOHN HUNTER,§ in his diſeaſes of the army in Jamaica, ſays, "there ſubſiſts an intimate connection between the remitting fever and dyſentery, in this iſland: the one frequently changes into the other, and the two diſeaſes are often complicated with various degrees of violence. In ſome caſes dyſentery ends in the remitting fever; though it oftener happens that the fever terminates in dyſentery."

Dyſentery, ſays REID,‖ is ſo intimately connected with the remitting fever, that ſome late writers have ſuppoſed it the ſame. He further adds, that it ariſes from the ſame cauſe, and, according to his late mode of treating it, he uſed the ſame

* Animal Economy, p. 356.
† On Jail Fever, p. 40 & ſeq.
‡ P. 50—1.
§ P. 218.
‖ Diſeaſes of the Army, p. 50.

ſame remedies, and with ſucceſs. Petechiæ are found in bad dyſenteric caſes, and ſome few have univerſal yellowneſs of the ſkin.

CLEGHORN* obſerves, that, from the great ſimilitude there is, in many reſpects, between the tertian fever and the dyſentery, he was induced to treat them in the ſame manner. He further adds,† "the tertian fever, cholera-morbus, raſh, eſſere, "diarrhœa, and dyſentery, are frequently epidemics; there "being a near alliance between all theſe diſeaſes: theſe fre-"quently put on tertian periods, and they change ſometimes "in one and ſometimes in the other: a tertian is ſometimes "changed into a dyſentery, and ſometimes a dyſentery changes "into a tertian; and when one of theſe diſeaſes is ſuppreſſed, "the other often enſues."

From theſe facts, then, it appears, that there is not only a great connection ſubſiſting between the intermitting and remitting fevers, and dyſentery, but alſo between this diſeaſe and the yellow fever of the Weſt-Indies, which is the moſt malignant of any, except the plague. The plague is only a higher degree of the yellow fever. That it is produced by the ſame cauſe will appear from the deſcription of the ſituation of Grand Cairo, the ſeminary of the plague.‡ "It is "ſituated in a ſandy plain, at the foot of the mountain, which, "by keeping off the winds, that would refreſh the air, makes "the heats very ſtifling. Through the midſt of it paſſes a "canal, which is filled with water during the overflowing "of the river Nile; and after the river is decreaſed, it gradu-"ally dries up. Into this canal the poeple throw all kinds of "filth, *carrion*, &c. ſo that the ſtench ariſing from this, and "the mud together, is inſufferable. In this poſture of things, "the plague, every year, conſtantly preys upon the inhabit-"ants, and is only ſtopt when the Nile, by overflowing, "waſhes away the load of filth."

MEAD

* P. 255, 6.
† P. 134.
‡ Mead on the Plague, p. 29, 30.

MEAD* further obſerves, that, from putrefaction in theſe northern climates, we find ſometimes very fatal diſtempers, though they do not riſe to the malignity of the plague; and ſuch fevers are often bred where a large number of people are cloſely confined together, as in jails, ſieges, and camps. Hence, then, it is evident, that all the grades of fever, from the intermitting up to the plague, ariſe from the ſame cauſe; and that this cauſe is contagion, produced from the putrefaction of animal and vegetable matter; and that this is the volatile ſeptic (nitric) oxyd and acid, as has been ſhewn before: and further, that there is a connection and intimacy between theſe fevers and dyſentery; conſequently dyſentery is produced from the ſame cauſe. The ſeptic (nitric) acid is the cauſe of theſe diſeaſes; and according to the virulence and activity of this peſtilential fluid, and the parts of the body to which it is applied, will depend the peculiar form of thoſe diſeaſes, as well as the malignancy of them; theſe diſeaſes differing only as to the part expoſed to the operation of this contagious matter, and alſo the degree of concentration and ſpiſſitude of the ſame peſtilential fluid.

SECT. V. *An Examination whether and in what Manner the Dyſentery, and Intermitting and Remitting Fevers, are infectious.*

IN conſidering the manner, and under what circumſtances, the intermitting and remitting fevers, and dyſentery, are infectious, it will only be neceſſary to ſhew, that if any one of them is ſo, it will be a neceſſary conſequence that the others are capable of communication from one to the other, under ſimilar circumſtances, as they are all produced from the ſame cauſe, but differently modified. I ſhall ſhew, in the firſt place, that dyſentery is infectious, as it has been a matter of great diſpute,

* On the Plague, p. 33, 34.

dispute, for a long time, and has been warmly contested between the two parties engaged in this speculation. I do not undertake to side with either party, but will endeavour to evince that both are wrong, and that the truth lies between.

The dysentery may or may not be infectious: this, however, depends upon circumstances. If, for instance, a patient is kept in a pestilential atmosphere, as in that of most bedchambers in which persons sick with diseases are; if it be not frequently changed, together with the linen and sheets; and if the discharges by stool, which are fœtid, be suffered to remain in the room; and whenever cleanliness is neglected; under these circumstances this disease will be infectious. But, on the contrary, where every attention is paid to cleanliness, the room frequently changed, and ventilated; with a due regard to these circumstances, it will be found that it is not capable of being communicated from one to the other; and by this means it will be prevented from spreading to those who are necessarily obliged to be about the diseased person. The reason why this disease rages so violently in camps, and other places where a great number of persons are crouded together, is because of an inattention to cleanliness, and a proper care of removing all putrid substances from about their habitations: the disease is continually receiving additional quantities of this pestilential fluid from the exhalations from their bodies; to which may be added what is derived from their privies.

PRINGLE* found the camp dysentery always contagious when it appeared in the fall.

Baron VAN SWIETEN† relates a case where a physician, who was engaged in an examination of the stools of a dysenteric patient, fell ill with the disease himself, as also the person employed to wash the linen which had been dirtied by the stools.

ZIMMERMAN‡ informs us, that dysentery becomes infec-

 tious

* Diseases of the Army, p. 214.

† Vol. ix. p. 357 & seq.

‡ Vol. ii. p. 126.

tious by the extreme putridity of the ſtools; that the moſt healthy ſubjects, and even animals, are affected with it. This author further relates an account of a dyſentery which had been brought from Amſterdam to Nimiguen, and from thence ſpread to fifty Dutch places, and carried off a great number of people. This diſeaſe, continues he, was ſo malignant at Bern, in 1768, that thirteen thouſand died with it.*

PRINGLE† was a man whoſe opportunities were very great, while in the army, to make obſervations on this diſeaſe, and was alſo a very nice and accurate obſerver; and it is on this account that I refer my reader ſo often to his writings. He gives an account of the ſtate of the ſick while the army was in Hannau: there were about fifteen thouſand perſons ſick; the greateſt number were affected with dyſentery, by which means the air became vitiated to ſuch a degree, that not only the reſt of the patients were attacked with this diſeaſe, but alſo the apothecaries, nurſes, and attendants, with moſt of the inhabitants of this village.

Theſe facts, taken from authors the moſt reſpectable in the profeſſion, will, I truſt, be ſufficient to convince every candid reader, that this diſeaſe, under the circumſtances which I have mentioned, will, to a certain degree, be infectious. On the contrary, where oppoſite circumſtances exiſt, this diſeaſe will be found incapable of being communicated from the one to the other, as daily experience muſt evince: it will not be neceſſary, therefore, to produce proof to corroborate this, as it is a well known fact, that dyſentery, attacking a patient whoſe ſituation in life is ſuch that a proper attention can be had to keep his apartment clean, and every thing neat about him, rarely or never infects the attendants. What has been advanced with regard to dyſentery, will hold good with the intermitting and remitting fevers. But, as it is generally ſuppoſed that the intermitting fever is not infectious, I ſhall produce

* Vol. ii. p. 127.
† P. 22.

produce an authority to prove that it is. CLEGHORN,* in his diſeaſes of the Iſland of Minorca, ſays, " tertians have as " good a right to be called infectious, as the meaſles, or the " ſmall-pox." That the fevers commonly remitting are alſo infectious, is a well eſtabliſhed fact. That the remitting fever, of which kind the jail is conſidered, is infectious, will appear from the authority of MEAD.† " Nothing (ſays this author) " approaches ſo near the firſt origin of the plague, as air pent " up, loaded with damps, and corrupted with the filthineſs " that proceeds from animal bodies. Our common priſons " afford us an inſtance of ſomething like this, where very few " eſcape what they call the jail fever, which is always attended " with a degree of malignity."

I am aware of the arguments which thoſe who do not believe theſe diſeaſes capable of being communicated from the ſick to thoſe who are in a ſtate of health, will uſe to maintain the poſition, that they are either epidemical or endemical from the peſtilential ſtate of the atmoſphere; and that every perſon will be more or leſs liable to be affected with thoſe diſeaſes from this cauſe. I grant this to be the caſe generally. But will not the perſons who attend and nurſe the ſick be more liable to be affected than thoſe who are not converſant with them? I anſwer, yes, moſt certainly; and I am ſupported by the authority of CLEGHORN and FORDYCE, who both declare this to be the caſe; and this is eaſily reconciled; for there is always exhaling from the ſick infectious effluvia, which in general may not be ſufficient to produce the diſeaſes; yet we are warranted to believe, that they may be ſometimes capable of exciting theſe unhealthy ſtates of the ſyſtem.

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* P. 132.
† Mead on the Plague, 110, 111.

SECT. VI. *Of the Phenomena of Diſeaſes ariſing ſporadically, endemically, and epidemically.*

HAVING conſidered the connection ſubſiſting between dyſentery and the intermitting and remitting fevers, we are neceſſarily led to conſider the phenomena of theſe diſeaſes, as ariſing ſporadically, endemically, and epidemically. Diſeaſes are ſaid to ariſe ſporadically, when a few ſcattering caſes of a particular diſeaſe is found to exiſt; the ſporadic diſeaſes, or their cauſes, are generally produced in the body or neighbourhood of the patient's habitation. Thus, when a dyſentery is produced from the putrefaction of the contents of the alimentary canal, it is the cauſe of a ſporadic affection. The matter produced by the putrefaction of animal and vegetable ſubſtances we have denominated the gaſeous oxyd of ſepton (azote), if oxygenated to the half acid point; the ſeptic (nitric) acid, if the acid be raiſed to a highly oxygenated ſtate, by the addition of the principle of acidity. Theſe may be produced in the body in the ſame manner as they are formed out of the ſyſtem; the inteſtines occaſionally containing all the requiſites neceſſary to produce putrefaction.

