

**Philosophical, medical, and experimental essays ... To which is added an appendix; containing a letter to the author from Dr. Saunders, on the solution of human calculi / [Thomas Percival].**

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Percival, Thomas, 1740-1804.  
Saunders, William, 1743-1817.

**Publication/Creation**

London : J. Johnson, 1776.

**Persistent URL**

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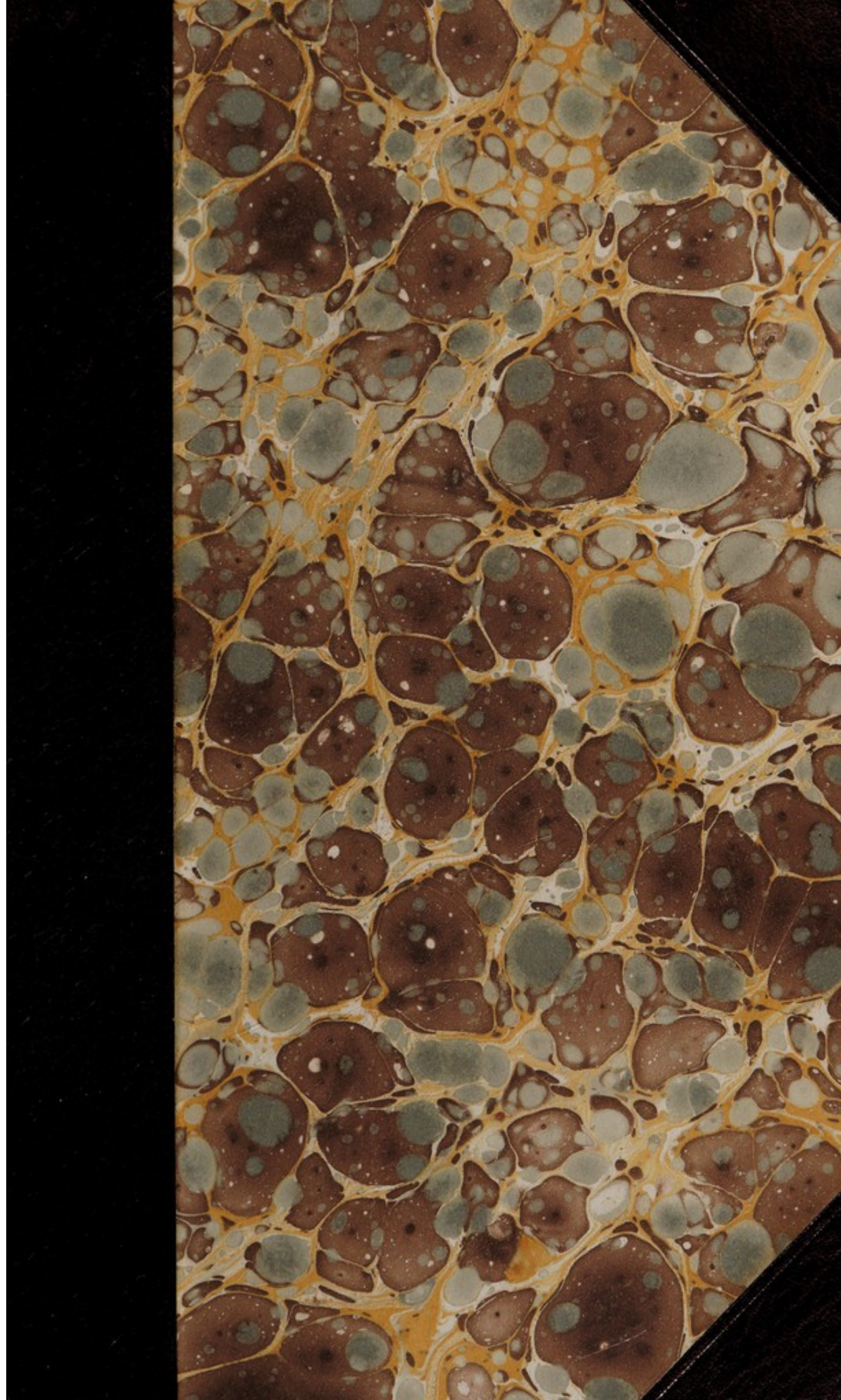
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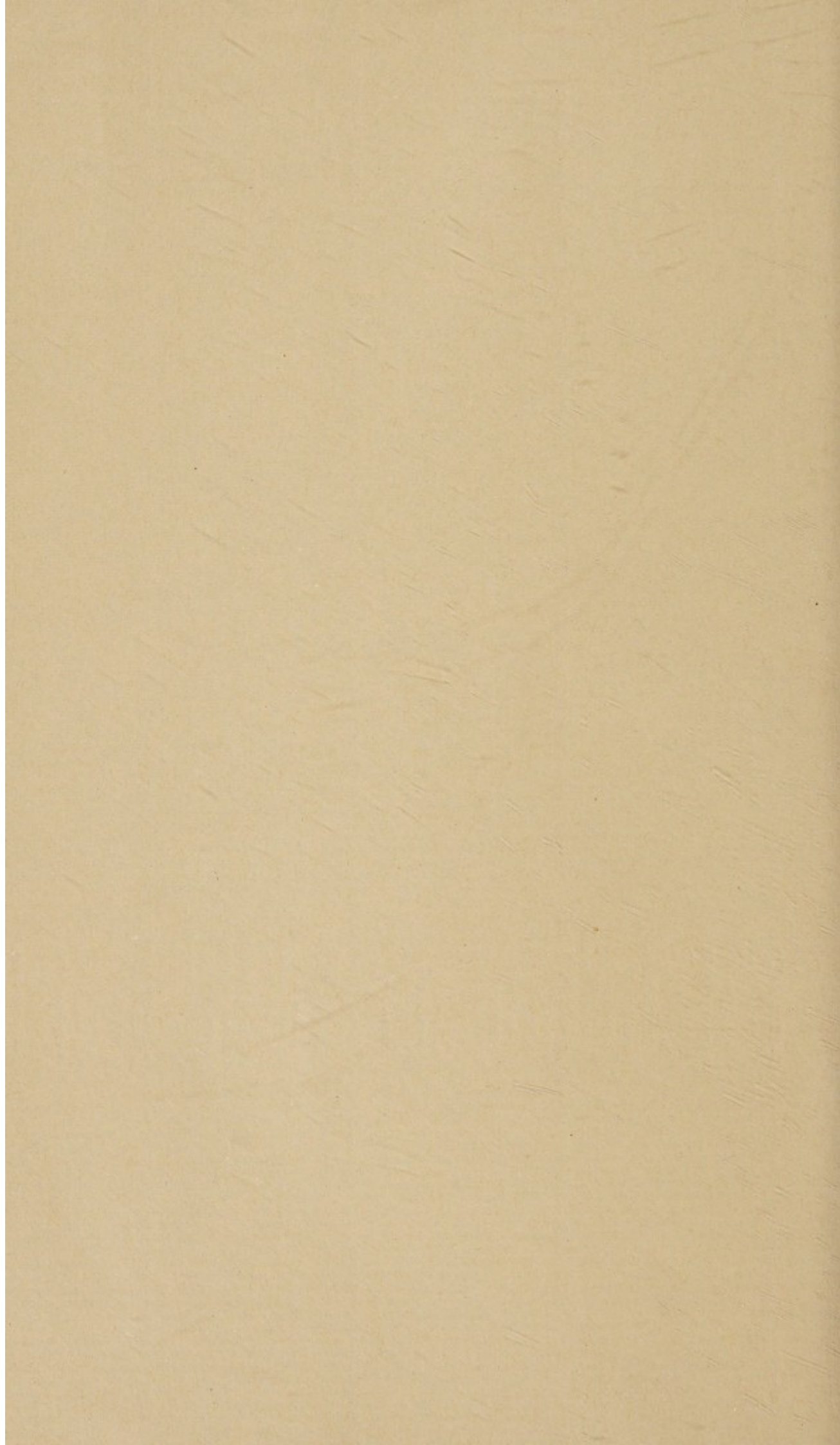


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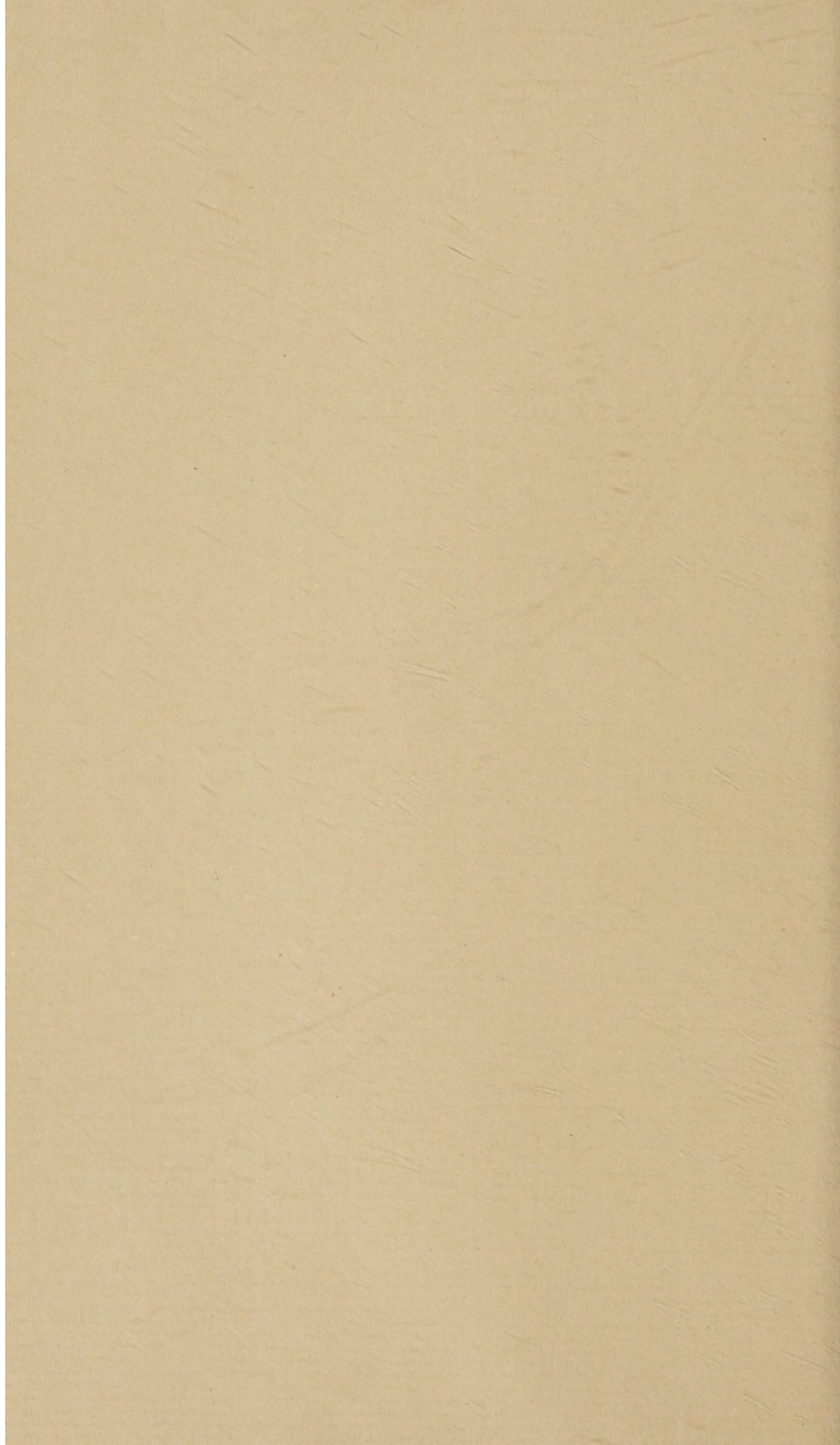




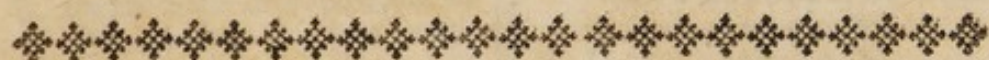








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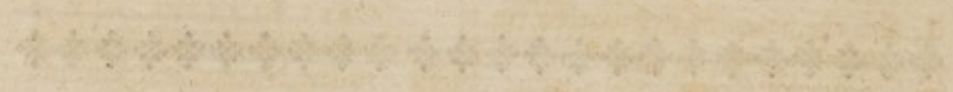
MEDICAL, AND EXPERIMENTAL

E S S A Y S.

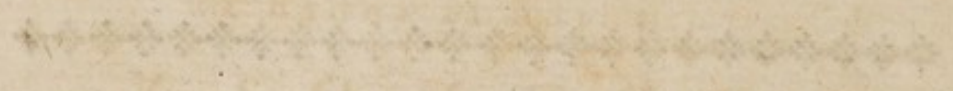




THE  
MEDICAL AND EXPERIMENTAL  
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PHYSIOLOGICAL  
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FESTIVAL

LONDON  
PUBLISHED BY  
J. B. LIPPINCOTT

22725

PHILOSOPHICAL,  
MEDICAL, AND EXPERIMENTAL  
E S S A Y S ;

V I Z.

- |   |   |
|---|---|
| I. On the State of Population in<br>MANCHESTER, and other<br>adjacent Places.   | GALL BLADDER, by Water<br>impregnated with Fixed Air.                       |
| II. On the proportional Mortality of the SMALL POX and MEASLES, in the several Periods of Life, and different Seasons of the Year; together with its comparative Fatality to Males and Females. | V. On the Nature and Composition of URINARY CALCULI.                        |
| III. On the different Quantities of RAIN which fall, at different Heights, over the same Spot of Ground.  | VI. On the Internal Regulation of HOSPITALS.                                |
| IV. On the Solution of STONES of the URINARY and of the   | VII. On the Influence of FIXED AIR on the Colours and Vegetation of PLANTS. |
|   | VIII. On the Action of different MANURES.                                   |
|   | IX. On the Properties of different ABSORBENTS.                              |
|   | X. Miscellaneous OBSERVATIONS, CASES, and INQUIRIES.                        |

By THOMAS PERCIVAL, M.D.

Fellow of the ROYAL SOCIETY, and of the SOCIETY of  
ANTIQUARIES in LONDON.

TO WHICH IS ADDED AN

A P P E N D I X ;

CONTAINING A

LETTER TO THE AUTHOR FROM DR. SAUNDERS,

ON THE SOLUTION OF HUMAN CALCULI ;

WITH OTHER PAPERS.

L O N D O N :

Printed for JOSEPH JOHNSON, No. 72, St. Paul's Church-Yard.