They are conſidered endemical when particular countries are more ſubject than others to a viſitation of certain diſeaſes, ariſing from peculiar cauſes, generated more frequently and in greater proportion; the ſtate of the atmoſphere being vitiated more or leſs, according to the proportion in which the cauſes producing them originated; theſe ariſing from local ſituations.

Epidemics are diſeaſes which, at certain times, are popular, and attack many people at the ſame time. Theſe diſtempers appear, and generally prevail, then for a time diſappear; they are ailments to which every country is more or leſs liable to be affected, according to circumſtances. The modes

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by which the fluids caufing thefe difeafes are taken into the conftitution will be confidered in another part of this work.

Permit me, before I enter upon the manner of preventing the dyfentery, to make a fhort digreffion, in order to remark upon nofologies, as the fyftems now extant are very exceptionable in feveral points of view.

The beft nofological arrangement, at prefent, is that formed by CULLEN; this elaborate and tedious work, though very imperfect in its claffification, has its ufe; its defects will point out to a future nofologift how to avoid the improprieties which it poffeffes; yet the manner in which this laborious philofopher has defcribed many of the difeafes, will be fufficient to hand down his name to pofterity. But this, like previous arrangements, is very exceptionable. As long as the nofologifts fhall form their arrangements upon any other bafis than the true caufe of difeafes, fo long will they be defective.

The only true method of forming a perfect and lafting claffification of difeafes, is to trace them from the caufes which produce diftempers; and all maladies arifing from the fame caufe fhould be claffed together, and under the fame genus, and their variations fhould be marked as different fpecies. Befides the method of the arrangement of CULLEN, fome of his terms are alfo liable to objections, as being vague and unmeaning. His term fever is the moft fo of any other, upon this principle, that it conveys no proper idea of the difeafe. *Fever* is derived from the Latin word *fevere*, to burn, or be hot: this alone fhews the impropriety of the term; for it is well known to phyficians, that what is called fever frequently exifts without any increafed heat; but, on the contrary, it is lower than the temperature of the body in a ftate of health. And further, if heat be the criterion to judge of the prefence of fever, every local affection of fome internal part will come under this denomination; "in fact, the whole number of "fymptoms enumerated in fevers, are fo many diftinct dif-
"eafes."

"eaſes."* CULLEN alſo places ſynocha with the ſimple affections termed fever. I queſtion very much, however, the propriety of this claſſification; a pure ſynocha, unaccompanied with a local affection, very rarely if ever occurs, and ought to have been ranked with thoſe diſeaſes. The term dyſentery is liable to the ſame objection: it would, perhaps, be more proper to call it the remitting fever of the alimentary canal. With regard to the arrangement, it is ſtill more exceptionable than the name; it ought to be arranged with the ſimple fevers, as it is produced by the ſame cauſe, and is only a different ſpecies of the ſame genus. The diarrhœa and cholera-morbus are alſo miſplaced, as they frequently ariſe from the ſame cauſe with the dyſentery: their proper place would be different ſpecies of the ſame genus; and their method and indications of cure are the ſame with thoſe of the diſeaſes before-mentioned; and, in ſhort, all the diſeaſes ariſing from peſtilential fluids ought to be arranged under the ſame genus, and formed into ſpecies, according as they are found to vary in their affection; for the ſame general treatment will hold good in them all.

If I ſhould proceed to point out all the imperfections of this noſologiſt, (which are leſs than any of his predeceſſors) I ſhould far exceed the limits preſcribed to a diſſertation. My intention, in theſe remarks, is not to detract any thing from the merits of the author, but only to point out what ſeemed to me to be the beſt plan of conſtructing a noſology, which ſhould be capable of ſtanding the teſt of time, and which ſhould be a compend of the practice of phyſic; by which means the young and inexperienced practitioner would not be miſled from the proper method of treating diſeaſes; for, by recollecting the treatment of one form of diſeaſe, the ſame ideas would apply to every ſpecies of that genus: he would there alſo find the exciting cauſe, and would proceed to remove that cauſe, not the ſymptoms; as this is the ſureſt and the

* Preface to Zoonomia, vol. ii. p. 10

the only way we can remove diſeaſes. It is too frequently the caſe, at preſent, that phyſicians preſcribe remedies for ſymptoms; and until practioners pay more attention to diſcover the true cauſes, there will always be ſome diſeaſes which will baffle phyſicians in their cure. It is on this account that ſome of the diſeaſes have been ſtiled the opprobrium medicinæ, becauſe phyſicians are not acquainted with the exciting cauſes producing them.

SECT. VII. *The Method of Prevention.*

HAVING completed the conſideration of the phyſiological, and entered upon the pathological parts of the ſubject, it yet remains incumbent on me to conſider the method of prevention and cure. The prevention of diſeaſes is as much the care of the phyſician as the cure of them, and requires a greater degree of penetration and diſcernment, as a perfect knowledge of the cauſes, and alſo the circumſtances neceſſary to produce them, is requiſite. The cure, in ſome caſes, may be made from a mechanical knowledge of medicine. In order, however, to prevent this diſeaſe, the following indications ought to be obſerved.

1ſt. The patient ſhould avoid all ſeptic aliment, ſuch as the whole claſs of animal ſubſtances, except their oils and fats, in that ſeaſon of the year in which the diſeaſe is moſt prevalent, and ſubſtitute a vegetable diet. Lean and muſcular animal ſubſtances, as has been ſhewn, contain a large proportion of the baſis of peſtilential fluids, which, combined with oxygene, have been proved to be the cauſe of dyſentery; and, on the contrary, that vegetables contain it in a leſs proportion: hence, then, it follows, that vegetable diet is to be preferred to that of animal.—The atmoſphere is impregnated with this deleterious fluid, which, being taken into the body by means of the ſtomach, lungs and abſorbing veſſels, will, if there

there be no addition from within, produce only a mild affection; but if, through ſeptic aliment, there be an addition from within, the diſeaſe will be aggravated, and inſtead of a mild dyſentery, a more violent affection will enſue: from which the neceſſity of prohibiting ſeptic food muſt be evident.

2d. The next conſideration which preſents itſelf to our view, is the avoiding coſtiveneſs. This has been univerſally conſidered by HIPPOCRATES, GALEN, and their followers down to the preſent time, to be an important conſideration in preventing diſeaſes in general; and in no caſe will it be found more neceſſary than in the preſent. The fæces, by remaining ſtagnant in the alimentary canal, and undergoing putrefaction, will produce the peſtilential fluid, or the cauſe of this diſtemper of the large inteſtines, as has been proved in a former part of this diſſertation; and by this means, if there be no addition of ſeptic (nitric) acid from the atmoſphere, a ſporadic dyſentery will be produced. Coſtiveneſs alſo weakens the body, and prediſpoſes it to the operation of contagion; by which means it leſſens the power of the ſyſtem to become habituated or ſeaſoned to the influence of the ſtimulus of peſtilence: it alſo indicates an interruption in the proceſs of digeſtion.—It will appear evident, that this ſtate of the bowels ought to be attended to, from this conſideration, that the fæces being ſuffered to undergo putrefaction in the inteſtinal tube, the matter of contagion will be formed there: this being united with a peſtilential ſtate of the atmoſphere, the patient will be more liable to be affected by it than thoſe who receive no addition from within; and if the peſtilential ſtate of the atmoſphere ſhould be ſo conſiderable as to be ſufficient to produce this diſeaſe, it certainly will be aggrevated by ſuch addition.

3d, and laſtly. The patient ſhould avoid a peſtilential air, which, according to the ſtate of impregnation of the atmoſphere, will be found more or leſs liable to affect the alimentary canal; nay, ſuch ſituations ſhould be avoided as the only certainty of eſcaping the diſeaſe. Although ſome conſtitu-

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tions are capable of remaining in tainted atmospheres without being taken sick, owing to the system becoming habituated to the action of this stimulus; yet this is no certain criterion to form a judgment, whether or no a person will escape the operation of this pestilential fluid: this, however, is certain, and for the reasons before stated, that persons abstaining from animal diet will be more likely to escape infection under similar circumstances, than those who make a free use of it. For the same reason it will appear, that of two persons, under a similarity of circumstances and situation, the one using animal food, the other vegetable; the former will be more severely attacked by this disease than the latter. If proper attention be paid to these circumstances, they will generally prove sufficient to prevent any affection of the large intestines: it will, however, frequently happen, from the particular circumstances of some inhabitants, that these observations cannot be complied with, and they will be attacked with this malady: they will therefore become the objects of cure.

SECT. VIII. *The Method of Cure.*

IN order to make a cure, the physician must administer such remedies as will prevent the disease, or exciting cause, from wearing out the excitability of the part affected. When I speak of curing the disease, I would not wish to be understood as meaning to prescribe a specific; for we have no such medicine; and it is a doubt whether any such remedy has ever cut short a disease: I therefore mean such remedies as will lessen the operation of the cause, in order that the body may not sink under its deleterious operation; and in so lessening this fluid, the body will, with greater certainty, become habituated to this particular action of the exciting causes; particularly as the disease will run its full time before a person can recover from any attack. It is upon this principle that all diseases are

ſaid to be cured, though the recovery has been aſcribed to certain remedies, and it is upon this principle that we can reconcile and explain the ſucceſs with which ſome oppoſite remedies have been in vogue, in curing diſeaſes. Phyſicians may be equally ſucceſsful in certain mild diſeaſes, although they make uſe of the moſt oppoſite remedies. The conſtitution of man poſſeſſes the power of becoming habituated to the action of certain ſubſtances which are deadly in their operation, beyond conception. We find that the moſt inveterate poiſons may be taken with impunity, and little or no inconvenience be experienced from them, provided a certain quantity be taken at firſt, and gradually increaſed. If a perſon, who is not accuſtomed to poiſonous matter, takes a doſe leſs than one which an habituated perſon may take, immediate death will be the conſequence. This power to take large quantities of poiſons is ſufficiently verified in the ſingle inſtance of perſons who are capable of taking a wine-glaſs full of laudanum without experiencing any other effect than a ſpecies of intoxication; while, on the contrary, a perſon unaccuſtomed to its ſtimulus would die almoſt inſtantly. Who is that preſumptuous phyſician that would pretend to cure the ſmall-pox? I believe none will be found who has hardineſs enough to attempt any ſuch thing. The only circumſtance to which the phyſician has to attend, is to prevent the variolous poiſon from producing indirect debility: the conſtitution will become gradually habituated; and in this manner the patient gets well. The ſame thing takes place in the meaſles; and I have not the leaſt doubt, that every diſeaſe has a certain period to which it will run in ſpite of all the healing art can do, and at which time the body will become habituated to the ſtimulus producing the diſeaſe. There are, however, ſome conſtitutions which require a longer time to become familiarized than others; and when they are incapable of becoming habituated, death muſt enſue; as it muſt alſo

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when the degree of the exciting cauſe is very conſiderable, and receiving continual additions.*

The indications of cure are three: 1ſt. To remove ſeptic and feculent matter from the alimentary canal. 2d. To correct the vitiated ſtate of the atmoſphere, or to remove from it. 3d. To allay the inflammation, and the other injuries which the alimentary canal may have ſuſtained by the original cauſe of the diſeaſe, and the remedies made uſe of to effect a cure.