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# THE RIGHT HONOURABLE WILLIAM LUTHER PEARCE EARL OF SHELBURNE

ON THE STATE OF THE NATION IN  
1834  
I. On the state of the nation in  
1834  
II. On the state of the nation in  
1834  
III. On the state of the nation in  
1834  
IV. On the state of the nation in  
1834

By THOMAS PERCIVAL, M.D.  
Fellow of the Royal Society, and of the Royal Academy  
of Medicine, London.

TO WHICH IS APPENDED  
AN APPENDIX IN D I X ;

CONTAINING  
THE RAPID PROGRESS OF  
SCIENCE, IN THIS AGE  
OF FREE INDUSTRY, IS A SUB-  
JECT OF THE MOST INTERESTING  
AND IMPORTANT NATURE.

TO  
THE RIGHT HONOURABLE  
WILLIAM  
EARL OF SHELBURNE,  
VISCOUNT FITZ-MAURICE,  
AND  
BARON WYCOMBE;

ONE OF HIS MAJESTY'S MOST HONOURABLE  
PRIVY COUNCIL;

AND  
LL. D.  
&c. &c.

MY LORD,

THE rapid progress of  
Science, in this age  
of free inquiry, is a sub-  
a 3 ject



ject of gratitude and exultation to every wise and good man. Human nature seems to have risen in the great scale of being; and the mind, exalted with its intellectual and moral acquisitions, labours still to ascend; aspiring to higher and higher degrees of perfection. The Philosopher contemplates, with heartfelt satisfaction, this glorious pre-eminence. He venerates the dignity of the human character; and disdains whatever tends to the degra-



# DEDICATION. vii

degradation or debasement of his species. This generous enthusiasm kindles in his breast the sacred flame of Liberty : He loves his country, but regards himself as a citizen of the world ; and vindicates the equal and unalienable rights of all mankind.

SUCH, my Lord, are the principles of genuine patriotism ; and how animating their influence is, I appeal to the feelings of your own  
a 4
heart,



heart, and to the uniform tenour of your public and private conduct! As a SENATOR, you have maintained, with intrepidity and zeal, those liberal maxims of Government, on which the Revolution was founded, and to which we owe the elevation of the House of Hanover to the sovereignty of these dominions: Illustrious events, which will for ever display the spirit and magnanimity of the PEOPLE of England!

As



DEDICATION. ix

AS a NOBLEMAN, you are entitled to the distinguished praise of being a promoter of the useful and ornamental arts ; a friend to commerce ; and a beneficent patron of learning. These, my Lord, are the superior privileges of an ample fortune and elevated rank ; and happy should I be, were it in my power to weave an unfading garland of honour, for one so meritorious in the application of them. But this I presume



sume not to attempt ; satisfied with the pleasing opportunity which I now enjoy, of expressing the perfect esteem, and affectionate regard, with which I have the honour to be,

MY LORD,

*Your Lordship's*

*most faithful, obliged,*

*and obedient Servant,*

MANCHESTER,  
Feb. 6th, 1776.

THOMAS PERCIVAL.



T H E

P R E F A C E.

**I**N the Preface to a former volume, published about three years ago, I availed myself of the authority of the great Lord Bacon ; whose plan I have steadily pursued in the collection and arrangement of FACTS, OBSERVATIONS, and EXPERIMENTS. Long and systematic compositions are neither compatible with the extensive



tenfive engagements of my profession; nor with the attention which is due from me to a dear and numerous family. But in this desultory way, I can employ a vacant hour; beguile the distance of a tedious journey; or divert the anxieties of a feeling heart, with improvement to myself, and, I am willing to hope, with advantage to others. The indulgence, with which I have hitherto been honoured by the public, may, at least, be pleaded as an apology for this self-flattery.

To Men of Letters, the mode of writing in detached Essays is commonly agreeable; because it precludes



precludes the labour of reading or of repeating elementary propositions, and well-known truths ; it renders the detection of error more easy ; facilitates the communication of new discoveries ; and presents to the mind, in separate and distinct views, the additions which are made to the general stock of knowledge.

SEVERAL of the following Tracts and Miscellaneous Observations have before appeared in the Philosophical Transactions, and in other publications. As they were favourably received, I have revised, enlarged, and inserted them in this volume.



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OBSERVATIONS  
ON THE  
STATE OF POPULATION  
IN  
MANCHESTER,  
AND OTHER ADJACENT  
PLACES,



CONTENTS

OF THE

STATE OF POPULATION

MASSACHUSETTS

IN THE YEAR 1850

AS ASCERTAINED BY THE

UNITED STATES CENSUS

OF 1850

AND THE

STATE OF MASSACHUSETTS

IN THE YEAR 1850

AS ASCERTAINED BY THE

UNITED STATES CENSUS

OF 1850

OBSERVATIONS  
ON THE  
STATE OF POPULATION  
IN  
MANCHESTER,  
AND OTHER ADJACENT PLACES.

FROM an account taken in 1717,  
the number of inhabitants in  
Manchester, for I am uncertain  
whether Salford (*a*) was included, ap-  
pears to have been 8000.

By

(*a*) MANCHESTER and Salford, though distinguish-  
ed by different names, like London, Westminster, and  
the Borough of Southwark, may be considered as one  
and the same town, being divided only by a small river,  
over which two bridges are erected,



#### 4 OBSERVATIONS ON

By a survey made in 1757 of Manchester and Salford, the number of inhabitants was found to be 19839. And from 1754 to 1761 inclusive, the number of deaths amounted to 5769. The annual deaths therefore, at the period of the survey, must have been 721, exclusive of dissenters. It is probable, as will appear afterwards, that these would have increased the number to 771. At this time therefore 1 in 25.7 of the inhabitants of Manchester died every year.

A NEW survey of Manchester has been executed this summer (1773) with great care and accuracy, of which the following is a particular account.

#### MANCHESTER. SALFORD.

3402	Houses	866.
5317	Families	1099.
10548	Males	2248.
11933	Females	2517.
7724	Married	1775.



POPULATION, &c. 5

MANCHESTER. SALFORD.

432	Widowers	89.
1064	Widows	149.
7782	Under 15	1793.
3252	Above 50	640.
342	Male Lodgers	18.
150	Female Do.	13.
44	Empty Houses	26.

FROM hence it appears that the number of tenanted houses in Manchester and Salford amounts to 4268 ; the families to 6416 ; and the inhabitants to 27,246. The proportion of persons to a house therefore is more than  $6\frac{1}{3}$  ; and of individuals to a family about  $4\frac{1}{4}$ . The females exceed the males by 1654 ; the widows are more than double the number of widowers ; and about a seventh part of the inhabitants have attained the age of fifty.

THE following Table is formed from the Register of Burials and Baptisms at

B 3 the



# 6 OBSERVATIONS ON

the Collegiate or Parish Church in Manchester, and gives the annual number of each on an average.

		Burials. Baptisms.	
From 1580 to 1587 inclusive,		184	
1680	1687	286	
1720	1727	359	
1754	1760	736	769
1761	1765	731	843
1766	1770	870	970

BUT it should be remarked that this account does not include the Deaths or Births amongst the Dissenters. These, by a late improvement in our Bills of Mortality, are now received into the Parish Register; and last year (1772) the former amounted to 50, the latter to 181. Admitting these to be the average of unregistered Baptisms and Burials in Manchester, the annual medium of Deaths from 1768 to 1772 inclusive, will be 958. And the annual Births during



during the same period, with the like allowance, will be 1098. Hence the present proportion of annual Deaths to the Inhabitants is nearly as 1 to 28 .4; and of Births to the Inhabitants almost as 1 to 25. The Births also, it appears, exceed the Burials 140 every year at a medium.

THE rapid growth of Manchester is sufficiently evident from the preceding facts. Yet Liverpool, during the same space of time, has increased in a much greater proportion. This appears from the following Table, which I have extracted from a very curious and entertaining work, lately published by my ingenious friend the Rev. Dr. Enfield, Lecturer on the Belles Lettres in the Academy at Warrington.



## 8 OBSERVATIONS ON

(b) Year. Number of Inhabitants. Annual Addition.

1700	5714	
1710	8168	245
1720	10446	227
1730	12074	162
1740	18086	601
1750	22099	401
1760	25787	368
1770	34004	822

ACCORDING to this Table, Liverpool has at present upwards of six times the number of inhabitants which it contained at the beginning of this century.

BUT the progress of trade and opulence in Manchester has been more than adequate to its advancement in population. For a considerable part of the manufactory of this flourishing town, is carried on in the adjacent country, which is thereby crouded with houses and inhabitants.

(b) History of Liverpool, page 28, second edition, corrected.



bitants. So populous are the Environs of Manchester, that every house in the township has been found, by a late survey, to contain at an average six persons. The township is indeed but of small extent; and the greatest part of it will probably, in a short time, be included in Manchester. It contains 311 houses; 361 families; 947 males; 958 females; 656 married persons; 21 widowers; 42 widows; 763 under 15 years of age; and 222 above 50.

It is pleasing to observe, that notwithstanding the enlargement of Manchester, there has been a sensible improvement in the healthiness and longevity of its inhabitants; for the proportion of Deaths is now considerably less than in 1757. But this is chiefly to be ascribed, as Dr. Price has justly observed (*c*), to the large accession of new settlers

(*c*) See a most valuable Treatise on Reversionary Payments, page 188, third edition.



settlers from the country. For as these usually come in the prime of life, they must raise the proportion of *inhabitants* to the *deaths*, and also of *births* and *weddings* to the *burials*, higher than they would otherwise be. However, exclusive of this consideration, there is good reason to believe that Manchester is more healthy now than formerly. The new streets are wide and spacious, the poor have larger and more commodious dwellings, and the increase of trade affords them better cloathing and diet than they before enjoyed. I may add too, that the late improvements in medicine have been highly favourable to the preservation of life. The cool regimen in fevers, and in the small pox; the free admission of air; attention to cleanliness; and the general use of antiseptic remedies and diet, have certainly mitigated the violence, and lessened the mortality of some of the most dangerous and malignant distempers to which mankind are incident.



dent. The Ulcerous Sore Throat, which prevailed here in the year 1770, is the only epidemic which has appeared in Manchester with any fatal degree of violence, for many years. Miliary Fevers, which were formerly frequent in this town and neighbourhood, now rarely occur; and if I may judge from my own experience, the natural Small Pox (for Inoculation is not much practised here) carries off a much smaller proportion of those who are attacked by it, than is commonly supposed. Puerperal diseases also decrease every year amongst us, by the judicious method of treating women in child-bed: and as nature is now more consulted in the management of infants, it is reasonable to suppose that this must be favourable to their health and preservation.

BUT it must be acknowledged that large towns are injurious to population; and the advantages I have enumerated, which



which in hamlets or country villages would have operated with full force to the benefit of mankind, have only served to check the destructive tendency of the accumulation of inhabitants in Manchester. In the Pais de Vaud, a district of the province of Bern in Switzerland, and in a country parish in Brandenburg, 1 in 45 of the inhabitants die annually; and at Stoke Damarell in Devonshire, 1 in 54 (*d*): whereas in this town the yearly mortality appears to be 1 in 28; in Liverpool 1 in 27; and in London 1 in 21. Half the children who are born in Manchester die under five years old; and the proportion which the births bear to the number of inhabitants who attain the age of 80, is as 30 to 1. Diseases are most frequent and fatal here in the months of January, February, and March; and least so in July, August, and September.

(*d*) See the Treatise before referred to, on Reverfionary Payments, by my learned friend Dr. Price.



tember. The mortality of these two seasons is as 11 to 8; and of the first six months of the year compared with the last six months, as 7 to 6.

IN April, 1773, several Gentlemen, from motives of curiosity, undertook an enumeration of the people of BOLTON, a manufacturing town about twelve miles distant from Manchester. The houses were found to be 946; the males 2159; the females 2392; and persons aged seventy years and upwards, 74. To these numbers 17 must be added, which by a mistake were not classed under either denomination. The inhabitants of Bolton therefore amount to 4568; the number of individuals to a house is 4.8; and about a sixtieth part of the people have attained the age of seventy.

LITTLE BOLTON, a suburb of Bolton, including the manor, and extending into the country as far as the inhabitants  
are



## 14 OBSERVATIONS ON

are subject to *suit* and *service*, contains 232 houses; 771 individuals; 361 males; 410 females; and 15 persons aged seventy years and upwards. From this account it appears that the inhabitants are 3.3 to a house; and that 1 in 51 has reached the age of seventy. The difference in these proportions between a small town, and a country manor contiguous to it, is worthy of observation.

MR. FLETCHER has favoured me with an enumeration of the people of BURY, which he has just executed with great care. The town contains 463 houses; 464 families; and 2090 inhabitants. Each house and family therefore consists of  $4\frac{1}{2}$  individuals. Bury is situated nine miles from Manchester, and is enriched by a branch of the woollen manufactory.

AT ALTRINGHAM, a market town in Cheshire, which has no manufactory, the number of houses, according to an exact



exact survey made in July, 1772, was 248; of inhabitants 1029, or  $4\frac{1}{7}$  to a house. An enumeration of the people of this town was made about twenty years ago, at which time they amounted very nearly to 1000.

THE following is a comparative view of the state of population, the duration of life, and the mortality of the several seasons of the year, &c. in EASTHAM, and ROYTON, two country places widely different from each other in climate, situation, and in the occupation of their inhabitants.

THE parish of Eastham lies in Wirral, one of the hundreds into which Cheshire is divided, and is extended along the banks of the river Mersey, a few miles distant from the Irish sea. The people are most of them farmers; though some are fishermen, and others are employed in the ferry to Liverpool.

ROYTON



ROYTON is a chapelry, situated ten miles eastward of Manchester, under the great chain of mountains which divides Lancashire and Yorkshire. The inhabitants are employed chiefly in the cotton and linen manufactory; a few of them are farmers; and some I believe work in the coal pits, with which this country abounds.

I AM indebted to my learned friend the Rev. Mr. Travis, Vicar of Eastham, for the survey of his own parish, which he undertook at my desire, and executed himself; and also for that of Royton, which was made by his uncle, the worthy and respectable Clergyman of that Chapelry.



JANUARY 1<sup>st</sup>, 1772, the number of inhabitants in the chapelry of Royton were found to be 1105.  
The number of inhabitants in the parish of Eaftham, 912.

The number of persons <i>in a house</i> , in the chapelry of Royton is somewhat more than	-	-	-	5 $\frac{1}{7}$ .
The number of ditto, - in the parish of Eaftham,	-	-	exactly	- 5.
The number of persons <i>in a family</i> , in the former on an average,	-	-	about	- 4 $\frac{3}{4}$ .
The number of ditto, - in the latter,	-	-	more than	- 4 $\frac{1}{2}$ .
The proportion of males to females, in Royton,	-	-	nearly as	- 53 to 56.
The proportion of ditto, - in Eaftham,	-	-	nearly as	- 54 $\frac{1}{2}$ to 56.
The widows to the widowers, in Royton,	-	-	as	- 3 $\frac{1}{3}$ to 1.
The widows ditto, - in Eaftham,	-	-	as	- 3 to 2 $\frac{1}{2}$ .
C The number of births in Royton (on an average of 3 years) 42. } Proportion between males and females as 13 to 11.				
The number of do. in Eaftham - do. - 34. }	Proportion between ditto, - as 18 to 16.			

N. B. These proportions for 7 years.

The number of births in Royton to the number of married inhabitants, as (very nearly) 1 child to 5 married couples.				
The number of do. in Eaftham to ditto, - - as (somewhat more than) 1 child to 4 married couples.				
The number of births in Royton to the whole number of inhabitants, - as -	-	-	-	1 to 26 $\frac{1}{3}$ .
The number of do. in Eaftham to ditto, - - as -	-	-	-	1 to 26 $\frac{4}{5}$ .
The number of married persons in Royton to the number of unmarried persons above 15, - as -	-	-	-	8 to 5.
The number of ditto, - in Eaftham to the number of - ditto, - nearly as	-	-	-	6 to 5.

The



The number of burials in Royton (on an average of 3 years)		21.	} Proportion between males and females as 13 to 10.	
The number of ditto in Easfham	- ditto	- 26.	} Proportion between - ditto - as 14 to 12.	
The number of burials in Royton to the number of all the inhabitants,		-	as	- 1 to 52.
The number of ditto in Easfham to	- ditto,	-	as	- 1 to 35.
The number of children dying under 3 yrs. old to the number of children born in Royton (on an average of 3 yrs.) as 1 to 7.				
The number of children	- ditto	- to	- in Easfham	- as 1 to 17.
Persons alive in Royton under 3 years old Jan. 1. 1772, 129; dead under 3 years old, average of 3 years, 6, or 1 of 21 $\frac{1}{2}$ .				
Ditto in Easfham	- - -	- 100;	- - -	dead 2, or 1 of 50.
Persons alive in Royton under 15 years old Jan. 1. 1772, 450; dead under 15 years old, average of 3 years, 11, or 1 of 41.				
Ditto in Easfham	- - -	- 329;	- - -	dead 4, or 1 of 82.
Persons alive in Royton between 15 and 30 years old Jan. 1. 1772, 333; dead before 1773 of these 5, or 1 of 66 $\frac{1}{2}$ .				
Ditto in Easfham	- - -	- 199;	- - -	dead 5, or 1 of 40.
Persons alive in Royton from 30 to 40 years old ditto, 96; dead before 1773 of these on an average, 2, or 1 of 48.				
Ditto in Easfham	- - -	- 124;	- - -	dead 4, or 1 of 31.
Persons alive in Royton from 40 to 50 years old ditto, 98; dead before 1773 of these on an average, 2, or 1 of 49.				
Ditto in Easfham	- - -	- 83;	dead before 1773 of these	- 3, or 1 of 28.
Persons alive in Royton from 50 to 60 years old ditto, 61; dead before 1773 of these 1 $\frac{1}{3}$ , or 1 of 45.				
Ditto in Easfham	- - -	- 64;	dead before 1773 of these	- 2, or 1 of 32.

Persons



Persons alive in Royton from 60 to 70 years old	ditto, 49	dead before 1773 of these	-	$1\frac{1}{3}$ , or 1 of 36.
Ditto in Eastham	-	54; dead before 1773 of these	-	$1\frac{1}{3}$ , or 1 of 40.
Persons alive in Royton from 70 to 80, Jan. 1. 1772,	10	{	dead before 1773, on an	{
80 to 90, ditto,	8		average of 3 years,	
Persons alive in Eastham from 70 to 80,	34	{	dead before 1773, on an	{
80 to 90, ditto,	5		average of 3 years,	

(e)

THE mortality of the seasons at Royton and Eastham, for the last seven years, has been as follows:

## ROYTON. EASTHAM.

January,	February,	March,	39	56
April,	May,	June,	31	34
July,	August,	September,	31	45
October,	November,	December,	18	53
			<hr/>	<hr/>
			119	188

(c) THE averages here adopted may, in some instances, seem to be too small; but Mr. Travis assures me, that through a series of fifteen successive years, the Marriages, Births, and Deaths at Eastham, do not vary, in any degree worth remarking, from the foregoing Table.



OF all the months in the year singly taken, October is the most, and April the least fatal to the inhabitants of East-ham. Whereas the three last months of the year appear to be the most healthful at Royton; although a very large quantity of rain usually falls there during this season. For the wind at this time being generally westerly, the clouds are intercepted by the high mountains, and discharge themselves in frequent and heavy showers. At Townley, which is situated under the same chain of hills, and is not very far distant from Royton, 42 inches of rain fall at a medium, every year. The quantity of rain at Manchester, which is farther removed from the mountains, is about 33 inches *communibus annis*. It has been observed by a very useful writer, that the *moist seasons* in Great Britain and Ireland are more remarkably free from epidemic diseases, than the dry ones; and that storms, the usual concomitants of rain, are attended with more health and less



less sickness than calm weather, probably because they dissipate the vapours, which by stagnation might prove an occasion of various distempers (*f*). I shall not presume to determine that these observations account for the superior healthiness of the last months of the year at Royton; but they certainly should remove the prejudice which is too generally entertained against the wetness of the climate in Lancashire, and other western counties of England. For the bounties of Providence are dispensed with an equal, as well as with a liberal hand. And if we, in this part of the island, enjoy less sunshine than our neighbours, we have milder winters, and summers tempered with more refreshing showers, to balance the inconvenience.

THE Rev. Mr. Bolton, a very worthy dissenting Clergyman at MONTON, a few miles

(*f*) Rutton's Chronological History of Weather.



miles from Manchester, has at my request, made an enumeration of his people, with a retrospective view of the births and deaths amongst them during the last ten years. By this survey, his congregation, including servants, consists of 196 males; 190 females; 97 families; 60 married persons; 14 widowers; 13 widows; 142 under 15 years of age; and 64 above 50. The deaths during ten years have been 57, and the births 138. Hence it appears, that of this society 1 in 6 has attained the age of 50; that the births are more than double the burials; and that only 1 in 68, at a medium, dies every year. The last circumstance is somewhat extraordinary; but to remove all doubts concerning the accuracy of his enumeration, Mr. Bolton, with the most obliging assiduity, has repeated it twice. And he has derived his information not only from the register of his chapel, but also from the private records, or deliberate recollection of every family



family in his congregation. The *situation* of Monton appears to be rather unfavourable to health, from the vicinity of a large moss; but the people are most of them farmers, and are remarkable for their diligence and sobriety. The long life which they enjoy affords a striking and pleasing proof of the great advantages of temperance; and confirms a curious observation of M. Muret, who examined the register of mortality in one town, to mark those whose deaths might be imputed to *excess*. The number of these he found so great, as led him to believe that *drunkenness* is more destructive to mankind than pleurifies, fevers, or the most malignant distempers.

AUG. 16th, 1773.



24 OBSERVATIONS ON

FURTHER

OBSERVATIONS

ON THE

STATE OF POPULATION

IN

MANCHESTER,

AND OTHER ADJACENT PLACES.

THE number of inhabitants and progress of population in the kingdom; the increase or decrease of certain diseases; the comparative healthiness of different situations, climates, and seasons; and the influence of particular trades and manufactures on the duration of life, are subjects of the highest



est importance to the community; and equally interesting to the statesman, the philosopher, and the physician.

“ I HAVE somewhere read,” says Dr. Franklin (in the remarks on my former paper with which he has lately favoured me) “ that in China an account is yearly taken of the number of people, and the quantities of provision produced. This account is transmitted to the Emperor, whose ministers can thence foresee a scarcity likely to happen in any province, and from what province it can best be supplied in good time (*a*). To facilitate the collecting of this account, and prevent the necessity of entering houses and spending time in asking and answering questions, each house is furnished with a little board to be hung without the door during a certain time each year; on which  
“ board

(*a*) CHINA, like all other countries that subsist chiefly upon rice, is subject to frequent famines. *Montesquieu*.



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“ board are marked certain words, against  
 “ which the inhabitant is to mark num-  
 “ ber or quantity, somewhat in this  
 “ manner :

Men
Women
Children
Rice or Wheat
Flesh, &c.

“ ALL under 16 are accounted chil-  
 “ dren, and all above, men and women.  
 “ Any other particulars which the go-  
 “ vernment desires information of are  
 “ occasionally marked on the same  
 “ boards. Thus the officers appointed  
 “ to collect the accounts in each district,  
 “ have only to pass before the doors, and  
 “ enter into their book what they find  
 “ marked on the board, without giving  
 “ the least trouble to the family. There  
 “ is



“ is a penalty on marking falsely; and as  
 “ neighbours must know nearly the truth  
 “ of each other’s account, they dare not  
 “ expose themselves by a false one, to  
 “ each other’s accusation. Perhaps such  
 “ a regulation is scarcely practicable with  
 “ us.”

BUT an enumeration of the people of England, similar to that lately executed at Manchester, would not be so difficult an undertaking, as may at the first view be imagined. And if accurate and comprehensive Bills of Mortality were universally established, they would admirably coincide with the views of such inquiries, and give precision and certainty to the conclusions deduced from them (*b*).

FROM

(*b*) Vid. The author’s Proposals for establishing accurate Bills of Mortality in Manchester. *Essays Medical and Experimental*, Vol. 2. These Proposals have been adopted, and with a few variations carried into execution by Dr. Haygarth at Chester, Dr. Dobson at Liverpool, and by Mr. John Aikin at Warrington.



FROM the populousness of this neighbourhood, it may perhaps be supposed, that a great number of burials are brought from the Country to the Collegiate and other Churches in Manchester, and that this circumstance is likely to create uncertainty and error in the calculations made from the parochial register of deaths. But it appears from the best information I can collect, that the number of such burials is not considerable; and that they are pretty exactly balanced by those which are carried out of Manchester to the neighbouring episcopal or dissenting chapels. This fact admits of an easy and satisfactory explanation, were it necessary to trouble the reader with it.

IT is remarked in the former paper that wet seasons are generally more free from epidemic diseases than dry ones, and the Bills of Mortality at Manchester *seem* to confirm the observation: It appears at least from the following table, that the  
year



year 1766, remarkable in this climate for the small quantity of rain which fell during the course of it, was more fatal than any of the rest. And the proportion of deaths will be deemed greater when it is recollected, that the town contained at that time fewer inhabitants (probably two thousand) than it does at present. For the rapid increase of Manchester commenced about the year 1765, after the conclusion of the last war.

Year.	Quantity of Rain at Manchester. Inches.	Deaths at Manchester.
1765	31. 378	723
1766	25. 762	1019
1767	29. 186	690
1768	40. 526	867
1769	32. 514	788
1770	39. 363	988
1771 from Jan. 1. to June 1. }	6. 8 (c)	

THIS

(c) THIS account of the quantity of rain, was communicated to me by George Lloyd, Esq. F. R. S. The  
observa-



THIS table, it must be acknowledged, does not comprehend a sufficient length of time to admit of any very accurate or incontrovertible conclusions from it. And the influence of other causes of disease, which have little or no relation to the state of the atmosphere, together with the irregularity which necessarily occurs in the annual increase of a large manufacturing town, may be regarded as further sources of fallacy and uncertainty. It is therefore with diffidence I observe, that though wet seasons are less mortal than long continued droughts, yet the rainy years 1768 and 1770 proved extremely sickly and fatal. And those years are probably most unfavourable to health, in which heavy rains fall about the beginning of summer, and  
are

observations were made (upon the ground) at his seat, about a mile distant from the center of Manchester, and were continued only till June 1771. The situation of my own house, and my frequent and distant calls into the country prevent me from undertaking such experiments myself.



are succeeded by great and uninterrupted heats. For the earth being thus drenched with moisture, and the low lands overflowed with water, the exhalations become constant, copious, and often putrid.

JOAN LEO in his history of Africa relates, that if heavy rains fall in that country during the months of July and August, the plague usually breaks out the September following (*d*). But in European climates it is well remarked by Sir John Pringle, that frequent showers in summer cool the air, check the excess of vapour, dilute and refresh the corrupted waters, and precipitate the noxious effluvia which float in the atmosphere (*e*). And it appears from a variety of observations which I have collected, that October, November, and December are generally

(*d*) Hist. Africæ, Lib. 1. Cap. 10.

(*e*) Vid. Sir John Pringle on the Diseases of the Army, p. 5, ed. 4.



nerally very healthy, although the most rainy months in the year. I shall subjoin a table which will set this point in the clearest light; and at the same time shew the comparative mortality of the different seasons at Middleton, Bowden, Chowbent, Dishley, Middlewich, Richmond, and Manchester.

A TABLE



A TABLE SHEWING THE COMPARATIVE MORTALITY OF THE  
DIFFERENT SEASONS OF THE YEAR.

	Middleton from 1663 to 1673. Ten years.	Middleton from 1763 to 1773. Ten years.	Bowden from 1663 to 1673. Ten years.	Bowden from 1763 to 1773. Ten years.	Manchester from 1766 to 1774*. Eight years.
January, February, March,	117.	265.	179.	259.	1538.
April, May, June,	99.	291.	139.	300.	1366.
July, August, September,	79.	215.	114.	209.	957.
October, November, December.	72.	222.	127.	207.	1339.

\* This account is taken from the register of the collegiate or parish church only.



	Chowbent from 1767 to 1773. Six years.	Difhley from 1763 to 1773. Ten years.	Middlewich from 1768 to 1773. Five years.	Richmond from 1764 to 1774. Ten years.	Rochdale from 1760 to 1773. Thirteen years.
January, February, March,	71.	64.	67.	170.	1533.
April, May, June,	37.	78.	55.	156.	1336.
July, August, September,	28.	51.	59.	172.	1077.
October, November, December.	33.	43.	69.	144.	1239.

Total.



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Total.	Jan.	Feb.	March.	4263.
	April.	May.	June.	3857.
	July.	Aug.	Sep.	2961.
	Oct.	Nov.	Dec.	3495.

THERE is a considerable diversity in the situation of these places. Middleton lies six miles north east of Manchester, not far from the great chain of mountains which divides Lancashire and Yorkshire; and about thirty six miles from the sea.

BOWDEN is ten miles to the south west of Manchester, and thirty five miles from the sea. It is an elevated situation, in a level country; and at a great distance from any hills.

CHOWBENT is ten miles westward of Manchester, and twenty five miles distant from the sea. It is in a low and flat  
D 2 situation,



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situation, and near a very extensive morafs.