1ſt. Great care ſhould be had to evacuate the contents of the inteſtines freely, in order to remove any ſeptic or feculent matter which may be found there. The reaſon for this precaution is obvious, as theſe ſubſtances, if left in the alimentary canal, would act as a fountain to foſter or generate the original or exciting cauſe, and add to the violence of the diſeaſe. The remedies which I ſhall recommend for this purpoſe are, the carbonate of pot-aſh (ſalt of wormwood), acetite of pot-aſh (regenerated tartar), ſulphite of pot-aſh (vitriolated tartar), tartrite of pot-aſh (ſoluble tartar), tartrite of ſoda (Rochelle ſalt). Theſe ſalts are decompounded by the ſeptic (nitric) acid, which coming in contact with them, the alkaline baſes will part with the acids with which they are combined, and unite with the ſeptic according to the laws of attraction, and form with them ſeptites. By this means the cauſe of the diſeaſe will be removed, and the patient reſtored to his former ſtate of health. The muriate of ſoda (common ſea ſalt), with the vegetable acids, is alſo highly recommended in this diſeaſe. WRIGHT † obſerves, that marine ſalt diſſolved in any of the vegetable acids, operated as a charm in dyſenteries, in the Iſland of Jamaica, when all the other remedies which have been celebrated in curing this diſeaſe had failed.

This

* Vide Appendix B.

† Medical Commentaries, Philadelphia edition, vol. vi. p. 121.

This is corroborated by the experience of others. This ſalt, like all the others, owes its good effects to the alkali with which the marine acid is combined, the ſeptic (nitric) acid being ſtronger and having a more powerful attraction for ſoda than the muriatic: the ſoda quits its combination with its former acid, and combines with the ſeptic (nitric), forming a ſeptite of ſoda.

The vegetable fixed alkali (carbonate of pot-aſh) will be found to be a very efficatious remedy in this diſeaſe, as appears from its effects in the two caſes annexed to this paper, where it has had the deſired effect, while all the other remedies generally employed had failed. The doſe which may be given with ſafety is four grains diſſolved in half an ounce of water, and repeated every two or three hours, until natural ſtools are evacuated. If jalap or rhubarb be combined with vegetable fixed alkali (carbonate of pot-aſh) its operation will be greatly aſſiſted; for, while the pot-aſh attracts the ſeptic (nitric) acid, and deſtroys its deleterious quality, the jalap or rhubarb will tend to remove the matter contained in the alimentary canal. The oleum ricini and the cerated glaſs of antimony have alſo been found to be of ſervice in removing the contents of the inteſtines. After having evacuated the inteſtines, we are next to endeavour to relieve our patient of the teneſmus: this will be anſwered by making uſe of the ſtarch enema with the tincture of opium; a mucilage made of any of the gums, as the gum arabic, a decoction of marſh-mallows, with laudanum, or an oleaginous mixture with anodynes. While the tincture of opium tends to take off that extreme irritability of the inteſtines, the ſtarch forms a ſheath for them, which defends them againſt their acrimonious contents, and in this manner ſupplies the place of the mucus, which is deſtroyed by the ſeptic acid.

While we are turning our attention to the alimentary canal, we ſhould not neglect to cleanſe the body externally,

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in order to remove all ſeptic matter from its ſurface, which, if neglected, would, in a great meaſure, retard the recovery of the patient. For this purpoſe I would recommend the cold bath, which, while it cleanſes the body, will, at the ſame time, ſubduct the ſtimulus of heat, and make the patient more comfortable, and alſo produce a diaphoreſis.

2d. After having cleared the alimentary canal of the peſtilential matter exiſting there, the next circumſtance which requires the attention of the phyſician is the ſtate of the atmoſphere ſurrounding the patient. The vitiated ſtate of it is to be corrected; or, if we ſhould not ſucceed, we are to remove the patient. The chamber of the ſick ought to be perfectly ventilated, and frequently changed; and care ſhould be taken, immediately after the removal of the ſick, to clean the floors with alkaline ley, and white-waſh the walls with lime. By this means the peſtilential matter will unite with the lime and alkali, and form ſeptites, and thus be taken out of circulation.

Sprinkling cloths with vinegar would ſupply a grateful odour to the ſick. The food of the patient muſt not be cooked in an impure atmoſphere, for peſtilential fluids have a great tendency to mix with water; neither ought the drinks of the patient to be ſuffered to remain in vitiated air; for, through the neglect of theſe precautions, we may unexpectedly find the diſeaſe increaſed, without being able to account for it. The frequent changing of the bed-cloths will alſo greatly contribute to the recovery of the patient, as it is a notorious fact, that they are capable of imbibing large quantities of the matter of contagion, eſpecially woollens, cottons and feather beds; and further, they are very apt to communicate it to perſons who are in health: we cannot, therefore, be too careful and attentive to theſe circumſtances. The linen of the ſick ought alſo to be very frequently changed, as much of the ſucceſs of our practice depends upon a due attention to cleanlineſs.

I cannot, in this place, help noticing a practice which commonly

monly proves too fatal to the ſick, but which has been ſtrenuouſly recommended by certain practitioners, in order to purify the atmoſphere—a method which muſt appear to every intelligent and candid obſerver as highly reprehenſible; and inſtead of purifying the atmoſphere, muſt make it leſs pure than before—a practice which muſt be conſidered to be injudicious and improper in the extreme, and can only be the reſult of ignorance and prejudice. The practice I allude to is the burning of certain combuſtible ſubſtances, as tar and ſulphur; nay, any attempt to purify the air by combuſtible materials ought to be avoided, as they act powerfully in vitiating the atmoſphere; and upon this principle; during combuſtion, oxygene (vital air), ſo neceſſary to ſupport flame, is abſorbed, by which means that vital fluid which already exiſts in too ſmall a proportion in the atmoſphere, is deſtroyed, and thus the air neceſſary for animal exiſtence will be intirely expelled, or at leaſt ſo much diminiſhed as to endanger the life of the patient.

If, however, we ſhould not ſucceed in purifying the atmoſphere, we ſhould remove the ſick out of it into that which is uncontaminated by this peſtilential poiſon. This precaution we ought never to omit, whenever the ſituation is ſuch as to render it practicable. This will greatly accelerate the recovery of the ſick, as every addition from without muſt greatly retard the cure, and moſt generally will wear out the conſtitution, and cauſe the death of the patient; for, during the continuance of the patient in ſuch an atmoſphere, the power of becoming habituated to the diſeaſe may not always be ſufficient to counteract the continual accumulation of the peſtilential ſtimulus.

3d. In the laſt place, we are to turn our attention to allay the inflammation, and other injuries which the alimentary canal may have ſuſtained, by the original cauſe of the diſeaſe and the remedies made uſe of in order to effect a cure. For this purpoſe, bleeding will be neceſſary, not only to allay the inflammation,

inflammation, but alſo to prevent the matter of infection from wearing out the excitability of the heart, and producing indirect debility, and its frequent conſequence, death. That there is infectious matter in the ſanguiferous ſyſtem, is certain from the fever which attends this diſeaſe. While we adminiſter cathartics to the alimentary canal, we ſhould not neglect to purge the blood-veſſels, and ſubduct the ſtimulus or infectious matter from the blood; the bleedings ſhould be ſmall and frequent; but this, in a great meaſure, muſt depend upon the judgment of the practitioner, as circumſtances ſhould require: we ſhould not be deterred from taking a ſufficient quantity on the approach of ſyncope, as no bad conſequence will ariſe from this circumſtance; nor ſhould we be prevented from repeating it, from the diſeaſe or fever not yielding to the ſecond or third bleeding, nor, in the firſt inſtance, from the ſmallneſs or weakneſs of the pulſe, as it will riſe after or during bleeding. In this manner the blood-veſſels will be emptied or cleared of the matter of infection; when the patient ſhould be directed to take nouriſhing ſoups. In order to ſhew more clearly how bleeding will leſſen the quantity of peſtilence contained in the blood-veſſels, I ſhall explain in numericals. Suppoſe, for inſtance, the blood contains peſtilential matter equal to 100, and by bleeding you draw off a portion equal to 20, it is evident, that there will remain infectious matter equal to 80: if, therefore, the operation be repeated two or three times, you will reduce it to leſs than half its original quantity. This is not the only advantage derived from bleeding; it is a powerful ſudorific, which is alſo of conſequence to be attended to, as the remedies commonly adminiſtered for this purpoſe are too ſtimulant: the moſt of them contain opium, and therefore illy accord with the inflammation in the inteſtines. The injuries which the alimentary canal has ſuſtained from the original cauſe of the diſeaſe and the remedies, ought alſo to be attended to. It will perhaps be aſked, what injury the remedies do to the inteſtinal canal?

canal? or how it can be poſſible that remedies can do that injury, and yet the patient get well? The medicines made uſe of for this purpoſe muſt certainly have ſome effect upon the guts, or otherwiſe they would not be capable of producing any change whatever, but be inert, which is not the fact. They muſt operate from ſome ſtimulant quality inherent in them; and every thing that ſtimulates muſt leave an effect after the operation of ſuch ſtimulus; but ſtill the good effect which they produce greatly overbalances the ſituation in which they leave thoſe parts, which is much leſs than the original cauſe, and from which the patient will ſooner and very readily be relieved, by the efforts of nature alone. To ſhew this, I ſhall ſuppoſe the operation of the peſtilential fluid to be as 100, and the effect of the remedy as 10: now, if by giving the remedy we remove the original cauſe, which is as 100, there will remain a diſeaſed ſtate of 10 in the alimentary canal; conſequently the leſſer evil will be preferred to the greater. To repair theſe injuries, mild tonics, and a rich and nouriſhing diet, together with pure air and gentle exerciſe, will be ſufficient.