DISHLEY is in that part of Cheshire, which borders on the peak of Derbyshire. It is a mountainous situation, thirteen miles south east of Manchester, and fifty miles from the sea.

MIDDLEWICH is twenty eight miles southward of Manchester, and about forty miles from the sea. It is furrounded by a well cultivated and level country.

RICHMOND is a considerable market town in the north riding of Yorkshire, about forty miles distant from the German Ocean. It stands on an eminence, which terminates a long continued range of mountains. The country below is an extensive, rich and well cultivated plain.

THE observations of Dr. Franklin on the subject of moisture will, I doubt not, be



be very acceptable to the medical reader, although he may not entirely acquiesce in the opinion of this excellent philosopher. I shall therefore give a farther quotation from the letter before referred to. “The gentry of England are remarkably afraid of moisture, and of air. But seamen who live in perpetually moist air, are always healthy if they have good provisions. The inhabitants of Bermudas, St. Helen and other islands far from continents, surrounded with rocks, against which the waves continually dashing fill the air with spray and vapour, and where no wind can arise that does not pass over much sea, and of course bring much moisture, are remarkably healthy. And I have long thought mere moist air has no ill effect on the constitution; though air impregnated with vapours from putrid marshes is found pernicious, not from its moisture but putridity.



“ tridity. It seems strange that a man  
 “ whose body is composed in great  
 “ part of moist fluids, whose blood and  
 “ juices are so watery, who can swallow  
 “ quantities of water and small beer daily  
 “ without inconvenience, should fancy  
 “ that a little more or less moisture in  
 “ the air should be of such importance.  
 “ But we abound in absurdity and in-  
 “ consistency.”

IN the former paper I gave a striking  
 example of the great advantages of dili-  
 gence and sobriety in *the length of days*  
 which the people of Monton enjoy.  
 Such an instance though a single one,  
 affords the most animating lesson of mo-  
 rality; and I can enforce it by farther  
 proofs.

THE Rev. Mr. Harrop has favoured  
 me with an account of the people who  
 attend Divine Service in the Chapel at  
 Hale,



Hale, near Altringham, which he has lately taken with a retrospect of the births and deaths amongst them during the last seven years. The society is composed of 140 males, 136 females, 92 married persons, 8 widowers, 12 widows, 105 under fifteen years of age, and 41 above fifty. The deaths during seven years have been 28, and the births 68. It appears from this enumeration that only one in 69 of the people, who are most of them farmers, dies annually. Hale is a low situation, and the soil is clayey.

THE congregation belonging to the Chapel at Horwich consists of 305 individuals, viz. 149 males, and 156 females, 94 married persons, and 9 widowers, 8 widows, 127 under fifteen years of age, and 50 above fifty. The births for the last seven years have amounted to 101, and the deaths to 32. Hence the yearly proportion of deaths to the inhabitants



is as 1 to 66. Horwich is between Bolton and Chorley, the country is mountainous, and the people are composed almost equally of farmers and manufacturers. I am obliged to the Rev. Mr. Evans for this account.

THE Rev. Mr. Smalley of Darwen, three miles from Blackburn in Lancashire, has transmitted to me the following survey of his congregation. It consists of 1850 individuals; 900 males; 950 females; 640 married persons; 30 widowers; 48 widows; 737 persons under the age of fifteen, and 218 above fifty. During the last seven years the deaths have amounted to 233; and the births to 508. The annual proportion of deaths therefore is 1 in 56; and the births are to the number of inhabitants nearly as 1 to 25.5. Darwen is a country district, bleak and elevated in its situation, surrounded by moors, and ill cultivated.



vated. The inhabitants are chiefly employed in the cotton manufactory.

A CLERGYMAN in the peak of Derbyshire has, at my desire, undertaken an enumeration of the people of Edale, a fertile valley in that part of the county, inhabited by a sober and industrious race of farmers. But I have not yet received a particular account of the survey; and have only been informed that 1 in 59 of the inhabitants dies annually, on an average of ten years.

THE principles and manners of the Quakers, though often made the subjects of illiberal censure and ridicule, may probably afford them advantages with respect to the duration of life over other bodies of men. The diligence, cleanliness, temperance and composure of mind, by which the members of this society are in general distinguished, may reasonably be supposed to contribute to health  
and



and longevity: And as there are no persons among them in abject poverty, and few immoderately rich, this more equal distribution of property must lessen the sources of disease, and furnish every individual under it with the necessary means of relief. These considerations excited my curiosity to know the proportion of deaths amongst the Quakers in Manchester; and I have been gratified by Mr. Routh, in the most obliging manner, with the following information. The society consists of 81 males; and 84 females; 54 married persons; 9 widowers; 7 widows; and 48 persons under fifteen years of age. The births during the last seven years have amounted to 34; and the burials to 47. About 1 therefore in 24.6 of the Quakers in Manchester dies annually; whereas the proportion of deaths amongst the inhabitants of the town at large is as 1 to 28. If no allowance be made for the temporary and accidental irregularities which may occur



occur in a single and small body of men, when the average of a few years has only been taken, a conclusion directly contrary to what I have presupposed, will be drawn from this fact. And perhaps it will be urged that the want of vivacity in the people of this sect, and the sedentary lives of their females, are causes which shorten the period of their existence, and counterbalance the advantages from cleanliness and sobriety which they enjoy. But the reader will entertain a different opinion concerning this point, when he is informed that the Quakers here have had few or no accessions to their number, by supplies from other places, during the last seven years. This must considerably increase their proportional mortality, for reasons which have been before assigned; and is the true cause why the deaths amongst them so much exceed the births. Were it not for new settlers in the prime of life, who annually pour into Manchester, it is probable that  
more



more than 1 in 25 of its inhabitants would die annually. So baleful is the influence of large towns on the duration of life ; and so justly are they styled, by a writer of the most distinguished abilities (*a*), the *graves* of mankind.

THE Rev. Mr. Barnes, whom I cannot mention without expressions of esteem and friendship, made a survey in September, 1773, of the people belonging to the new chapel at Cockey Moor, near Bolton, the particulars of which are as follow :

Houses	150.
Families	154.
Males	320.
Females	391.
Married persons	248.
Widowers	10.
Widows	27.
	Under

(*a*) Dr. Price.



# POPULATION, &c. 45

Under fifteen	252.
Above fifty	99.
Births in five years	125.
Deaths in seven years	114.
Total number of people	711.

THE married persons in this society are therefore to the single as 1 to 1.867; the widows are nearly treble the number of widowers; a seventh part of the people have attained the age of fifty, and those under fifteen exceed one third of the whole congregation. The average number of births is 25 every year, and of deaths  $16\frac{2}{7}$ ; so that the former are to the latter in the proportion of somewhat more than 5 to 3; and 1 person in about 44 dies annually. It should be remarked, that the number of deaths in this period was considerably increased by the uncommon fatality of the small-pox in the year 1770. Cockey Moor is surrounded by a cold, wet, and barren country;



country ; the inhabitants are farmers and manufacturers.

THE congregation belonging to the chapel at Chowbent consists of 1160 persons, viz. 554 males; 606 females; 173 males, and 150 females under ten years of age; 83 males, and 91 females above fifty; 6 males, and 4 females above eighty; 199 married couples; 26 widowers; and 43 widows. The baptisms during six years (wanting six weeks) have amounted to 293; and the deaths to 169. About 1 therefore in 41.2 of this society dies annually. This survey was made in November, 1773, by the Rev. Mr. Mercer. The people of Chowbent are employed chiefly in the manufactories of cotton, linen, and iron.

AT Ackworth, near Ferry-bridge in the county of York, the christenings and burials for ten years, viz. from March  
25th.



# POPULATION, &c. 47

25th. 1757, to March 25th. 1767, have been as follow :

## CHRISTENINGS.

Males 104.  
Females 108.

Total 212.

## BURIALS.

Males 79.  
Females 77.

Total 156.

OF this number have died,

	Males.	Females.	Total.
Under 2 years old	18	13	31
Between 2 and .5	9	7	16
5 and 10	4	1	5
10 and 20	2	2	4
20 and 30	7	5	12
30 and 40	3	8	11
40 and 50	2	4	6
50 and 60	11	3	14
60 and 70	13	13	26
70 and 80	7	14	21
80 and 90	3	6	9
90 and 100	0	1	1
Of all ages in ten years	79	77	156

Dis-



DISEASES.	Males.	Females.	Total.
Child-bed	0	2	2
Chincough	0	2	2
Consumption	23	15	38
Diabetes	1	0	1
Fever	12	11	23
Infants	7	6	13
Measles	0	2	2
Old Age	11	19	30
Small Pox	7	6	13
Dysentery	1	1	2
Dropsy	0	3	3
Apoplexy	2	1	3

IN this parish there are,

184 Houses, eleven of which are uninhabited.

728 Persons, of the following ages, viz.

Under



# POPULATION, &c. 49

	Males.	Females.	Total.
Under 2 Years old	31	25	56
Between 2 and 5	32	36	68
5 and 10	34	38	72
10 and 20	50	51	101
20 and 30	44	63	107
30 and 40	61	62	123
40 and 50	31	38	69
50 and 60	28	32	60
60 and 70	20	28	48
70 and 80	7	10	17
80 and 90	2	4	6
90 and 100	0	1	1
Of all ages—Total	340	388	

THIS account of Ackworth was lately transmitted to my friend Mr. White, by the Rev. Dr. Lee, Rector of the parish. It appears that 1 in 46.6 of the inhabitants dies yearly; and that the proportion of persons to each tenanted house is  $4\frac{1}{5}$ . Amongst the males under 2 years

E

of



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of age, the number of deaths exceeds by a third those amongst the females; and 43 women and only 29 men have attained the age of sixty and upwards. These facts (and I could adduce many similar ones) confirm a curious remark lately advanced by Dr. Price, that the life of males is more frail than that of females.

I SHALL conclude this Paper with a Table deduced from the preceding observations.

FEB. 1<sup>st</sup>. 1774.

A TABLE



A TABLE SHEWING THE PROPORTION OF INHABITANTS DYING  
ANNUALLY IN SEVERAL DIFFERENT PLACES.

MANCHESTER.	LEVERPOOL.	CHOWBENT.	EASTHAM.	COCKEY.	ROYTON.
1. in 28.	1. in 27.7.	1. in 41.	1. in 35.	1. in 44.	1. in 52.
DARWEN.	EDALE.	ACKWORTH.	HORWICH.	HALE.	MONTON.
1. in 56.	1. in 59.	1. in 47.	1. in 66.	1. in 69.	1. in 68.



## OBSERVATIONS

ON THE

STATE OF POPULATION

IN

MANCHESTER,

AND OTHER ADJACENT PLACES,

CONCLUDED.

A VERY accurate survey was completed last year of the towns of Manchester and Salford, with their respective townships. This spring an enumeration, equally exact and comprehensive, has been made of the whole parish of Manchester; which comprehends thirty one townships (exclusive of the two above-



above-mentioned) in the compass of less than sixty square miles. The reader is here presented with the particulars of this enumeration.

Tenanted houses	2371.
Families	2525.
Inhabitants	13,786.
Males	6942.
Females	6844.
Married	4319.
Widowers	232.
Widows	315.
Under fifteen	5545.
Above fifty	1762.
Above sixty	470.
Above seventy	261.
Above eighty	87.
Male lodgers	68.
Female lodgers	51.
Empty houses	41.

THE number of persons to a house, in the parish of Manchester, is therefore

E 3                      nearly



nearly  $5\frac{2}{3}$ ; of individuals to a family about  $5\frac{1}{2}$ ; and  $\frac{7}{8}$  of the inhabitants have attained the age of fifty. It is unnecessary to point out the difference in the proportions between the *Town* and adjacent *Country*, as it will appear sufficiently obvious by comparing this account with that of Manchester. The whole number of inhabitants in the town, township, and parish of Manchester, amounts to 42937.

AT the close of 1772, an account was collected from every country chapel, both Episcopal and Dissenting, in the parish, of the baptisms and burials of that year. The former were found to amount to 401; the latter to 246; and there is a presumption that this is nearly the annual proportion of deaths in the parish of Manchester, exclusive of the town and township. For the number of burials in the whole parish was, in the same year, exactly 1200; and it has been  
shewn



shewn that the deaths in the town of Manchester are, one year with another, 958. This sum being subtracted from 1200, leaves a remainder (242) for the country, very nearly equal to 246. And if 13786, the number of people in the parish, be divided by 246, it will appear that only 1 in 56 of the inhabitants dies annually; whilst the yearly mortality in Manchester is as 1 to 28. Such a striking disparity in the healthiness of a large town, and of the country which surrounds it, granting it to be less than has been supposed, will scarcely be credited by those, who have paid no attention to inquiries of this nature. And it must afford matter of astonishment even to the physician and philosopher, when he reflects, that the inhabitants of both live in the same climate, carry on the same manufactures, and are chiefly supplied with provisions from the same market. But his surprise will give place to concern and regret, when he observes the havoc



## 56 OBSERVATIONS ON

produced in every large town by luxury, irregularity, and intemperance (*a*); the numbers that fall annual victims to the contagious distempers, which never cease to prevail; and the pernicious influence of confinement, uncleanness, and foul air on the duration of life (*b*).

YE who amid this feverish world would wear  
A body free of pain, of cares a mind;  
Fly the rank city, shun its turbid air;  
Breathe not the chaos of eternal smoke  
And volatile corruption, from the dead,  
The dying, sickening, and the living world  
Exhaled, to fully heaven's transparent dome  
With dim mortality. It is not air  
That from a thousand lungs reeks back to thine,  
Sated

(*a*) THERE are at this time, in Manchester, no less than 193 licenced houses for retailing spirituous and other liquors.

(*b*) THE Rev. Dr. Tucker, Dean of Gloucester, informs me, "That were it not for the daily arrival of recruits from the country, his parish (St. Stephens, in Bristol) and indeed Bristol in general, would be left in a century without an inhabitant; unless the people should betake themselves to better courses."



Sated with exhalations rank and fell,  
The spoil of dunghills and the putrid thaw  
Of nature ; when from shape and texture she  
Relapses into fighting elements :  
It is not air, but floats a nauseous mass  
Of all obscene, corrupt, offensive things.

*Armstrong on Health, Book 1.*

GREAT towns are in a peculiar degree fatal to children. Half of all that are born in London die under two, and in Manchester under five years of age ; whereas at Royton, a country township not far distant from Manchester, the number of children dying under the age of three years, is to the number of children born only as 1 to 7.