The diet for the uſe of the patient ſhould be rich ſoups, milk and vegetables: the lean part of animals ought to be prohibited during the whole period of the diſeaſe, and even when the health of the perſon is reſtored it ought to be uſed very ſparingly, as it would be liable, from the powers of digeſtion being weakened, to bring on a relapſe: it could not be completely digeſted, and putrefaction would take place, and regenerate the cauſe of ſickneſs, more eſpecially if the diſeaſe occurred in that ſeaſon when the atmoſphere is more or leſs charged with peſtilential vapours.

The tonics ought to be mild, as the excitability muſt be reduced to the healthy ſtandard, otherwiſe we ſhould endanger the patient by producing another diſeaſe; for the exceſs of ſtimulus deſtroying the excitablity, or reducing it beneath the healthy point, will occaſion a diſeaſe as dangerous as the original.

ginal. An infusion of the chamomile flowers has been much esteemed: if to this infusion a small proportion of the carbonate of pot-ash (the salt of wormwood) be added, it will be greatly aided in its operation; for this reason the debilitated state of the stomach and intestines, from the operation of the septic compounds, will incapacitate them from performing their functions completely; consequently a small portion of the septic acid will perhaps be formed, and endanger a relapse. Now, while the tonic quality of the infusion tends to restore the system to its healthy point, the alkali will assist it, by destroying the septic compounds which may be formed, and thus tend to prevent a second attack, and insure a more speedy recovery. The colombo, the cinchona, and all the other mild tonics may be used; but the particulars of them must be left to the prescriber and the particular circumstances of the patient.

CASES.

I am favoured by Dr. BAKER *with the following Case.*

" I WAS requested to visit Mrs. F—CH on Sunday, Feb. " 5, 1797; I found her of a slender habit, light hair, large " eyes, round face, about twenty-two years of age, in the se- " venth month of her pregnancy. She complained of pain in " the abdomen, tenesmus, frequent mucus stools streaked " with blood, pain in the head, nausea, and small quick pulse. " From the above symptoms it appeared to be a case of true " dysentery, and I ordered the following medicines: Ol. ri- " cini half an ounce, statim sumend. et omni semihora repe- " tend. si causa fuerit.—Monday morning nausea had sub- " sided; all the other symptoms aggravated; restless all night. " —R. infus. senæ tartaris eight ounces, coch. iij. 2d. quaq. " hora sumend.—Monday evening, six o'clock, debility " rather increased: the tenesmus still continued.—R. gelat.

" amyli ſix ounces, tinct. opii gut. 50 miſce pro enem. omni
" bihora utend.—R. kali ppt. 5 grains (pot-aſh) aq. puræ
" one ounce, miſce pro hauſt. omni hora ſumend.—Tueſ-
" day morning, the patient had reſted well in the night, ex-
" cepting the fatigue which taking the medicine occaſioned:
" pulſe not ſo frequent: teneſmus relieved: a quantity of ſcy-
" balli were diſcharged.—Perget in uſu ſolut. kali (pot-aſh).
" —This patient recovered by uſing the following decoction.
" —R. kali ppt. one drachm, (pot-aſh) flor. cham. half an
" ounce, rad. ſerp. virg. one drachm, aq. puræ 16 ounces,
" coque and cola cap. one ounce, quart. in die."

The following Caſe occurred in the Practice of Mr. J. B. Jones.

" Mrs. S—th, aged 45 years, of a tall thin habit, who had
" been ſeveral years afflicted with hemeplegia, applied to
" Mr. Baker, who deſired my aſſiſtance in conſultation.
" On the 4th of Feb. at 11 o'clock, I paid my firſt viſit, and
" obſerved the following ſymptoms:—Conſiderable pain in
" the umbilical region—teneſmus, attended with a diſcharge
" of bloody mucus, pain in the head, which was augmented
" on the admiſſion of light—coldneſs of the extremities—dry
" ſkin—tongue of a brown colour—pulſe 120, very ſmall
" and weak.

" This appearing to be a well marked caſe of dyſentery,
" and believing that diſeaſe to ariſe from the preſence of the
" ſeptic acid (the acid of contagion) in the inteſtinal canal, we
" came to the reſolution of trying the effects of alkaline re-
" medies, and to quiet the teneſmus by anodyne glyſters.—
" R. gelat amyli unc. quat. tinct. opii gtt. 40. M. ft. enema
" ſtat. injiciend. et pro re natâ repetend. In the next place,
" attending to the pulſe, and with a view to raiſe them.—R.
" ammon gra. tres, aq. menth. pip. unc. unam, m. ft. hauſt.

" 3tia.

" 3tia. quaq. hora ſumend.—8 in the evening; pulſe more
" full, and conſequently leſs frequent; ſkin ſomewhat moiſt;
" teneſmus relieved conſiderably. Contin. in uſu medicam.

" Feb. 5, 11 o'clock; reſted well all night; pulſe more
" quick than laſt evening; ſkin dry—ordered the feet to be
" bathed in warm water.—R. aq. ammon. acetat. unc. unam,
" menth. pip. unc. ſep. m. et cap. coch. iijj. 3tia. quaq. hora.
" —8 o'clock in the evening; in every reſpect worſe.—Rep.
" enema, anod. omni bihora. Mittet ol. ricini unc. tres, cap.
" coch. un. omni bihora donec alv. reſpond.

" 6th. Ten in the morning; reſtleſs in the night; frequent
" vomiting; pulſe low, quick and ſmall. The oil appearing
" to be the cauſe of the moſt diſtreſſing of the above ſymptoms
" (vomiting), it was diſcontinued.—R. tinct. opii gtt. 30, aq.
" menth. pip. unc. unam, m. ft. hauſt. ſtatim ſumend.—R.
" tartrit. potaſſe dra. un. 2d. quaq. hora ſumend.—10 o'clock
" in the evening—after the anodyne had quieted the patient's
" ſtomach, the tartrite of pot-aſh was adminiſtered, three of
" which powders procured an evacuation of the inteſtines,
" in which a ſmall quantity of ſcyballa were diſcharged; the
" pulſe was remarkably low and ſcarcely perceptible: ſhe
" had frequent faintings, and could be perſuaded to take no
" more medicines until the 10th, when a diarrhœa came on,
" together with profuſe uterine hæmorrhage; cold extre-
" mities; intermittent pulſe. Cold applied to the pubis and
" loins checked the hæmorrhage. The anodyne injection
" was frequently repeated. And the patient recovered by
" uſing the following decoction:—R. flor. cham. unc. dimid.
" potaſſe drachm unam, aq. puræ unc. ſex decim, coque and
" cola cap. coch. iij. 3tia. quaq. hora."

In

In a Letter from W. SALTONSTALL, M. D. *dated at New-London, March* 5, 1797, *to the Author, are the following Remarks.*

" ON Saturday I was consulted by a labourer in the case " of his wife, who, he said, had been for some days afflicted " with griping pains, and discharges, by stool, of blood, al- " ternating with green slimy matter:—On Sunday morning " I visited her at her house, about two miles from town, and " found her affected with *dysentery*, which had troubled her " for more than a week past; during which time her strength " had been gradually decreasing, so that she was now unable " to walk across the room: pulse quick, tongue little furred, " skin dry, and complains of loss of sleep. I directed an " ounce of the ol. ricini to be taken immediately, and a large " anodyne draught to be taken h. s. The next morning found " the cathartic medicine had operated freely, and she was " much relieved of her pains. I began now to exhibit the " soda in powder, in doses of a drachm each, thrice a day: " these were continued for two days only, when the stools " became changed from a bloody and greenish, to that of a " yellow appearance, occuring in frequency much as in the " usual state of health. The other symptoms disappeared, " and the patient was so well on the following day as to su- " percede the necessity of any further attendance."

CHAP. III. *The Theory of Pestilential Fluid.*

THE theory of contagion is simply this, that septon (nitrogene), in combination with oxygene (the principle of acidity), forms a compound which, when applied to the bodies of animals, will produce the varieties of fevers and other infectious

fectious diſeaſes, according to the parts to which it is applied; and theſe will be inveterate or mild, according to the degree of combination of theſe ſubſtances. In the firſt degree, it will form the gaſeous oxyd of ſepton; in the ſecond, the ſeptic gas; in the third, the ſeptous acid; in the fourth, the ſeptic acid; and in the fifth degree, the oxygenated ſeptic acid.

The ingredients of this matter of contagion conſtitute the chief part of our atmoſphere; they exiſt in the following proportions: ſeptous gas, 72 parts of an hundred, and 28 parts of oxygene. Hydrogene gas and carbonic acid gas are ſometimes found exiſting in the atmoſphere; but they are only conſidered accidental, and not neceſſary. The particles of theſe fluids float about, in ordinary circumſtances, through each other, by means of the wind, which are neceſſary to keep them mixed, in like manner as oil is kept mixed in water by a continual agitation; but no ſooner is the oil and water ſuffered to be at reſt, than they ſeparate; and the ſame would take place with the component parts of the atmoſphere, were they not kept in continual motion by the winds, as they differ in many degrees of ſpecific gravity. But theſe have, under certain circumſtances, attractive powers ſtrong enough to make them frequently combine. The principle cauſe which prevents their combination, after they have acquired an aerial form, is the greater affinity they have for caloric or the matter of heat (which gives them the properties of an elaſtic fluid) than for each other. Whenever, therefore, ſepton (nitrogene or baſis of azotic air) and oxygene (baſis of vital air) can come together, without aſſuming the aerial form, they will combine together according to the laws of chemical affinities, and conſtitute, in this form, peſtilential fluids, varying in proportion to the degree of oxygenation, and poſſeſſing qualities very different from either of their elementary or component parts.