It is a common, but injurious practice in manufacturing countries to confine children, before they have attained a sufficient degree of strength, to sedentary employments, in places where they breathe a putrid air, and are debarred the free use of their limbs. The effect of this confinement,



finement, says an able writer, is either to cut them off early in life, or to render their constitutions feeble and sickly. But the love of money stifles the feelings of humanity, and even makes men blind to the very interest they so anxiously pursue. The same principle of sound policy which induces them to spare their horses and cattle, till they arrive at a due size and vigour, should determine them to grant a proportionable respite to their children (*c*). And this observation may, perhaps, be extended to the untimely culture of the mind. For too early an application to study impairs the faculties, injures the constitution, and hurts the temper by frequent contradiction. Almost as soon as a boy has acquired the powers of speech, he is shut up many hours every day in a noisome school, secluded from the benefit of exercise and the

(*c*) See Dr. Gregory's Comparative View of the State and Faculties of Man, &c.



the refreshment of the open air, and tied down to the severe drudgery of learning what serves only, at such a period of life, to overcharge his memory, and to destroy his native chearfulness of disposition. Thus the age of gaiety (to use the words of the elegant writer before referred to) is spent in the midst of tears, punishments, and slavery; and this to answer no other end but to make a child a man, some years before nature intended he should be one.

THE Rev. Mr. Harrison of Chapel in le Frith has made a survey, at my request, of the inhabitants of Chinley, Brownside, and Bugsworth; three hamlets contiguous to each other, in the parish of Glossop, and peak of Derbyshire. They are four statute miles in length, and three in breadth; and contain 301 males; 310 females; 200 married persons; 15 widowers; 18 widows; 234 persons under fifteen years of age; 121  
above



above fifty; and 9 who have attained the age of eighty. This enumeration was finished in September, 1773.

I HAVE been furnished by the Rev. Mr. Afsheton, Rector of Middleton near Manchester, with an account of the births, deaths, and marriages in his parish, during ten corresponding years of the last, and of the present century. From 1663 to 1672 inclusive, the deaths were, males 180, females 187; the births, males 200, females 188; the marriages 121.

THE births therefore, during ten years, only exceeded the deaths in number 21; and the average number of births to each marriage, was as  $3\frac{1}{3}$  to 1.

FROM 1763 to 1772 inclusive, the deaths were, 499 males, 494 females; the christenings, 802 males, 768 females; the marriages 330. The baptisms therefore,



fore, during this period, exceeded the deaths 577, that is, near 58 annually. And if no allowance be made for illegitimate births (which, I believe, in this parish are not numerous, and can nowhere be supposed equal to one fourth of all that are born) each marriage has produced  $4\frac{7}{10}$  children.

It is curious to observe the change both in the proportion of births to the deaths, and also to the marriages, which has taken place at Middleton (and I have received similar accounts of other places) during the course of the last century. The former may be explained by the greater encouragement to matrimony, from the increase of trade: the latter is of more difficult solution; though it is probable that the warmer cloathing, and better fare, which the poor now enjoy, may have contributed to it. Luxury, when carried to such a degree as to enervate the constitution, is unfavourable to population;



population ; but plenty of nutritive diet may well be regarded as a source of fruitfulness. The lower class of people in this country, formerly lived upon the coarsest food. Wheat, an hundred years ago, was almost unknown to them ; and so lately has it been cultivated in Lancashire, that it has scarcely yet acquired the name of corn, which in general is applied only to barley, oats, and rye. Potatoes also are much improved by the present judicious method of growing and propagating them ; and they now constitute a most wholesome and nourishing part of our diet.

A PHYSICIAN, of the first rank in his profession, has suggested to me that tea may be considered as a powerful aphrodisiac ; and he imputes the amazing population of China, amongst other causes, to the general use of it (*d*). But the Dutch,

(*d*) IN China, the women are so prolific, and the human



Dutch, who drink large quantities of the infusion of this vegetable, are so far from being remarkable for the number of their children, that I have been well informed, two births to a marriage is the common proportion in Holland.

It must be acknowledged, however, that warm infusions of tea, by relaxing and augmenting the sensibility of the fibres, which in cold climates, and in hard labouring people, are usually too rigid and torpid, may promote the increase of the human species. But the observation is true only under certain limitations; for the same cause, by debilitating the constitution beyond the due medium, may operate in a contrary manner. Perhaps the general use of pepper, and of other spices, may increase the fertility of mankind.

BUT

human species multiplies so fast, that the lands, though ever so much cultivated, are scarcely sufficient to support the inhabitants. *Montesquieu.*



BUT I shall suspend my conjectures for the present. A variety of causes may counteract the operation of those which I have enumerated; and a considerable number of facts must be adduced to ascertain, whether the proportion of births to marriages be generally increased in countries advanced from poverty to wealth, by the introduction of trade, or the improvement of agriculture. The instance of Middleton, and of one or two places more which first occurred, and suggested the preceding observations, is opposed by others which have lately fallen under my notice. And I cannot close this subject better, than by giving a view of all the facts, which I have collected on both sides of the question.



A TABLE SHEWING THE PROPORTION  
OF BIRTHS TO MARRIAGES IN  
DIFFERENT PLACES, AND AT DIF-  
FERENT PERIODS OF TIME.

MIDDLETON.

Year.	Marriages.	Christenings.	Births to a Marriage.
From 1663 to 1672,	121	388	$= 3\frac{1}{5} +$ .
1763 to 1772,	330	1570	$= 4.7$ .

WARRINGTON.

From 1702 to 1722,	131	385	$= 2.9$ .
1752 to 1772,	1549	5034	$= 3\frac{1}{4}$ .

PENTRAETH PARISH, ANGLESEY\*.

From 1740 to 1747,	32	100	$= 3\frac{1}{8}$ .
1764 to 1771,	33	149	$= 4\frac{1}{2}$ .

LLANDYFNAN PARISH, ANGLESEY\*.

From 1750 to 1757,	28	111	$= 4$ .
From			

\* See Philosophical Transactions, Vol. 63.



## 66 OBSERVATIONS ON

Year.	Marriages.	Christenings.	Births to a Marriage.
From 1764 to 1771,	32	154	$= 4\frac{3}{4}$ .
1547 to 1554,	8	36	$= 4\frac{1}{2}$ .
1620 to 1627,	20	44	$= 2\frac{1}{5}$ .

### LEVERPOOL.

From 1700 to 1710,	500	2127	$= 4\frac{1}{4}$ .
1762 to 1771,	4812	10010	$= 2\frac{1}{12}$ .

### BOWDEN.

From 1653 to 1662,	136	573	$= 4\frac{1}{5} +$ .
1763 to 1772,	369	1300	$= 3\frac{1}{2}$ .

### MANCHESTER.

From 1763 to 1773, 4396 11052  $= 2\frac{1}{17}$ .  
 From the whole about  $2\frac{2}{3}$  births to 1 marriage  
 Exclusive of the great towns Manchester  
 Liverpool & Warrington about  $3\frac{1}{10}$  or near  
 4 births to 1 marriage. The great towns  
 taken separately about  $2\frac{1}{2}$  to 1 marriage

I HAVE



I HAVE lately received from the Rev. Mr. Archdeacon Blackburne, Rector of Richmond in Yorkshire, the following account of his parish. From the year 1764 to 1773 inclusive, 452 males, and 376 females have been baptised; and 299 males, and 341 females have been buried. The marriages during this period have amounted to 200. In Richmond there are about six hundred houses; but the Easter Book enumerates only 450 families; and Mr. Blackburne computes the number of inhabitants to be 2300.

“ We have no distempers, he says, that  
 “ can be called endemial; and when  
 “ fevers prevail in the neighbourhood,  
 “ few are affected by them in this town.  
 “ If any person brings an ague to Rich-  
 “ mond, he is generally freed from it in  
 “ a few days; though the village of  
 “ Gilling, about a mile and a half dis-  
 “ ant, which stands low, and has a large  
 “ pool of stagnant water adjoining to it,



68 OBSERVATIONS ON

“ is visited with this complaint every  
 “ spring and autumn.

“ THE air of Richmond seems to be  
 “ peculiarly unfavourable to consumptive  
 “ disorders. Many strangers come hi-  
 “ ther, from different parts, in the first  
 “ stage of the *phthisis pulmonalis*; but  
 “ after thirty five years experience I may  
 “ truly say that not one has recovered;  
 “ although the utmost care and attention  
 “ has been paid to their respective cases.  
 “ The natives and constant residents  
 “ however are not subject to distempers  
 “ of the lungs, except when brought  
 “ on by intemperance. But rheumatic  
 “ complaints are very general, especially  
 “ amongst the senior part of the inhabi-  
 “ tants. In small corporation towns  
 “ like Richmond, numbers are taken off  
 “ by excessive drinking; but the peo-  
 “ ple here who live temperately seldom  
 “ die earlier than in their eightieth  
 “ year.”

HAPPEN-



HAPPENING to pass through Sutton-Coldfield in Warwickshire, last summer, I was very much struck with the beauty and apparent healthfulness of its situation; and was desirous of knowing the duration of life which the inhabitants of it enjoy. The Rector of the parish has, with great politeness and good nature, gratified my curiosity as far as he is able, by furnishing me with an extract from the church register, and by referring me to the xxxii. vol. of the Gentleman's Magazine, for the following authentic account of the place, drawn up I suppose by himself.

“ SUTTON-COLDFIELD is almost full  
 “ south of Litchfield, at the distance of  
 “ about eight measured miles, by which  
 “ it undoubtedly got its name of Sutton,  
 “ a contraction of South town: A remark-  
 “ ably bleak and barren common, which  
 “ lies directly west of it, just out of the  
 “ bounds of the parish, might probably



“ give it the additional denomination of  
 “ Coldfield; the air being, upon that  
 “ heath, as keen and cold as in the High-  
 “ lands of Scotland. The parish is  
 “ nearly oval in its figure; the longest  
 “ diameter seven miles, and the breadth  
 “ four. The face of it is agreeably di-  
 “ versified with gently rising hills, and  
 “ vallies of tolerably fruitful meadows.  
 “ It is bounded on the north by Kenston,  
 “ on the west by Barr, on the south by  
 “ Curdworth, and Aston near Birming-  
 “ ham, and on the east by Middleton:  
 “ It contains four hamlets, viz. Mancy,  
 “ Hill, little Sutton, and Warmley. In  
 “ the year 1630, there were 298 houses  
 “ in the parish; in 1698 there were 310;  
 “ in 1721 the number was increased to  
 “ 360, which is nearly about the num-  
 “ ber at present. I compute the inha-  
 “ bitants at 1800. The register begins  
 “ in the year 1603. The number of  
 “ christenings for the first 20 years of the  
 “ register was 645; the burials during  
 “ the



“ the same period were 501. The num-  
 “ ber of christenings for the last 20 years  
 “ (ending at Christmas 1761) was 747;  
 “ the burials 694 (*a*).”

It is curious to observe the almost exact proportion which the christenings bear to the burials, in two very distant periods of time. But the like proportion seems to hold no longer. For from 1762 to 1772 the births have been 655, the deaths 445. The vicinity of Birmingham, and the amazing extension of its manufactures, will account for this change; which seems to have arisen from the recruits annually drawn from Sutton-Coldfield, as well as from every other adjacent place. If the number of inhabitants of this town be rightly computed, the yearly mortality amongst them is only as 1 to 51; and  
 every

(*a*) Gentleman's Magazine for September 1762,  
 p. 401.



every house, at a medium, contains five persons.

It appears by the observations lately communicated to me by the Rev. Doctor Tucker, that the number of females baptised at the parish church of St. Stephens in Bristol, from 1754 to 1774, have exceeded the number of males baptised during the same period of time; and that the like remark has been made in some other parishes of the same city. From these facts the learned Dean concludes that Dr. Derham's calculation, which supposes the proportion of male to female births to be as 13 to 12, may probably be erroneous; and he expresses his earnest wish that further inquiry may be made into a subject of so much importance. The following table will shew the result of the few observations which I have collected.

A COM-



A COMPARATIVE VIEW OF  
THE NUMBER OF MALES AND  
FEMALES, BAPTISED IN DIFFER-  
ENT PLACES.

Places.	Males.	Females.
Dishley, 11 years -	149	145
St. Stephen's parish, } Bristol, 20 years }	591	607
Taxal, 16 years -	204	230
Richmond, 10 years	452	376
Middleton, 10 years	200	188
Bowden, 10 years -	663	639
Middlewich, 5 years	229	242
Chapel in le Frith, } 10 years }	451	332
Warrington, 1 year	175	181
Collegiate Church in } Manchester, 7 yrs. }	3215	3024
Royton, 10 years -	134	120
Chester, 2 years -	408	415
Total.	<u>6871</u>	<u>6499</u>

FROM



# 74 OBSERVATIONS ON

FROM this table it appears that the proportion of males to females baptised is nearly as 12 to 11; but the succeeding ones shew that the number of females alive considerably exceed the number of males, in a variety of places; and that the widows are almost double the number of widowers.

## A COMPARATIVE VIEW OF THE NUMBER OF MALES AND FEMALES IN DIFFERENT PLACES.

Places.		Males.		Females.
Manchester	-	10548	-	11933
Salford	-	2248	-	2517
Townships of ditto		947	-	958
Parish of Manchester		6942	-	6844
Bolton	-	2159	-	2392
Little Bolton	- -	361	-	410
Monton	- -	196	-	190
Hale	- -	140	-	136
				Horwich



# POPULATION, &c. 75

Places.		Males.		Females.
Horwich	- -	149	-	156
Darwen	- -	900	-	950
Cockey	- -	320	-	391
Chowbent	- -	554	-	606
Ackworth	- -	340	-	388
Eastham	- - -	451	-	461
Chinley	- -	181	-	168
Brownfide	- -	40	-	47
Bugsworth	- -	80	-	95
Ashton under line		1406	-	1453
Parish of ditto	-	2584	-	2513
Tattenhall Parish	-	382	-	399
Waverton Parish.		310	-	332
Total.		<u>31238</u>		<u>33339</u>

## A COMPARATIVE VIEW OF THE NUMBER OF WIDOWERS AND WIDOWS, IN DIFFERENT PLACES.

Places.		Widowers.		Widows.
Manchester	- -	432	-	1064
				Salford



# 76 OBSERVATIONS ON

Places.	Males.	Females.
Salford - - -	89 -	149
Township of ditto -	21 -	42
Parish of Manchester	232 -	315
Monton - - -	14 -	13
Hale - - -	8 -	12
Horwich - - -	9 -	8
Darwen - - -	30 -	48
Cockey - - -	10 -	27
Chowbent - - -	26 -	43
Chinley, Brownsfide, } and Bugfworth }	15 -	18
Ashton under line -	50 -	81
Parish of ditto - -	67 -	95
	<hr/>	<hr/>
Total.	1003	1915
	<hr/>	<hr/>

LET no arguments in favour of polygamy be drawn from these tables ! The practice is brutal ; destructive to friendship and moral sentiment ; inconsistent with one great end of marriage, the education of children ; and subversive of the natural



natural rights of more than half of the species.

— HIGHER of the genial bed by far,  
And with mysterious reverence I deem.

MILTON.

NOR is this tyranny of man over the weaker, but more amiable sex, favourable to population. For notwithstanding the number of females in the world may considerably exceed the number of males, yet there are more men capable of propagating their species, than women capable of bearing children. This painful office gradually becomes more dangerous, and less frequent as the rigidness of the fibres increase; and ceases entirely at the age of fifty. The fatality of it is thus wisely obviated, and the comforts of declining life are not interrupted by the arduous toil of nursing. An institution therefore which confines in servile bondage to one usurper,



ber, many females in the prime of youth, must leave numbers destitute of the means which nature has pointed out for perpetuating and increasing the race of mankind. And it is a fact well known that Armenia, in which a plurality of wives is not allowed, abounds more with inhabitants than any other province of the Turkish Empire.

JUNE 5th. 1774.

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P. S. SINCE the preceding Paper was written, the Rev. Mr. Craddock has favoured me with a survey of the town and parish of Ashton under Line, distant about eight miles from Manchester. The inhabitants consist of manufacturers and farmers.



AN ENUMERATION OF THE INHABITANTS OF THE TOWN AND PARISH OF ASHTON UNDER LINE, MADE IN 1775.

	Town.	Parish.
Inhabitants - - -	2859	5097
Houses - - -	553	941
Families - - -	599	971
Males - - -	1406	2584
Females - - -	1453	2513
Married - - -	982	1679
Widowers - - -	50	67
Widows - - -	81	95
Under five years of age	509	896
From five to ten -	396	764
ten to twenty	541	1011
twenty to fifty	1044	1882
fifty to seventy	307	471
seventy to ninety	62	73



THE Reverend Dr. Peploe, Chancellor of the diocese of Chester, has honoured me with the following account of the parishes of Waverton and Tattenhall, both in the neighbourhood of Chester. The inhabitants are farmers and labourers.

AN ENUMERATION OF THE INHABITANTS OF TATTENHALL, MADE IN AUGUST 1774, BY THE REVEREND BRICE STORR, CURATE.

Inhabited Houses	-	-	148.
Uninhabited ditto	-		2.
Heads of families	-		176.
Aged above fourteen years			462.
Men and boys	-	-	382.
Women and girls	-		399.

CHRISTEN-



CHRISTENINGS. BURIALS.

1764	-	28	-	8
1765	-	21	-	9
1766	-	19	-	12
1767	-	29	-	11
1768	-	28	-	16
1769	-	24	-	15
1770	-	37	-	15
1771	-	30	-	9
1772	-	26	-	15
1773	-	38	-	20
		<u>280</u>		<u>130</u>

AN ENUMERATION OF THE INHABITANTS OF WAVERTON, MADE IN AUGUST 1774, BY THE REVEREND MR. BISSELL, MINISTER OF THE PARISH.

Inhabited Houses	-	-	-	109.
Uninhabited ditto	-			2.
Heads of families	-			116.

G

Aged



# 82 OBSERVATIONS ON

Aged above fourteen years		406.
Men and boys	- -	310.
Women and girls	-	332.

## CHRISTENINGS. BURIALS.

1764	-	19	-	10
1765	-	26	-	2
1766	-	17	-	7
1767	-	18	-	10
1768	-	22	-	10
1769	-	17	-	7
1770	-	20	-	8
1771	-	23	-	9
1772	-	18	-	12
1773	-	13	-	9
		<u>193</u>		<u>84</u>

IN the valuable work which I have so often quoted, Dr. Price has given many convincing and melancholy proofs of the declining state of population in this kingdom. The growth of large towns, the prevalence



prevalence of vice and luxury, the discouragements to marriage, the destruction of cottages, and various other causes, have the most unfavourable influence on the increase of mankind. But it is to be hoped that these evils do not universally prevail, and that even some good may arise from them to check their baneful effects. Certain it is, that in this part of England the inhabitants multiply with great rapidity: And though the increase may be chiefly owing to recruits drawn from other counties, yet the flourishing state of our manufactures cannot fail to promote population, by affording plentiful means of subsistence to the poor. The Bishop of Chester informs me, that in various parish registers which he has consulted, the births have progressively become more numerous from generation to generation. At Broxley in Kent, where his Lordship was Vicar, he divided the times, from the commencement of the reign of Queen Elizabeth, into peri-



ods of twenty one years ; and found that the number of births in the first period was 310, and in the last 525. The increase was gradual through the whole time.



T A B L E S  
OF THE  
COMPARATIVE MORTALITY  
OF THE  
S M A L L - P O X  
A N D  
M E A S L E S,  
&c.



THE A. B. L. S.

OF THE

COMPARATIVE MORTALITY

OF THE

SMALL-POX

MEASLES

A

BY

G. 3



TABLES SHEWING THE NUMBER OF  
DEATHS OCCASIONED BY THE SMALL-  
POX IN THE SEVERAL PERIODS OF LIFE,  
AND DIFFERENT SEASONS OF THE  
YEAR, TOGETHER WITH ITS COMPA-  
RATIVE FATALITY TO MALES AND  
FEMALES; EXTRACTED FROM THE  
REGISTER OF THE COLLEGIATE OR  
PARISH CHURCH IN MANCHESTER,  
AND FROM OTHER BILLS OF MORTA-  
LITY.

**A**CCURATE and comprehensive  
Bills of Mortality furnish a vari-  
ety of the most curious and im-  
portant observations; and it is to be la-  
mented that they are not universally a-  
dopted. The general uses to which they  
may be applied, have been fully pointed  
out; and a plan for the establishment of



them has been proposed to the consideration and correction of the public (*a*). It is one part of this plan, that the register of burials shall contain not only a list of the diseases of which all die, but also express particularly the numbers dying of each disease *in the several divisions of life, and different seasons of the year*. The following Tables will illustrate the advantages, which may be derived from this improvement.

(*a*) Percival's Essays Medical and Experimental,  
Vol. 2. p. 244.



# SMALL-POX, &c. 89

AN ACCOUNT OF DEATHS BY THE SMALL-POX,  
DURING SIX YEARS, VIZ. FROM 1768 TO 1774;  
COLLECTED FROM THE REGISTER OF THE COL-  
LEGIATE CHURCH AT MANCHESTER.

T A B L E I.

Ages.	Males.	Females.	Annual Deaths by the Small-Pox.		Deaths by all Diseases.
From Birth to 3 Months.	2.	2.	A. D.		
From 3 Months to 6 Months	9.	8.	1769.	74.	549.
----- to 1 Year.	51.	68.	1770.	41.	689.
2.	103.	113.	1771.	182.	678.
3.	55.	55.	1772.	66.	608.
4.	33.	26.	1773.	139.	648.
5.	18.	16.	1774.	87.	635.
10.	17.	12.			
20.	1.	0.			
30.	0.	0.			
Total	289.	300.		589*.	3807.

\* THIS account of the Annual Deaths by the Small-Pox from 1768 to 1774, differs from the printed Bills of Mortality; which make the number amount to 586, and not to 589. But it has been extracted from the Church Register with a degree of care and attention not usually bestowed upon the printed Bills; and the accuracy of it may, I believe, be relied upon.

I. THIS



I. THIS Table is formed from a very accurate Register, and affords a striking view of the disparity in the ravages of the Small-Pox at different periods of life. The proportion of deaths under the age of three months is extremely small; and I think we may conclude that this distemper rarely occurs in the early part of infancy. For children in that tender season are neither in the way of infection, nor does experience shew that they are much disposed to receive it. Dr. Monro informs us, that of twelve infants, inoculated within a fortnight after their birth, not one had the variolous eruption (*b*). In the second stage of infancy the fatality of the Small-Pox is somewhat increased; but the advancement proceeds afterwards with amazing rapidity. For during the eighteen months which

(*b*) Monro on Inoculation, p. 25. Percival's Essays Medical and Experimental, Vol. 1. p. 372, second edition.



which next succeed, the number of deaths amounts to 335; which is more than one half of all that occur through the remainder of life. At this period therefore we may presume that the body is peculiarly liable to the disease; and the violence and malignity of it are aggravated by the breeding of teeth, and by the general irritability of the nervous system. But the first dentition is usually completed before the end of the third year; at which time the Small-Pox appears by the Table to become considerably less mortal. And its declension is not less rapid than its progress, as the constitution improves in vigour, and as those decrease in number who are liable to its attack.

IN the year 1773, the Small-Pox raged with great violence in the town of Warrington; and I have procured from my very ingenious friend Mr. John Aikin, an exact account of the number and ages  
of



of those who died of it. This account coincides with the foregoing Table, and confirms many of the conclusions which are deducible from it.

DEATHS BY THE SMALL-POX AT  
WARRINGTON IN 1773.

TABLE II.

Ages.		Numbers.
Under 1 Month	-	0.
From 1 to 3 Months	-	4.
3 -- 6 -----	-	6.
6 -- 12 -----	-	39.
From 1 to 2 Years	-	84.
2 -- 3 -----	-	33.
3 -- 4 -----	-	18.
4 -- 5 -----	-	15.
5 -- 6 -----	-	4.
6 -- 7 -----	-	2.
7 -- 8 -----	-	2.
8 -- 9 -----	-	4.
None above.	Total	<hr/> 211. <hr/>



II. THE Small-Pox, by Table I. appears to have been more fatal to female than to male children, and the difference is considerable under the age of two years. At Warrington, two thirds of all who died of this disease in 1773 were females. These facts are somewhat extraordinary; as it has been fully evinced by a variety of observations, that the life of males is much more frail than that of females(*c*), and particularly in the period of infancy(*d*). They also contradict the following remark of Baron Van Swieten: “*Cum autem muliebri Corpus mollius et laxius sit Corpore virili, hinc cæteris paribus, & in his mitior esse solet hic morbus.*”

Comment. Vol. 5. p. 16.

### III. THE

(*c*) Vide a Treatise on Reversionary Payments, by my learned friend Dr. Price, passim; also the preceding Observations on the State of Population in Manchester, and other adjacent Places.

(*d*) Ibid.



III. THE comparative mortality of the Small-Pox at Manchester, Warrington, and Chowbent, in the different seasons of the year, may be estimated by the following Table.

TABLE III.

Months.	MANCHESTER, From 1768 to 1774.	WARRINGTON, 1773.	CHOWBENT, From 1767 to 1773.	Total.
January, February, March. }	160.	21.	17.	198.
April, May, June. }	137.	135.	7.	279.
July, August, September. }	147.	51.	2.	200.
October, November, December. }	145.	4.	1.	150.

SYDENHAM has observed that the Small-Pox, when it is mild and regular, usually commences about the vernal equinox in those years in which it is epidemic; but that it begins earlier when it is of an irregular and more dangerous kind.



kind. No one can doubt that variations in the moisture, dryness, temperature, and other qualities of the air, must influence a disease which is always of an inflammatory, and often in its last stages of a putrid nature. But the progress of it cannot be regulated by the seasons, because it is derived from contagion; the communication of which frequently depends upon accident, is confined to no period of time, and is varied by its degrees of malignity. During the late visitation of the Small-Pox at Warrington, the state of the atmosphere went through all possible changes, but with no perceptible difference in the circumstances of the disease (*e*).

IV. DURING the period of time included in the first Table, the Small-Pox was twice epidemical in Manchester; and

(*e*) See Philosophical Transactions, Vol. 64.



and the deaths by it amount nearly to one sixth and a half of those occasioned by all other diseases. But it may be proper to remark, that the poor of this town are chiefly buried at the Collegiate Church; and this distemper proves much more fatal to them than to persons of better rank, from their want of cleanliness, and their prejudice in favour of a hot regimen. In London, from 1762 to 1772, the average proportion of deaths by the Small-Pox is 109 in 1000, or about a ninth of the whole. And at Ackworth, a country parish near Ferrybridge in Yorkshire, the proportion during twenty years, viz. from 1747 to 1767, is as 1 to 19; two hundred and sixty-three persons having been buried, fourteen of whom died of the Small-Pox. Were such accounts to be collected from different places, and at different periods of time, it is probable that farther variations in the fatality of this disease



disease would be discovered (*f*). But from its least destructive ravages we may derive arguments, of unanswerable force, in favour of inoculation. And the two first tables may perhaps furnish some useful information concerning the particular season of life in which this practice will be most expedient, and attended with the greatest prospect of success.

V. IF

(*f*) BARON Van Swieten has given the following remarkable account of the proportion of deaths by the Small-Pox, in several schools and hospitals at Vienna. “*Ratione subducta, patet, quod numerus omnium, qui in his locis variolis decubuerunt, sit 355, et quod ex hoc numero septem mortui fuerint. Adeoq; proportio mortuorum ad numerum sanatorum est ut 1. ad 50. circiter. Si autem de hoc mortuorum numero detraberentur tres aegri, quorum mors solis variolis adscribi nequit, tunc certe proportio mortuorum ad sanatos foret ut 1. ad 89. circiter.*”

Van Swieten. Comment. Vol. 5. p. 145.

Mr. Bew, an ingenious apothecary in Manchester, informs me that he attended seventy patients the last year (1774) under the natural Small-Pox, of which number only two died. They were chiefly children above the age of two years; and the cool regimen was strictly pursued in the treatment of them.

H



V. If we regard only the state of the body, the fittest period for the ingraftment of the Small-Pox seems to be between the age of two and four in healthy children, and of three and six in those who are tender and delicate. The powers of nature are then sufficiently vigorous; perspiration is free and copious; the irritability of the body is diminished; the viscera are sound and unobstructed; the mind, though active and lively, is not disturbed by violent emotions; the teguments are properly extenuated; and the fibres are neither too tense nor too lax for the variolous eruption. To these important advantages may be added, that at this age the child is both a proper subject for preparatory medicines, and for such as may be deemed necessary during the course of the distemper (*g*). But other considerations, besides the state of the constitution, demand our attention.

The

(*g*) Percival's Essays Medical and Experimental, Vol. 1.

p. 373, second edition.



The risque of receiving the natural Small-Pox by infection appears to be very great during the second year of life; and the fatality of the disease at this period is highly alarming. To avert such impending danger, the inoculation of healthy and vigorous children, at the *age of two or three months*, seems to be adviseable, especially in large towns. An earlier period might complicate the Small-Pox with the jaundice, thrush, gripes, diarrhœa, and other disorders incident to the first stage of infancy; and a later season may superadd the fever, convulsions, and other symptoms of dentition. But I have enlarged upon this subject in another work, to which I refer the reader (*b*).