This combination is produced by the particles of the one becoming intimately and chemically blended with thoſe of the other:

other: this will take place in every circumſtance where they can come in contact with each other before their union with caloric, or the matter of heat. This chemical union is moſt generally the product of the putrefaction of the greater part of animal ſubſtances, except their fat; and of vegetables which contain ſepton, ſuch as wheat, coffee, &c. Rain-water is found to contain a conſiderable proportion of the ſeptic acid, as alſo the wells and reſervoirs of hot climates. It is alſo found to exiſt in the plaiſtering and walls of old houſes, eſpecially if the inhabitants have lived in an unclean manner, and the houſe ſtood in the neighbourhood of foul and corrupted vapours. Jails are alſo found to have the lime ſaturated with ſeptic acid. This is verified by the following deſcription of the late keeper of the ſtate-priſon of Olmuts, where LA FAYETTE is confined. "Beſides many other inconveniencies, "the ſituation of the dungeon is rendered more unwholeſome "by the vicinity of the barracks on one ſide, and the common "neceſſary-houſe on the other, the damp of which is ſo "great as to cauſe the walls to be covered with ſalt-petre.* "The *ſtagnated water* of the Morawa, cloſe to them, not "only breed innumerable ſwarms of inſects and thick va-"pours, but that branch which paſſes along the walls, under "their windows, being, by its depth, favourable to carry off "the filth, &c. of the city, has become its common ſewer; "to which circumſtances is attributed the reputed inſalubrity "of the town. Add to this, that the neareſt buildings are, "on one ſide, the military, and, on the other, the city hoſpi-"tals."†

Before I leave the ſubject of peſtilential fluids, I ſhall make a few remarks upon the ſimilarity of theſe ſentiments, with ſeveral paſſages in DARWIN's Zoonomia. In treating of the *febris a pure clauſo*,‡ he has the following ſentence. "In "this

* The ſal muralis of Walker, terrene nitre of Cronſtedt, and nitre calcaire of Morveau.

† Vide account publiſhed in M'Lean and Lang's paper, Feb. 15, 1797.

‡ Zoonomia, vol. ii. Claſs II. 1. 6.

"this fever, the matter not having been expoſed to the air, "has not acquired oxygenation; in which a new acid, or "ſome other noxious property, is produced, which acts *like* "*contagion* on the conſtitution, inducing fever-fits, called "hectic fever, which terminate in ſweats or diarrhœa; where-"as, as the matter in the cloſed abceſs is either not abſorbed, "or does not ſo affect the circulation as to produce diurnal "or hectic fever-fits; but the ſtimulus of the abceſs excites "ſo much ſenſation as to induce peſtilential pyrexia, or inflam-"matory fever, without ſuch marked remiſſions."—"But in "the pulmonary* ulcers, which cannot protect themſelves "from the air by forming a ſcab, the uncombined oxygene "of the atmoſphere unites with the purulent matter, convert-"ing it to a *contagious ichor*, which, by *infection*, not by "*eroſion*, enlarges the ulcers, as in the itch and tenea, &c." —"Another† proof of the ſtimulant quality of oxygene, "appears from the increaſed acrimony which the matter of a "common abceſs poſſeſſes, after it has been expoſed to the "air of the atmoſphere, but not before; and probably all "other contagious matters owe *their fever-producing proper-*"*ty to having been converted into acids by their union with* "*oxygene*."—"The matter‡ depoſited in large abceſſes does "not occaſion hectic fever, till it has become oxygenated by "being expoſed to the open air, or to the air through a moiſt "membrane: the ſame ſeems to happen to other kinds of "matter, which produce fever, or which occaſion ſpreading "ulcers, and are thence termed contagious."

His febris *a pure aerato*§ is aſcribed to the union of the oxygenous portion of the atmoſphere with the effuſed pus, converting it to *a weaker kind of contagious matter*. Doubtleſs, in the caſes alluded to by DARWIN, the *oxygene* combines

* Vol. ii. p. 288.
† P. 689.
‡ P. 729.
§ Vol. ii. p. 285.

bines with *ſepton* (nitrogene), and the acid formed is the *ſeptic (nitric) acid.* This is the product which MITCHILL ſuppoſes to be occaſionally formed from the materials of ſome articles of diet, in the alimentary canal, and to cauſe certain nauſeas, vomitings, gaſtrites, diarrhœas, choleras, dyſenteries, &c. and abſorbed from thence by the lacteals, or from the ſurrounding air, which he conſiders as poiſoned by it, by exhalations from putrid ſubſtances in peſtilential ſeaſons, by the lymphatics of the ſkin and lungs, and excites various commotions in the heart and ſanguiferous ſyſtem, aſſuming the form of continued, remitting and intermitting fevers. What is particularly to be noticed is, that it does not appear that this coincidence of opinion between our PROFESSOR OF CHEMISTRY and the PHILOSOPHER OF DERBY, is the reſult of any communication of ideas between them on the ſubject; Dr. DARWIN having indeed publiſhed his book before Dr. MITCHILL wrote, but Dr. MITCHILL having gone deeply into the ſubject, and delivered his doctrine of peſtilential fluids in his lectures, the winter of 1795-6, before the volume, whence the above extracts are taken, had reached AMERICA.

IT is with great ſatisfaction I obſerve the Editors of the Monthly Review * have taken notice of the diſſertation of SALTONSTALL, on the chemical and medical hiſtory of ſepton, and treated it with candour and politeneſs. They forbear giving any deciſion on the new doctrine of contagion, until they have received farther information on the ſubject. As this inaugural diſſertation is intended as a further inveſtigation of the ſubject, and a more particular application of it to another form of diſeaſe, I have endeavoured, as far as I am able, to collect, from the wide field of ſcattered facts, ſuch as were

* Appendix, September, 1796.

were applicable to the ſubject, in order to ſhew how nearly the theory accorded with the phenomena of nature. How far I have ſucceeded in my attempt, I muſt leave to the candid and indulgent reader to determine. If this incorrect performance (as all thoſe muſt be which undertake to explore new regions of ſpeculation, that can only be thoroughly examined by the united and ſucceſſive enterprize of all who engage in them) ſhould fall into the hands of the Gentlemen Reviewers, I hope that ſpirit of liberality and forbearance which they have, upon ſimilar occaſions, evinced, will be extended to me, as my object in theſe pages has been to diſcover truth. In contributing my mite to the maſs of information, I hope my labours may not be deemed entirely uſeleſs, and that my offering, however ſmall, may be as favourably accepted as it was well intended.

APPENDIX A.

Effects of Peſtilential Fluids (Combination of Septon with Oxygene) upon the Sanguiferous Syſtem of Animals, particularly the Human Species.—In a Letter from Mr. MITCHILL *to* JONATHAN N. HAVENS, *Eſq; Repreſentative from the State of New-York in the Congreſs of the United Sates.*

YOU write me, in your letter from Shelter Iſland, of the 20th of July, 1796, "that you have been reading SALTONSTALL's diſſertation on peſtilential fluids with attention, and "that it has raiſed your curioſity upon that ſubject." To gratify this further, you requeſt me to ſend you the publication I made about a year ago on contagion, as you have not yet read that performance. It is out of print, and I have for ſometime not known where to get a ſingle copy. As it may, however, one day fall into your hands, I ſhall, in my preſent anſwer to your late favour, conſider the ſubject in a manner different from any thing contained in that tract.

If I have not deceived myſelf, there are facts enough ſtated there and elſewhere, (my letter to MILLER,) to ſhew that ſeptous and ſeptic vapours (combination of ſepton, or azote, with oxygene) iſſuing from organized ſubſtances, in certain ſtates of putreſcent decay, in the open air, riſe and contaminate the atmoſphere near the earth, and in the habitations of men; and unleſs I am greatly miſtaken, there is a ſufficiency of facts to perſuade us, that ſimilar products are formed at times in the human ſtomach; when, on a ſuſpenſion of the concoctive proceſs, a load of *beef*, half-tainted and half-raw when eaten, corrupts in a Britiſh or American ſtomach, and cauſes gaſtritis and black-vomiting. I mention *beef particularly*,

larly, becauſe, in RAMMAZZINI's account of the contagious epidemic which infected the neat cattle throughout almoſt the whole of the Venetian dominions in 1711, (Opera. Med. & Ph. p. 460.) we are informed, that, on ſome former occaſion, there took place diſputes between the butchers and inhabitants, both at Venice and Padua, about the quality of the beef brought to market. It ſeems, many of the people who ate the beef became ſick, and died of dyſentery. The blame of this was thrown upon the butchers, who were charged of buying up ſickly cattle in Hungary, and ſelling their diſtempered fleſh to the people. This matter being referred to the phyſicians, they gave an opinion in favour of the butchers. Whence it would ſeem, that complaints of the unhealthy quality of this ſort of animal food are by no means new and unprecedented.

Peſtilential fluids, thus exhaling from the ſurface of the earth, may completely ſurround the human body, and be applied to the whole cuticular and pulmonary ſurface, as well as to the entire mouth and noſtrils: and the like productions, generated in the alimentary canal from corrupted food, may be ſpread all along the inteſtinal tube, ſo that the internal ſurface from the gullet to the anus, may be at times partially or entirely diſordered by them.

If ſuch noxious ſubſtances are applied, both externally and internally, to ſo large a ſurface, it might be expected they would have ſomething more than a local operation, and extend their influence beyond the mere part which they touched. Theſe exhalations acting *externally* in their ſtrong ſtate, may inſtantly kill, by ſtopping reſpiration; may cauſe, by their cauſtic quality, ulcers to form, bliſters to riſe, and mortifications to ſpread along the ſkin; and they may inflame the noſe, throat and eyes, and cauſe pimples and ſpots of various ſhapes and hues to appear; or, by *internal* agency, ſimilar fluids may excite an erythematic or eryſipelatous inflammation in the ſtomach and inteſtines, inducing gaſtritis, diarrhœa, and dyſentery,

dyſentery, with deſtruction of the lining of the guts, effuſion of blood from the corroded veſſels, and ulcerations, gangrene, and ſphacelus, from their cauſtic ſharpneſs. But theſe are not all the effects which ſuch deleterious fluids are capable of working on the living body. Can it poſſibly happen, that peſtilential fluids ſhall come in contact with the lungs, ſkin and inteſtines, whoſe ſurfaces are thickly beſet with abſorbent veſſels, and that their noxious matters ſhall remain around the orifices of thoſe inhaling tubes for a very long time, and yet no atom or particle of them be taken in? Will not a portion of them be ſucked up by the lacteals from the inteſtines, and by the lymphatics, from the other expoſed ſurfaces of the body, and through their channels be conveyed into the maſs of blood? Will not the blood, on receiving theſe foreign materials, aſſume new qualities, and, as it travels the round of circulation, carry with it miſchief and venom to the brain and nervous ſyſtem? Let us examine theſe queſtions.