(*b*) See Observations on the Disadvantages of inoculating Children in early Infancy; Essays Medical and Experimental, Vol. 1. second edition.



TABLES OF THE COMPARATIVE MORTALITY OF THE MEASLES FROM 1768 TO 1774, COLLECTED FROM THE REGISTER OF THE COLLEGIATE CHURCH IN MANCHESTER.

TABLE I.

Ages.	Males.	Females.	Seasons.	Total of Deaths by all Diseases, during 6 years.
From Birth to 3 Months.	1.	1.	Jan. }	17.
From 3 Months to 6 Months	3.	0.	Feb. }	
			March. }	
1 Year.	6.	4.	April, }	51.
2.	17.	14.	May, }	
3.	17.	8.	June. }	
4.	4.	3.	July, }	16.
5.	2.	7.	Aug. }	
			Sep. }	
10.	0.	2.	Oct. }	7.
20.	0.	1.	Nov. }	
30.	0.	1.	Dec. }	
Total	50.	41.	91*.	3807.

THIS

\* THIS, like the first Table of the Small-Pox, differs in the total of



THIS Table requires no comments. The proportional mortality of the Measles in the several periods of life, and various seasons of the year, is obvious at the first view. It is equally evident also that this disease differs from the Small-Pox, in being much more fatal to males than to females.

DURING the spring and summer months of the year 1774, the Measles were epidemical in Manchester, and proved fatal to a considerable number of children.

They

of deaths by the Measles, from the printed Bills of Mortality. I have therefore desired Mr. Holme, one of the clerks of the Collegiate Church, a very intelligent man and a good arithmetician, to revise the Church Register; and after the most careful inspection, he assures me that the numbers in both Tables are perfectly accurate. He says, "The printed Bills of Mortality are exact as to the number of deaths, and the division of males and females; but when the disorders are counted over, and the general amount is taken, there is often a mistake in the sum total. And as it is a great trouble and difficulty to discover wherein the error lies, and as few persons pay any regard to this part of the bills, it is common to add the number deficient to some of the disorders, so as to make the whole agree."



They were of the regular kind, so well described by Sydenham; but it was not unusual for violent peripneumonic symptoms to occur, five, six, or even eight days after the disappearance of the eruption. Under these circumstances venæsection, blisters, and the Seneka root were found to be very efficacious remedies. I prescribed the Peruvian bark with great success to many of my patients under the Measles, combining it with demulcents, and the saline mixture (*a*); and premising venæsection when the signs of inflammation were urgent. The practice of giving the bark in this disease was first introduced by Dr. Cameron, a very eminent physician at Worcester. He observes that it prevents the recession of the morbid acrimony,

(*a*) R. Lixivij Tartari drachmas tres, Succı Limonum q. s. ad saturationem, Aquæ Cinnamomi tenuis uncias duas, Elixir Paregorici, Vini Antimonialis ana sesquidrachmam, Extracti Corticis Peruviani, Extracti Glycyrrhizæ ana scrupulos quatuor. M.



mony, and continues the efflorescence on the skin, sometimes so long as the twelfth day (*b*). By this salutary operation, the cough and other inflammatory symptoms are in a great measure obviated; and the patient is freed from all danger of a peripneumony, the fatality of which Sydenham describes in such strong terms. It is many years since I first adopted the method of cure recommended by Dr. Cameron; and experience has afforded me the fullest conviction of its safety and efficacy, in all ordinary cases. During the late epidemic, not a single instance occurred to me of the peripneumony succeeding the Measles, when the bark had been employed. But my assistance was desired in the last stage of fifteen unfortunate cases of this kind, in which the common antiphlogistic and pectoral course had been pursued.

H 4

THE

(*b*) Medical Museum, Vol. 1. No. 37. p. 281.



THE Measles, when violent in degree, or ill treated, frequently lay the foundation of hectic fevers, or pulmonary consumptions. For as the infection is most probably conveyed by inspiration, the lungs become inflamed, a cough ensues, tubercles or a vomica are formed, and the patient sinks under a lingering, painful, and incurable disease. To obviate these evils, inoculation was proposed about fifteen years ago, and practised in several instances with considerable success by Dr. Home. The soreness of the eyes was mitigated by it, the cough abated, and the fever rendered less severe. His method of communicating the infection was by applying, to an incision in each arm, cotton moistened with the blood of a patient labouring under the Measles (*c*). But the morbillous matter has since been ingrafted by means of lint, wet with the tears, which flow from the eyes in the first

(*c*) Home's Medical Facts and Experiments.



first stage of this disorder. For these laudable endeavours to extend the benefits of inoculation, the public is highly indebted to Dr. Home; and it is to be lamented that so little attention has been paid to this valuable improvement of the healing art.

THE following Table shews the annual medium of deaths by the Small-Pox and Measles, from 1754 to 1774, compared with the deaths under two years of age by all diseases, and with the general amount of births and deaths during the same period of time. It is collected from the printed Bills of Mortality, published yearly at Manchester.

TABLE



T A B L E II.

Years.	Small-Pox.	Measles.	Under 2 Years of Age.	Total of Deaths.	Births.
From 1754 to 1758.	64.	21.	209.	651.	678.
to 1764*.	95.	10 .6	213.	639.	731.
to 1769.	98.	9 .6	229.	659.	827.
to 1774.	102.	21 .6	242.	651.	1002.
Total	359.	62 .8	893.	2600.	3238.

THIS Table comprehends so long a term of years, that the inferences which it affords would be no less indubitable than important, if we could entirely rely upon the accuracy of the *printed Bills of Mortality*. I apprehend, however, that the errors of these Bills are not considerable ;

\* I am not in possession of the Bill of Mortality for the year 1760 ; which is therefore omitted in this Table.



rable ; and that the following conclusions, with respect to Manchester, may be admitted as approaching very near to TRUTH.

I. ONE in *nine*, of all whose births are registered at baptism, dies of the SMALL-POX ; and nearly *one* in *fifty-two* of the MEASLES. It should be observed, that the births considerably exceed the burials at Manchester.

II. THE deaths by the MEASLES are to the deaths by the SMALL-POX, as *one* to *five* and *eight tenths*.

III. THE number dying under two YEARS OF AGE, of all diseases, is to the number baptised, as *one* to *three* and *six tenths*.

IV. THE number dying under two YEARS OF AGE is to the total number of deaths, as *one* to *two* and *nine tenths*.

V. THE



V. THE deaths by the SMALL-Pox are to the deaths by all diseases, nearly as *one* to *seven* and *a quarter*.

VI. NEARLY *three fifths* of those who are carried off by the SMALL-Pox die under the age of two years (see Table I. of the small-pox); and *one* in *four* of all that die under two years of age fall victims to this disease.

VII. HALF of the deaths occasioned by the MEASLES happen under two years of age; and the proportion which this number bears to the general deaths, under the same period, is nearly as *one* to *twenty-eight*.

MANY other very important corollaries may be deduced from this the and preceding Tables; but I wish rather to excite than to anticipate the inquiries of the intelligent reader.

FEB. 1st. 1775.



ON THE  
DIFFERENT QUANTITIES

OF

R A I N

WHICH FALL

AT

DIFFERENT HEIGHTS.



THEORY OF THE  
DIFFERENTIAL CALCULUS

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AN ATTEMPT TO ACCCOUNT FOR  
THE DIFFERENT QUANTITIES  
OF RAIN, WHICH FALL AT DIF-  
FERENT HEIGHTS, OVER THE  
SAME SPOT OF GROUND.

**I**N the last volume of the Philosophi-  
cal Transactions (Vol. 59.) some ex-  
periments are related, by which it appears,  
that there fell below the top of a house,  
above a fifth part more rain, than what  
fell in the same space above the top of  
the same house; and that there fell upon  
Westminster Abby, not above one half  
of what was found to fall in the same  
space,



space, below the tops of the houses (*a*). These observations, however new and singular, are too well authenticated to admit of the least degree of doubt; and philosophy should be employed not to invalidate a fact so fully ascertained, but to furnish a rational and adequate cause of it.

## DOCTOR

(*a*) I AM informed by an ingenious correspondent at Bath, that similar experiments have been made in that place, with the same result; and a friend of mine at Liverpool, on whose judgment and accuracy I can rely with confidence, has lately favoured me with the following account, dated March 14th. 1771, "During the late rains, I repeated Doctor Heberden's experiment: the upper vessel received thirteen ounces and a half of rain, the lower vessel twenty-seven ounces. The difference of altitude was about 16 or 17 yards. The wind blew a brisk gale from the South East.—I made the trial also during a fall of snow; and in that, found the proportion as three to five." The following experiment, communicated to me by the same gentleman, varies a little in its result from the former, owing, perhaps, to a difference in the serenity of the air: for the wind has a more powerful effect on the descent of snow, than of rain, because its specific gravity is less. "March 27th. 1771, there was a continued fall of snow, from  
eight



DOCTOR HEBERDEN conjectures that this phænomenon depends on some property of electricity, which he thinks remains hitherto unknown. To me it appears probable, that the common laws by which this power influences the ascent and suspension of vapours, are sufficient to explain their precipitation in rain, and

eight in the morning till five in the afternoon. The air was still; the snow came down very thick, and in large flakes. During the nine hours, which the snow continued to fall, the upper vessel received thirteen ounces, the lower vessel twenty-six ounces." In the years 1773 and 1774, the observations on the different quantities of rain, which fall at different heights, were repeatedly made at Liverpool. And it was almost uniformly found that a vessel, standing on the ground in a spacious garden, received *double* the quantity of rain which fell into another vessel, of equal dimensions, placed near the same spot, but eighteen yards higher. At Middlewich, during part of the year 1774, the quantity of rain received at the top of the church steeple was 15,75 inches; and 19 inches in a garden, eighty feet below. The garden, it should be remarked, was not contiguous to, although at no great distance from the church.



and the lately discovered mode of its descent.

THE electrical fluid is strongly attracted by water; and by destroying the cohesion between its particles, and repelling them from each other, it becomes a powerful agent in evaporation. The waters of the ocean abound in this fire, and vapours raised from them float in the air, forming clouds, which retain their electricity till they meet with other bodies, either destitute of it, or containing it in a less proportion than themselves \*. This, in all probability, is frequently the case with those vapours or clouds which are produced by exhalations from the earth, from fresh water, and the perspiration of plants and trees; at least it is an undoubted fact, that some clouds (to use the language of this branch of philosophy) are electrified *positively*,  
and

\* Vide Franklin on Electricity.



and others *negatively*. No sooner does the communication take place, but the repulsion between the particles of water is diminished, those which have discharged part of their electricity are successively attracted by the contiguous ones which have not, and thus they press nearer together, become specifically heavier than the atmosphere, and descend in small drops, which losing every instant more and more of the electric fire, coalesce, uniting into larger and larger drops, and consequently filling a space which is continually diminishing, as they approach nearer to the surface of the earth. This may be illustrated by electrifying the stream of a fountain, which will spread itself into the form of a brush by the mutual recession of the particles of water: but withdraw the supply of electric fire, and the fountain discharges itself in one continued current \*. A pair of

I 2

cork

\* Vide Franklin on Electricity.



cork balls suspended together by filken threads, when electrified recede from each other, and if the air be dry, return by degrees only to their natural position. Two feathers electrified will float in the atmosphere, mutually repelling each other, when in a certain degree of contiguity, and gradually descending as they lose that power, which by expanding their *plumulæ*, rendered them specifically lighter than the air. But if one of them discharges suddenly the electric fire, it will instantly be attracted towards the other, and receive a fresh supply; when a repulsion (acting indeed at a much less distance than before) will again take place between them.

WHEN two clouds, one replete with electric fire, the other destitute of it, come within the sphere of each other's attraction, they will rush together, and the electrical fluid being diffused through a larger space, the particles of water will  
unite,



unite, and form themselves into drops of greater magnitude, and a heavy shower will be produced. Still however as the rain descends through an atmosphere containing little electric fire, it will be continually communicating it, and the discharge being greatest from the circumference of the cloud, because the surface is there largest, the drops will be drawn nearer and nearer to each other, and approaching towards one common centre, will gradually coalesce in their passage. Doctor Franklin has related a most ingenious experiment, which elucidates the formation of rain as thus described.—

Take two round pieces of pasteboard of two inches diameter; from the centre and circumference of each of them, suspend by fine silk threads eighteen inches long, seven small balls of wood, or seven peas equal in bigness; so will the balls appending to each pasteboard, form equal equilateral triangles, one ball being in the centre, and six at equal distances from



that and each other; and thus they represent particles of air. Dip both sets in water, and some adhering to each ball, they will represent air loaded. Dexterously electrify one set, and its balls will repel each other to a greater distance, enlarging the triangles. Could the water supported by the seven balls come into contact, it would form a drop or drops so heavy as to break the cohesion it had with the balls, and so fall. Let the two sets then represent two clouds, the one a sea cloud electrified, the other a land cloud; bring them within the sphere of attraction, and they will draw towards each other, and you will see the separated balls close thus:— The first electrified ball that comes near an unelectrified ball, by attraction joins it, and gives it fire; instantly they separate, and each flies to another ball of its own party, one to give, the other to receive fire, and so it proceeds through both sets, but so quick as to be in a manner



manner instantaneous. In their collision they shake off and drop their water, which represents rain. This experiment would better illustrate and confirm my *hypothesis*, if a large number of balls were appended, at equal distances, to each pasteboard, so as to form several circles, having one common centre.

BUT it rarely happens that a land cloud is equal in magnitude to one raised from the sea; consequently the rain produced by their union, will be proportionably lighter in the upper, and heavier in the lower regions of the atmosphere, as the electric matter is more or less gradually diffused.

WHEN an electrified cloud, without mixing with another cloud, or losing part of its electric fire, becomes specifically heavier than the atmosphere, by cold, or some local change in the density of the air, it will descend at first



perhaps in a mist; but will form, as it approaches nearer to the earth, and is less replete with the electric fluid, a light shower of rain.

BESIDES the clouds which float separately in the higher regions of the atmosphere, the air contains a large quantity of water in the state both of solution and of diffusion; and dews, fogs, and sometimes even showers of rain, are probably produced by the precipitation of the water thus suspended. Now the quantity of water which the air is capable of dissolving and suspending, is proportioned to its degree of density; and this density decreases in a certain ratio, according to its distance from the surface of the earth. Rain therefore in its descent will be every instant acquiring an accession to the bulk of its drops, by attracting these aqueous vapours. For the cold produced by a falling shower, will precipitate from the air, both its dissolved  
and



and diffused water. And thus at different heights will be produced from this cause, some difference in the quantity of rain which falls over the same spot of ground. The discharge of the electrical fluid from a falling shower, may also act as a powerful precipitant of the vapours, which are chemically dissolved in the air. For by conveying an electrified wire to the surface of a quantity of water, saturated with any saline substance, an immediate and copious precipitation is produced, and the salt forms itself into large *floculi*.