Firſt, let the appearances be obſerved which blood exhibits in the veſſels of thoſe who are dead of peſtilential diſtempers. The diſſections of this claſs, mentioned by LIEUTAUD, (which I ſhall take, becauſe the book lies before me on the table) are all declared to be attended with changes of the blood of a remarkable nature—blood taken away by veneſection being in a ſhort time liable to corrupt in *putrid* fevers (1 PRECIS de la Medicine, p. 45.); in the hepatic veins of *ardent* fevers being black, and having a reſemblance to pitch, (p. 56.); in *malignant* fevers ſometimes appearing to be in a ſtate of diſſolution, and at others very thick, and formed into polypus concretions, (p. 70.); the heart and veſſels in the *plague* very much enlarged, and filled with black and grumous blood. (p. 86.) In thoſe who die in the cold fit of *intermittent* fevers, the blood is black and thick, diſtending the lungs, heart, and large veſſels, (p. 96.) the vena portæ being prodigiouſly diſtended.

Secondly, it will be next proper to ſee what are the effects of

of ſeptous and ſeptic airs, when injected, artificially, directly into the blood-veſſels of living animals.

LUZURIAGA, one of the king of Spain's philoſophical penſioners, injected ſeptous gas (azotic air) into the jugular vein of a dog. The animal almoſt inſtantly expired; and on opening the thorax, the blood in both ventricles and auricles of the heart was found thick and dark coloured, though leſs ſo in the left than the right; which latter was full of polypi: the vis inſita of the muſcles, and the irritability of the heart, were deſtroyed.

He alſo injected ſeptic gas (nitrous air) into the jugular vein of another dog: on examination after death, the blood in the auricles and ventricles was of a darkiſh purple, or blackiſh hue; polypi were found in the right cavities; and blood, a ſhade or two lighter, in the left. The irritability of the heart was very much diminiſhed, and the lungs conſiderably damaged by the air injected. (Tentamen Medicum, &c. Exp. 4 and 6).

Thirdly, there will likewiſe be a propriety in examining what changes ſeptic gas makes upon blood drawn out of the veſſels. *Arterious* blood (Ibidem. Exp. 12.) running into a veſſel filled with ſeptic gas, quickly coagulated; a greeniſh coat formed upon the ſurface; the craſſamentum towards the bottom was dark coloured and leſs green; the quantity of ſerum was ſmall and greeniſh. *Venous* blood, treated in like manner, exhibited a large quantity of dark coloured ſerum, without any greenneſs.

From the compariſon of the blood in theſe diſſections with the blood treated with the ſeptous and ſeptic gaſes, it is evident there is in both caſes *a loſs of floridity*, an *acquiſition of a dark or black hue and ſpiſſitude, tending to the formation of grumes or polypi*; and, as far as inquiry has been made, I think we are warranted in concluding, that ſuch changes in the blood take place more or leſs in *all diſtempers ſpringing from peſtilential miaſmata, or contagious vapours.* A queſtion,

tion, however, arifes, whether the altered condition of blood in febrile diforders, is owing to the fame caufe which brought on a fimilar ftate of it in LUZURIAGA's experiments? or rather, whether feptic (nitrous) compounds do not fometimes infinuate themfelves into the blood veffels, and bring on the above recited ftate of the vital fluids? I am inclined to think this is the cafe. And though I am far from believing that feptous and feptic compounds, in their proper form of gafes, can, by any natural procefs, get into the circulating fyftem of living animals, yet it appears to me highly probable, that the feptous and feptic acids may be occafionally inhaled, in conjunction with other fluids, both by the lacteals and lymphatics, and thus enter into the fanguiferous tubes.

I fhall doubtlefs be confidered a favourer of the humoral pathology, from my dwelling upon the morbid conditions of the fluids and humors. I own that I am. A fafhion has too long prevailed of referring every thing immediately to the folids; and this has been carried fo far, that febrile difeafes in particular have been deemed original affections of the nervous fyftem. This doctrine of the nerves and folids has been carried a great deal too far by CULLEN, BROWN, MILMAN, and their followers, who, in their zeal for fupporting *the vital excitement of the moving fibre*, have overlooked half the facts which appertain to the fubject. This is fo much the cafe, that there is a certain fymptom occurring fometimes in the course of malignant difeafes, and not noticed by either of thofe writers, the true interpretation whereof affords a guiding light through the devious and obfcure region I have undertaken to explore.

1. Among the tokens of putrefcent fever, as it occurs in the Ifland of Jamaica, efpecially when putrefcent tendency is communicated from the primæ viæ to the reft of the body, there frequently comes on, towards the end of the diftemper, an uncommonly fine and delicate bloom of the complexion, (JACKSON's Treatife, p. 101.) while the edges of the tongue

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are clear and of a beautiful red in their colour, and the lips ſmooth and of a cherry-like appearance: when this beautiful blooming colour prevails, which is not natural to the patient, there is always reaſon to ſuſpect danger. (p. 113.) It is preſumable, that, in ſuch caſes, a highly oxygenated ſeptic acid is formed in the alimentary canal, which is abſorbed by the lacteals with the chyle, and carried into the blood-veſſels, where, inſtead of attracting oxygene from the vital fluid, as ſeptic gas does, it will give out a portion of its own oxygene to the blood, and impart to it a remarkable and unuſual degree of redneſs. This property, which it poſſeſſes in common with vegetable and other acids, may thus heighten the colour of the blood, which, at the ſame time, from its tendency to leſſen the living energy of the heart, by exceſſive ſtimulation, may be very operative in undermining the animal fabric, which it thus deſtroys, while it beautifies. We have ſeen, in the experiments related, how *nitrous* (ſeptic) *gas* attracted oxygene from the blood. The ſame thing takes place when it meets with *vital air*. The two airs inſtantly combine, and a quantity of heat is evolved. The product of their union is *nitrous acid*, as De la Metherie himſelf allows. (Eſſai Analytique ſur l'Air, &c. p. 376.) This author, who is no friend to the new Nomenclature, admits, however, with Thouvenel, that *nitrous acid* in the ſalt-petre works, is produced by the concourſe of pure air with *putrid* vapours. What then is putrid vapour but nitrous gas? Putrefaction *ſometimes* goes on among the inanimate animal contents of the alimentary canal. Putrid vapour then muſt be formed. If this is nitrous (ſeptic) gas, it will attract oxygene from the neighbouring ſubſtances, and be inſtantly converted to nitrous or nitric acid; and if this meets with no neutralizer in the bile or alkaline matter in the primæ viæ, it may inflame the ſtomach and inteſtines, be abſorbed, oxygenate the blood, &c. &c. I think further, ſome peſtilential matter vitiates the blood.

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2dly. Becauſe children born of mothers ſick with the plague have been known to bring with them from the womb evident marks of peſtilential infection. (RUSSEL, p. 95.) The fœtus can ſcarcely be ſuppoſed to have bred the diſtemper within itſelf; the matter of miſchief was therefore moſt probably received from the placental veſſels of the mother; although there is no direct communication of maternal and fœtal tubes, ſtill the connexion may be imagined intimate enough to allow ſomewhat of the taint of the mother's blood, to paſs through to the child. Or, if this explanation is deemed unſatisfactory, there is only one other poſſible mode of explanation, and that is through the medium of the liquor amnii, which muſt, in that caſe, have become contaminated with the peſtilential venom paſſing unchanged through the ſecretory organs. In either caſe the point I am looking at is clear, viz. that the blood of the mother has ſomething noxious in it.

3d. Becauſe, whether the maternal blood be enough vitiated to infect the fœtus or not, yet, women, in whatever ſtage of pregnancy, when diſtempered with plague, ſeldom eſcape abortion, and many of them periſh, even when the loſs of blood from miſcarriage is not conſiderable. (RUSSEL, p. 95.) As the lungs of the mother have to provide oxygenated blood for the conſtitution of her yet unbreathing child, as well as for her own, it is eaſy to conceive wherefore the dark coloured, under oxygenated, peſtiferous blood of the former, ſhould be unable to reſtore the vital ſtimulus in due quantity to the effete and exhauſted blood of the latter: for lack of this needful and exciting ingredient, the umbilical vein carries back to the young animal a maſs of blood quite ſluggiſh and inactive. The immature fœtus of courſe dies and drops from the uterus, like unripe vegetable fruit from its branch.

4th. Becauſe obſtructions and ſwellings of the *inguinal* and *axillary glands* often accompany a peſtilential condition of the air. The venom is, in all probability, imbibed by the abſorbents, and carried with their other contents into the maſs of blood.

blood. Buboes and glandular tumours thus occur only in comparatively a few cases, when the pestilential matter sticks by the way, and cannot find its passage freely along the opening into the left subclavian vein. I cannot help thinking the tumours of these glands, in pestilential cases, are as fair evidence of the poison absorbed, as in instances of an enlargement of similar parts, after the absorption of poisonous matter into the fingers of dissectors, from corrupting corpses, &c.

5th. Because, in abundance of instances, febrile ailments are followed by *mesenteric obstructions*, which, I suppose, are caused by the absorption of pestilential matter, either swallowed or generated in the intestines from putrified animal food, &c. as it may happen now and then that infectious matter, in flowing through the lacteals, may inflame the glands through which it passes, and excite in them tumour and its consequences.

6th. Because the quality of the blood in persons dead of the complaints already enumerated, is different, in many respects, from that brought on by mere exclusion of vital air, as in breathing septous and inflammable gases; leading thus to a persuasion, that, besides the *withholding oxygene*, there had, in pestilential ailments, been actually an *addition of something septic* to the circulating mass.

7th. Because, in many distempers of the summer and autumn, the colour of the blood circulating through the skin, and the hue of the skin itself, are considerably altered; and in this change of the skin from the ordinary flesh-colour to clay-coloured, dusky, yellow, purple, and black, there is something of a peculiar cast in pestilential diseases, that is not found to accompany any others: the complexion of persons dying under water, and in fumes of burning charcoal, being, in appearance, as well as in fact, considerably different.

8th. Moreover, I believe that pestilential matter is sometimes mingled with the circulating blood; because, though it has not been concentrated enough to produce, *in all instan-*

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ees, *diſeaſes*, when inſerted by inoculation in the body of a well perſon; yet there are not wanting facts to evince its virulent influence, in ſome experiments that have been made. (HOME's Exp. on the Meaſles, &c.)

Leſt this idea of the power of the abſorbents to imbibe ſuch fluids may appear to be merely ſpeculative, it may not be amiſs to mention the experiments of MAXWELL, *(Experiment. cum divers Aërum ſpeciebus in Animalibus, &c.)* proving the thing to be really a fact. This gentleman, among various other experiments, produced artificial emphyſemata, by forcing atmoſpherical, phlogiſticated (ſeptous), dephlogiſticated (oxygenous), fixed (carbonic acid) inflammable (hydrogenous), and nitrous (ſeptic) airs into the cellular membrane of living dogs and rabbits. The reſult of numerous trials was, that elaſtic fluids ſo injected, were very completely taken in by the lymphatics, though with different degrees of readineſs; that all the airs, except *two*, produced, by abſorption, ſcarcely any obſervable effect upon the body; that theſe two were SEPTOUS and SEPTIC gaſes; the *former* of which would not deſtroy life until after ſome days, while the *latter* KILLED IMMEDIATELY. When the ſeptic gas was injected, it was ſo ſuddenly abſorbed, that death came on not by its inflammatory action upon the ſuperficial muſcles, but by its being mixed in a *certain quantity with the blood*, and after converſion to *ſeptous* or *ſeptic* (nitrous) *acid, by conjunction with oxygene in circulating through the lungs*, STIMULATING THE HEART TO DEATH, and utterly deſtroying *all* the irritability of that muſcle. (p. 12. and ſeq.) The experimenter computes, from the facts which preſented themſelves during his inveſtigation, that this ſeptic poiſon may be abſorbed by the ſkin, and be conveyed to the heart in *about half a minute!* (p. 17.) Yet it muſt not be imagined, that, after peſtilential venom is inhaled into the blood-veſſels, death will in all caſes be the conſequence. The offending matter may be carried from the body through the excretory outlets; or

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it may circulate a long time with the other fluids, and ſo *ſeaſon both the veſſels and the heart* to its action, that, after a while, *they*, like the *external parts*, will grow *inſenſible to its ſtimulus*, and *no longer have their motions diſturbed by it.*

You will obſerve that I reject altogether the notion of *putridity*, as it is *very generally ſuppoſed* to be going on in the blood-veſſels; and that I have no faith in the introduction of *putrid ferments* into the maſs of fluids. A putrefactive proceſs taking place in the contained parts of the living body, except among the contents of the alimentary canal, is incompatible with life more than a few minutes. Putrefaction is a reſolution of an organic body into its elimentary atoms, or into new compounds. Now, many of theſe are gaſes, whoſe extrication in the blood-veſſels would extinguiſh life in a very ſhort time. Beſides, the fluids produced by putrefaction having already undergone that operation, connot be any more ſuſceptible of it. They not only do not putrefy the muſcles, but, in the common acceptation of the term, they retard putrefaction in other ſubſtances. Thus, *fixed air*, *nitrous acid*, and *volatile alkali*, which are reckoned among the moſt active *products of putrefaction*, are known to be ſome of the moſt *powerful oppoſers of it.* And it may be laid down as a pretty broad fact, that ſuch ſubſtances as are *ſeptic in their origin*, are *antiſeptic* in their effects; and this neceſſarily, from the nature of things.

As to the *dark colour* of the blood drawn from the *veins*, in malignant diſeaſes, and the *diſſolved ſtate* in which it appears, I conſider them as having no manner of connexion with a putrefactive ferment within the veſſels. It is very well known, (Annales de Chimie, tom. v. p. 266) that hydrogene gas, injected into the jugular vein, keeps the blood liquid, and imparts to it a colour almoſt as black as ink; and it is as well known, that the hydrogene gas obtained from animal ſubſtances contains a quantity of carbone in ſolution; ſo that *venous blood* owes its *dark hue*, and its diſpoſition to fluidity,

fluidity, to the commixture of a quantity of *carbonated hydrogene*.—When vital air is freely admitted into the chest, and the lungs perform their functions well, the venous blood parts with its hydrogene and carbone, to form with the principle of acidity, water and fixed air, in the bronchia, and receives, from the pulmonic cells, a portion of oxygene in their stead. When, therefore, by an impediment of the respiration, as in breathing pestilential air, the hydrogene and carbone are imperfectly or not at all exhaled; and, at the same time, very litttle or no oxygene is absorbed through the lungs, the *black* or *dark colour*, and *disordered appearance* of the blood, and particularly the *venous*, follows as a thing of course. And whenever afterwards the pestilential matter absorbed is added to such blood, the deviations of colour, consistence, and other qualities from the healthy state, must be yet more considerable.

From a review of what has been stated in this letter, the probability of the following inferences will be apparent. 1. That the presence of carbonated hydrogene, and the absence of oxygene, will explain the common qualities of the venous blood. 2. That pestilential matter may impart to it a further change of qualities. 3. That pestilential matter does actually enter the mass of blood. 4. That the lacteals and lymphatics carry it there. 5. That the appearances of the blood are very much alike in all pestilential distempers, from agues to plagues. 6. That these phenomena are nearly analogous to those induced by the injection of septous and septic gases into the blood-vessels. 7. That from the similarity of effects in the cases when pestilential matter was absorbed, and where septic fluids were injected, the two classes of phenomena are referable to the same general cause.

Yours very, &c.

SAMUEL L. MITCHILL.

New-York, Aug. 1, 1796.

APPENDIX

APPENDIX B.

Illuſtrations of Mr. MITCHILL'*s Doctrine of the Operation of Peſtilential Fluids upon the Human Body.—In a Letter to* SIMEON DE WITT, *Eſq; Serveyor-General of the United States.*

THE peruſal of your inſtructive letter, dated at Albany, June the 2d, 1796, on the ſubject of my pamphlet about peſtilential airs, which you are polite enough to call "an ingenious and valuable work," has given me much pleaſure. Availing yourſelf of the miſcibility of contagion and infection with water, you propoſe ſteam or the *vapour-bath* as an additional means of removing it, and deſcribe how the Indians apply and employ that remedy: I queſtion very much, however, whether in peſtilential complaints, occurring as they commonly do in North-America, in hot weather, it would unite ſo many good qualities as *clear cool water.*—I do not remember that the *earth-bath* which you mention was ever medically preſcribed for perſons labouring under ſimilar diſtempers; though I remember a queer fellow in Europe who uſed to recommend it very ſeriouſly to his patients and the public, and to bury himſelf up to his neck as an example for them; he uſed to ſay the application of freſh earth was admirably calculated to invigorate the body by extracting the cauſes of diſeaſes, and to ſtrengthen the mind by operating as a *memento mori*; its ſimilitude to interment, I rather ſuſpect, would make it operate unfavourably upon terrified perſons, who think it is quite ſoon enough to be buried after they are dead.—Such conſiderations as have occurred to me concerning ſome other matters mentioned in your letter,

ter, are contained in the papers which I read laſt winter before the Agricultural Society of New-York.

You expreſs your "full perſuaſion, that, under certain "combinations in our atmoſphere, gaſeous fluids are the cauſes "frequently of the worſt maladies that afflict us, whether "received by the abſorbing pores of the ſkin, by the lungs, "or by the bowels." In this ſentiment I fully agree with you. But as this concluſion ought to be admitted with ſome reſtriction, or requires certain explanatory conſiderations, I ſhall now preſent you with the reſult of my reflections on the limits by which their pernicious operation is circumſcribed.

When we ſpeak in common language of the unhealthy or deſtructive effects of contagious or infectious matter, we generally wiſh to be underſtood as referring to their operation on the bodies of thoſe to whom it is applied freſh, or who never felt its influence before. Thus, when it is affirmed the ſmall-pox is a dreadful diſtemper, the expreſſion is limited to thoſe who have not been ſeaſoned to its action; when it is aſſerted that the plague is very eaſily catched, the meaning is, by thoſe whoſe conſtitutions have always been wholly untouched by it: when it is declared the yellow fever cuts off multitudes of men in the tropical climates, the remark particularly refers to new-comers from the temperate zone, &c.

I have laid it down as a fact in my doctrine of fever, that the ſick get well in abundance of inſtances, leſs by the aid of the medicines they ſwallow, than becauſe the ſtimulus of infection wears itſelf out.—The conſtitution in theſe caſes becomes ſo habituated to the venom, that this no longer makes a ſenſible or morbid impreſſion on it.—After a ſervitude of greater or leſs duration or violence, it ſeems at length to get emancipated.—By various degrees of indurance, it acquires a ſort of immunity from the old ſource of inquietude, and obtains a diſcharge as it were from further vexation on that ſcore. It ſomehow becomes enabled to live and be uſeful in times of diſtreſs and danger, with little or no moleſtation from

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the ordinary cauſe of miſchief.—When peſtilence ſummons the multitude, ſuch perſons enjoy their privilege, and are in the nature of exempts from its mandate.

Thus, it appears unto me there is a whole claſs of animal maladies which leave the ſyſtem in a condition leſs liable than before to be incommoded anew by contagion or infection. Though I do not know that the human conſtitution can, *in any caſe*, acquire ſuch a degree of apathy or inirritability as to be wholly and always free from ſucceſſive attacks of theſe kinds of diſtempers, yet, in almoſt every one of them it experiences *ſomething of ſuch a tendency.* A citation of a few facts on this ſubject will at once elucidate the principle, and ſhew the analogy.

The ſmall-pox, when invading in the natural way, leaves the conſtitution ſo little liable to be troubled by it a ſecond time, that the art of inoculation has been contrived and practiced, with the view to induce in the body, artificially, whenever it was thought proper, an inſenſibility to the further operation of that contagion. A like inſenſibility is brought on by the meaſles and varicella.

Syphylitic contagion, applied to the urethra, will frequently, after exciting a variety of uncomfortable ſymptoms there, loſe its power of ſtimulating any more, or wear itſelf out; (Hunter on the Venereal Diſeaſe;) ſuch perſons as have had it once being, under equal circumſtances, not ſo likely to take the contagion afreſh.

They who eſcaped the yellow fever which raged in Charleston, in South-Carolina, in 1748, were far leſs likely than before to be attacked by it; (Lining, 2 Eſſay Phys. Lit. p. 374) and on this immunity from the diſtemper, the writer expreſſes himſelf with great confidence.—The ſame remark has pretty generally been made by men of experience and obſervation between the tropics.

Small animals who have been kept for pneumatic experiments, and frequently made to breathe non-reſpirable airs, grow

grow by degrees ſo far familiarized to their action as to ſuffer far leſs inconvenience and riſk than at firſt.

Priſoners in foul jails, like the natives of unhealthy countries, may become, by degrees, ſo accuſtomed to peſtilential air, that their conſtitutions will not be greatly diſordered by its preſence; while, at the ſame time, a perſon from a pure atmoſphere, ſuddenly introduced, may ſuffer violent diſeaſe, or be quite deſtroyed by it.

During a peſtilence which, in the former part of the eighteenth century, raged almoſt throughout Europe among the horned cattle, the German farmers would give almoſt any price for cows that had once had the diſeaſe, becauſe they were ſeldom or never ſeiſed again with the plague. (Van Swieten apud Boerhaav. § 587.)

If the perſon who is ſeiſed with a quartan, ſays Sydenham, (Opera Univerſa. § 1. chap. 5. p. 49. 8vo) of whatever age or temperament he be, has been affected with a ſimilar malady in any other period of his life, no matter how remote, this ſecond invaſion of the diſeaſe will not incommode him much, but will ſpontaneouſly leave him after a few fits.

Although patients are apt, from irregularity in diet and regimen, to *relapſe* when in a ſtate of convaleſcence from the plague; yet P. Ruſſel declares, that re-infections were always regarded as remarkably uncommon; (Treatiſe on the Plague, B. 2. p. 190.) inſomuch that out of four thouſand and four hundred peſtilential caſes, he met with only twenty-eight of re-infection, well aſcertained. And he affirms, that convaleſcents in plague are much leſs prone to *relapſe* than in other malignant contagious fevers. (p. 305.)

In all the conditions of the body now enumerated, you ſee there is a near and ſtriking analogy; that is to ſay, by the application and continuance of any of the before mentioned ſpecies of poiſon, the animal ſolids may be rendered ſo inſenſible of its action, as at laſt to be little incommoded by it, or ultimately to experience no inconvenience at all.

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This unſuſceptibility, thus induced, is the τὸθεῖον of the ancients, the *divine ſomething*, which brings the conſtitution ſafe out of the diſeaſe. Regardleſs of preſcriptions and medical directions, the ſick will get the better of their indiſpoſition as ſoon as the peſtilential cauſe loſes its power of acting, and not ſooner. While this accommodating proceſs is going on, it is well known that fevers *cannot be cured*, and therefore the wiſeſt phyſicians have carefully avoided too much interference, and have left the patient very much to *nature*, as they expreſſed themſelves; meaning thereby, whenever the body grows inſenſible of the noxious ſtimulus, the ſick would be reſtored to health, and not until then.

It ſtrikes me, this view of the ſubject enables us to comprehend the doctrine of what have been called CRITICAL DAYS. Theſe have given riſe to much diſpute, and conſiderable labour has been beſtowed to find out the true *judicatary periods*. In a mild or equable climate, where the conſtitutions of the people, their ways of living, the air they move in, &c. are very ſimilar, it is conceiveable that febrile paroxyſms ought to exhibit conſiderable regularity, and aſſume certain times of departure, as well as of approach; and that therefore, the tertian period of the third, fifth, ſeventh, ninth, and eleventh, may in common have been the natural order in Greece and the iſlands of the Archipelago; and when the diſorder was protracted beyond the eleventh day, the quartan period of the fourteenth, ſeventeenth, and twentieth, might have been the ordinary rule. The critical days become more diſtant and uncertain as the diſtemper is prolonged, until they are quite obliterated. The true meaning of the term *critical day*, then, is, not that the αὐτομρᾶτεῖα excerns or drives off ſomething noxious that day, but ſimply, *that then the habit is eſtabliſhed of being no longer ſuſceptible of infectious ſtimulation.*

I can conceive likewiſe, that there may occur now and then, from ſpecial cauſes, an exception to this general rule,

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and that a diſtemper may terminate on the eighth, tenth, twelfth, fifteenth, ſixteenth, or any other day which is uſually *non-critical.*

In all infectious and contagious diſeaſes, there is a certain courſe, which they will run, notwithſtanding the adminiſtration of remedies; and when that courſe has been run, they may terminate without the aid of remedies. Does phyſic poſſeſs ſpecifics of power ſufficient to prevent the variolus matter from acting on the ſolids? No; the contagion of ſmall-pox ſtimulates until it can ſtimulate no more, and then the ſufferer recovers. In like manner the infection of peſtilence will attack the body, and continue its attacks until an inſenſibility to its action is brought on, and afterwards the ſickneſs will terminate. In both caſes, the prudent phyſician knows the moſt and beſt he can do is to *conduct the ſick in ſafety to the end of their malady.* None but the ignorant and preſumptuous will pretend to be able to cure them. When, therefore, HIPPOCRATES and SYDENHAM proceeded moderately with their patients, they acted with a degree of ſenſe and conſideration infinitely ſuperior to thoſe idle calumniators who have lately found fault with ſuch feeble practice, and whoſe empirical raſhneſs has led them wholly aſtray from the true principle of proceeding. Under the impreſſion of ſuch ſentiments it probably was LIEUTAUD animadverted (Precis de la Medicine, p. 37.) upon the multiplicity of *remedies*, and RAMMAZZINI lamented (De abuſu Chinæ Chinæ) the *miſchief done by Peruvian bark.*

The immunity which the conſtitution acquires under the varied forms of infection, will not in *all* caſes *be equally laſting*; nor in *any* will it amount to an abſolute ſecurity againſt a ſecond attack. The plague *may* make a ſecond onſet; the ſmall-pox has done the like. Such ſeems to be the operation of infected air.

However, if the principles herein-mentioned are right, a plain inference is, that there may exiſt a condition of body

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not merely able to eſcape infection, but capable of being actually benefited by its preſence.

It has accordingly been remarked, that perſons prone to conſumption were not ſo likely as others to ſuffer from the infection of plagues in the unhealthy parts of Europe and Aſia.

We are informed that the peſtilential rice-grounds of Georgia exhale an effluvium of ſuch a quality as to cauſe mortal remittents in the ſound, and at the ſame time affording ſignal relief to the phthyſical.

There can be little doubt, that one principal benefit done to pulmonic ailments, by voyages to the ſouth, proceeds from the impregnation of the atmoſphere by infectious airs.

I hold it certain, there is always peſtilential gas in and around the habitations of men, though it but rarely becomes ſufficiently accumulated or concentrated to operate much in cool northern places.—But the caſe is otherwiſe in the lower latitudes towards the equator, where it is common for ſo much non-reſpirable air to generate as to bring on the diſtreſſes of peſtilence, while it keeps off the ravages of conſumption.

It has been aſſerted that peſtilential maladies chiefly affected the lower claſſes of people and the indigent. This indeed is very much the caſe. But people in the higher walks of life, phyſicians, princes, prieſts, and noblemen, have frequently fallen victims to their violence. (*Bibliſche Ergetzlichkeiten*, S. 947.) So that the wealthy and the great have by no means an entire exemption. See *Miſander*'s uber. 2 Sam. chap. 24.

But in ſeaſons of peſtilence, certain tribes of animals are exempted more completely than any deſcription of men, particularly many of the ſpecies of reptiles and inſects. It ſeems, that in the œconomy of nature, theſe, though many of them are breathing animals, do require an atmoſphere different from that which ſuits the conſtitution of mankind and quadrupeds.

They

They are bred in the midſt of peſtilential air, and thrive beſt in it.

On conſidering the hiſtory of modern endemic diſtempers, and comparing it with the relations made in the eighth, ninth, and tenth chapters of Exodus, the plagues of Pharoah will be found to be very analogous, and to ſucceed each other in a very orderly progreſſion. They are almoſt all local, and ſuch as might be expected to happen in a valley of conſiderable width near floods of the Nile. The converſion of the river into blood will admit of the ſame explanation with ſuppoſed ſhowers of blood; and the rain there, in the opinion of an agreeable writer, (1 Pott. Eſſai ſur la Nature, &c. ch. 8. p. 115.) may be coloured red during its deſcent by the duſt waſhed from certain inſects, by the preſence of microſcopical inſects themſelves, or by fluids emitted by the inſects; or after its fall it may acquire its ſanguine colour from oker or reddiſh earth brought down from the mountains. The exceſſive multiplication of *frogs*, *ticks*, (lice) and all ſorts of *flies* (gnats and muſquetos) ſwarming about, ſtarving and dying upon the land, were ſufficient to contaminate the air and generate peſtilence among domeſtic animals, and to cauſe ulcers and burning puſtules on the human ſpecies. I have endeavoured elſewhere to prove, that bitter cold in the atmoſphere is to be explained upon the ſame general cauſe which produces peſtilence. The occurrence there of hail and lightning, (ſee my latter to Mr. *Valentin)* and ſubſequent darkneſs are all very natural, as well as the extraordinary production of graſs-hoppers, (locuſts) and the mortality among the young Egyptians. (CALMET ſur L'Exode. p. 65 and ſeq.) This coincidence of peſtilence and hail is very remarkable, and is ſtrictly conformable to philoſophical truth.

There is another inſtance of exemption which occurs to me, and that is of the white people of Nantucket and Martha's Vineyard, when ſuch ſad mortality prevailed among the Indians in 1763. The Indians alone ſuffered from it in theſe

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two iſlands. The account given of this peſtilence, by Mr. Oliver, in his letter to Mr. Mauduit, is very ſhort and incomplete. From it, however, we learn, that the *Indians had been ſcanted in their allowance of corn*, which led them probably to the conſumption of a greater quantity of fiſh for food: in this way the diſtemper might have ariſen. We learn further, that the diſeaſe ſo produced was attended with *a violent inflammatory fever, which carried them off in about five days*, reſembling, in theſe reſpects, the endemic diſorders of New-York and Philadelphia. And we learn further, that the *Indians chiefly lived and died by themſelves:* whence it would be not at all difficult of explanation, why the white inhabitants, who had better food and lived in diſtinct parts of the iſlands, altogether eſcaped.

As your official ſituation puts it in your power to collect information with great advantage from the weſtward, I have to requeſt you will aſcertain for me the effects which the air of thoſe nitre-grounds, mentioned by Mr. Secretary Pickering, in one of his reports, has upon animal bodies, and eſpecially upon human conſtitutions. In ſo doing you will aid the cauſe of ſcience, and greatly oblige your ſincere friend

SAMUEL L. MITCHILL.

New-York, June 14, 1796.

SIMEON DE WITT, Eſq.

THE END.

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