RAIN, when undisturbed by winds, descends in lines converging towards the centre of the earth, like the *radii* of a circle. This direction towards the perpendicular, however trifling in degree, gives some little tendency to the drops to coalesce together, and concurs in the general effect of producing a different quantity of rain at different heights.

FROM



FROM what has been advanced it appears probable to me, that the gradual discharge of the electrical fire is the principal cause of the phenomenon I have attempted to explain. As the rain descends, the drops coalesce more and more together, by the continued diminution of the repulsive power which counteracted their mutual attraction; and consequently, in a given space, a much larger quantity will fall near to, than at a distance from the surface of the earth. A cloud which fills many thousand acres in the higher regions of the air, when the electric fluid operates upon it with full force, may not cover one third of that extent, when it has descended in a shower of rain. To this effect the precipitation of the vapours contained in a dissolved or diffused state, in the lower regions of the atmosphere, and the influence of gravitation in producing a convergency of the drops of rain, will in some degree contribute.

P O S T-



## P O S T S C R I P T.

HAVING communicated the preceding paper to Doctor Heberden and Doctor Watson, I have been favoured by the latter with the following curious fact.—“The water in the Rain Gage at the top of Lord Charles Cavendish and Doctor Heberden’s houses, which are about a mile distant from each other, pretty nearly correspond; but at the bottom of Lord Charles’s house, though the level is forty feet above the top of Doctor Heberden’s, the quantity always exceeds that of Doctor Heberden’s. Last year, for instance, at the top of both their houses, there were collected about twenty two inches of rain; but in Lord Charles’s garden, at a distance from any buildings, there fell twenty six inches; and



and this in his Lordship's garden has been constant for several years. Doctor Heberden has been too much confined to make accurate observations at the bottom of his late house; but he is now removed to Pall Mall, where his opportunities of observing are more favourable."

THIS fact, at first sight, appears to be a strong objection to the *hypothesis* I have advanced. May it not, however, be obviated by supposing, that the discharge of the electrical fluid from a falling shower, is not so much influenced by the absolute, as by the relative height of the places where the rain descends? And as the earth may be considered as the great recipient and attracter of electrical fire; is it not probable, that the quantity of rain collected, will be proportioned to the distance of the receiver from the ground immediately below, and not to its



its absolute height, measured from any distant level, except in such altitudes, where the density of the air, and the vapours floating in it, are so far diminished as to produce a sensible variation? But I offer this conjecture with diffidence; and am sensible indeed, that the whole of my attempt to account for the different quantities of rain, which fall at different heights, is liable to objections, because the *data* are yet few upon which it is founded. To promote the solution of so curious a *phænomenon*, I shall here subjoin a few queries, proposed to me by different correspondents. The fourth should, I apprehend, be reversed; because it appears probable to me, that trees, plants, water, and moist earth, afford more copious exhalations than paved streets, houses, burning fuel, or the bodies of men.

I. DOES a glass funnel catch an equal quantity of rain at the same height, as a  
metal



metal funnel ; the former being an electric, the latter a non-electric ?

II. Is there a difference in the quantity of rain and snow caught in similar vessels, at different heights ?

III. Is the difference of rain, caught at different heights, greatest at the beginning of a shower ?

IV. Is not this difference greater in large cities, than in the country, owing to the lower regions of the air being more loaded with watery vapours, which have been exhaled by fires, and from the human body ?

V. HAS the wind no share in producing the disparity observed in the quantities of rain, which fall at different heights ?

VI.



VI. MAY not the column of air through which a drop of rain passes, in the space of twenty or thirty yards, contain a sufficient quantity of watery particles, to double the bulk of the drop? This may be illustrated by precipitating any saline substance from a saturated solution of it, contained in a cylindrical vessel, and examining the proportional quantities of precipitate at different heights. Or, perhaps, it may be determined by the following experiment: Take a cylindrical glass vessel, four inches in diameter, and eight inches high; fill it with ice or snow, and place it in a warm room. A watery dew will soon be congealed upon its surface, which being committed to a nice scale, may probably be found to be equal in gravity to a drop of rain. Suppose this cylinder to be drawn out to the length of twenty or thirty yards; the surface of it will still continue nearly the same, though the  
diameter



diameter of it be diminished ; and such a tube will aptly represent the column of air, through which a drop of rain descends, in its passage to the earth.

MARCH 30th. 1771.



ON THE  
SOLUTION  
OF  
STONES OF THE URINARY,  
AND OF THE  
GALL BLADDER,  
BY  
WATER  
IMPREGNATED WITH  
FIXED AIR.



ON THE  
SOLUTION  
OF  
STONES OF THE URINARY,  
AND OF THE  
OVARIAN BLADDER,

OF W. A. T. H. K.

IN TWO VOLUMES.

K



ON THE  
SOLUTION  
OF  
HUMAN CALCULI  
BY  
FIXED AIR.

I FLATTER myself that fixed air is now become an object of the attention of Physicians; as it has been fully shewn that it is capable of being applied to many important medicinal purposes. In *pulmonic disorders*, the *gangrenous sore throat*, and in *malignant fevers*, the happiest effects have been experienced from the use of it; and I know not a more powerful remedy for *foul ulcers*, as it mi-



tigates pain, promotes a good digestion, and corrects the putrid disposition of the fluids. I have related several cases, in the second volume of my *Essays Medical and Experimental*, and in the Appendix to Dr. Priestley's *Treatise on Air*, which evince the truth of these observations; and since the publication of those works, a variety of similar facts have occurred to my learned friend Dr. Dobson, in his Hospital practice at Liverpool; and to Dr. Rotheram at Newcastle upon Tyne.

BUT I have a farther, and very interesting discovery to communicate, concerning the medicinal properties of this species of factitious air. About the end of last year I was informed that Doctor Saunders, a Physician in London, eminent for his knowledge of chemistry, had employed it as a solvent of the human *calculus*. I was ignorant of the manner in which his trials were conducted, and of the success which had attended them; but



but my curiosity was excited; the acquisition of such a remedy was flattering to my hopes; and I engaged in the pursuit of it almost with as much ardour, as if it had been the Philosopher's stone. I recollected that Dr. Black and Mr. Cavendish have proved the solubility of various earthy bodies in water, either by abstracting from, or superadding to the fixed air which they contain: And as the human *calculus* is dissolved in the former way by lime water, and the caustic alkali; it appeared highly probable that the like effect would be produced, on the same substance, by the latter mode of operation. Analogy seemed favourable to the hypothesis, and experiment has confirmed it.

## EXPERIMENT I.

DECEMBER 13th. 1774. A human *calculus*, in figure and size like a Pistachio



chio nut, of a smooth surface and firm texture, and which weighed fifty two grains, was suspended in pure spring water, strongly impregnated with fixed air, and continually supplied with fresh streams of it, by an elegant and well contrived apparatus, lately invented (*a*). After forty-eight hours maceration, the stone was carefully dried, and weighed forty-nine grains and a half. It was become more friable in its texture.

## EXPERIMENT II.

ANOTHER *calculus* extracted from the same bladder, and similar to the former in figure, texture, and in the smoothness of its surface, was immersed forty eight hours in a quantity of the spring water before employed, not impregnated with fixed air. The weight of the stone before immersion, was forty two grains and

(*a*) Sold by Parker, Glass-Man, Fleet-street, London.



and a half; and after it was taken out of the water, and thoroughly dried, forty two grains. The texture and external appearance of it were unchanged.

## EXPERIMENT III.

THE *calculus* employed in the first experiment, and which now weighed forty nine grains and a half, was suspended, during the space of forty eight hours, in an atmosphere of fixed air, and exposed to a stream of it, at the distance of seven inches from the effervescing mixture of chalk, water, and oil of vitriol. By this operation the *calculus* was rendered much more friable; the *laminæ* of which it was composed were loosened, and part of the external one was separated; its colour was changed from grey to white, and when committed to the balance it weighed fifty one grains, having absorbed a grain and a half of fixed air. By expo-



ture during the night to the common atmosphere, the stone lost half a grain of this additional weight, and another half grain afterwards by being laid before the fire.

#### EXPERIMENT IV.

THREE *calculi* were suspended in an atmosphere of fixed air, and exposed, as in the last experiment, to a stream of it, during three days. When put into the vessel, the first was of a yellow colour, and solid texture, and weighed two drachms, forty five grains and a half. By the absorption of fixed air, its gravity was increased about the third part of a grain; the colour in certain spots was rendered lighter, and those spots were softer than other parts of the stone. The second *calculus* was of a white colour, and crystallised form, and weighed, before immersion in the fixed air, two drachms,



drachms, six grains and a half. Its weight, when taken out of the vessel, was unchanged; but the surface of it was become more friable than before. The third stone was one drachm, eight grains and a half; was hard, and of a bright colour; and the external *laminæ* of it were broken. It acquired half a grain from the fixed air, and was rendered somewhat softer and whiter.

#### EXPERIMENT V.

THE *calculi* employed in the foregoing experiment were immersed three days in mephitic water, constantly supplied with fresh streams of fixed air, by the apparatus before mentioned. Each stone was then thoroughly dried, and exposed forty eight hours, in damp weather, to the air of my study, before the weight of it was examined. Number one, the yellow *calculus*, was changed to a very light colour,



colour, almost approaching to white, and had lost more than two grains. Number two, was become perfectly white in many parts, was very friable, and had lost one grain and a half. Number three, was rendered white in various parts; was more friable, and was diminished in weight three grains and a half.

THESE experiments fully evince, that water, impregnated with fixed air, is a powerful diffolvent of the human *calculus*. And it is probable that the action of this *menstruum* would have been considerably increased, if a proper degree of heat could have been employed. Even the warmth of summer might have proved favourable to my trials; which were made in a season, when the greatest height to which the mercury rose in the thermometer, was the fifty fourth degree of Fahrenheit's scale. Lime water has been long and justly celebrated as a lithontriptic; but its solvent powers appear to be inferior  
to



to the artificial mineral water, of which we are now treating. As a proof of this, it may not be improper to relate the following experiment, although it was made on a different occasion, and is inserted in a former work (*b*).

## EXPERIMENT VI.

THREE fragments of human *calculi*, numbered for the sake of distinction, one, two, three, were immersed in equal quantities of different lime waters; the first in lime water made with distilled water, the second in lime water prepared with hard pump water, and the third in lime water made with the same hard pump water, poured, boiling hot, upon the quick lime. Number one, was of a brown colour, and hard texture; was smooth on one side, and rough on the other;

(*b*) Treatise on Water; Percival's Essays Medical and Experimental, Vol. 1. p. 329, second edition.



other; and weighed twenty six grains and a half. Number two, was a fragment of the same *calculus*, and weighed twenty five grains and a half. Number three, a fragment of a different *calculus*, was of a looser and more spongy texture than the former, and weighed twenty seven grains. The phials which contained the *calculi*, and four ounces by measure of lime water, were all nearly full, and closely corked. After continuing the maceration eight days without heat, the *calculi* were taken out, carefully dried on filtering paper before a gentle fire, and then weighed. Number one had lost a grain and a half, and was covered in many parts of it with a soft, white, cretaceous matter. Number two had lost only half a grain: many little crystals shot from its surface. Number three had lost a grain: but it should be remarked that this fragment was much softer than the other two.



## EXPERIMENT VII.

THREE drachms of the caustic alkali, prepared by Mr. Lane, rendered a pint of water so pungent, that the tongue and palate could scarcely endure the taste of it. In this liquor were macerated forty eight hours, two *calculi*, one of which weighed a hundred and forty one grains, the other thirty three grains and a quarter. When dried, the first stone had lost four grains and three quarters, the *laminæ* of it were separated in many places, and it was covered with a white efflorescence. The second stone suffered a diminution in weight of three grains, one of its *laminæ* was separated, and a white efflorescence also appeared on the surface of it. The water, impregnated with the caustic alkali, was defended from the atmosphere, during the experiment; but had acquired from the *calculi* such



such a quantity of fixed air, as to effervesce with the acid of vitriol.

### EXPERIMENT VIII.

A SIMILAR experiment was tried with two other *calculi*, which were immersed during the same space of time, in a pint of water strongly acidulated with oil of vitriol. One of the *calculi*, which weighed a hundred and sixty five grains, was unchanged in its appearance, and diminished in weight scarcely half a grain. The other stone was rendered very friable, had a white efflorescence in several parts of it, and was reduced from forty one to thirty one grains.

HUMAN *calculi* vary in their structure and composition; and it has been demonstrated by Dr. Dawson (c), that  
some

(c) See the Medical Transactions, Vol. 2. p. 105.



some of them which are soluble in an alkaline, are but little affected by an acid *menstruum*; whilst others will resist the action of an alkali, and yet be readily dissolved by an acid. Even in the same subject, he observes, there may be found *calculi* of opposite kinds, some of which will dissolve in acids, some in alkalis, and some in neither; as from careful and sufficient trials he judged to be the case in a patient of his own. But water impregnated with fixed air, though inferior in efficacy to the vitriolic acid, or the caustic alkali, is a more universal solvent than either of them. For, as far as my observations have reached, it acts upon every *calculus* that is suspended in it. And I have tried it with those which have suffered no diminution of weight from the *menstrua* above-mentioned. But a farther detail of my experiments would be no less tedious than unnecessary. And I flatter myself that I may now, without incurring



incurring the imputation of enthusiasm, express the heart-felt satisfaction I enjoy, in the discovery of a new lithontriptic medicine, that is at once grateful to the palate, strengthening to the stomach, and salutary to the whole system. Lime water often nauseates the patient, destroys his appetite, and creates the heart-burn; and the soap ley is so caustic and acrimonious, that it can be taken only in the smallest quantity, frequently produces bloody urine, and aggravates the tortures it is intended to relieve. Both these remedies also require a very strict regimen of diet; and their qualities are liable to be changed either by acidities, or the fermentation of our food in the first passages. But the mephitic water may be drunk in the largest quantity, without satiety or inconvenience: It requires no restrictions in diet, and its medicinal virtues will be undiminished in the stomach or bowels.

PERHAPS



PERHAPS it may be questioned whether fixed air can be conveyed, by the ordinary course of circulation, to the kidneys and bladder. In an elastic state it certainly cannot; but dissolved in water, it may pass through the vascular system without creating the least disturbance or disorder, and by its diuretic quality will be powerfully determined to the urinary organs. So strong is the relation that subsists between mephitic air and water, that they remain firmly combined, although exposed to considerable variations of heat and cold. Dr. Priestley found that it required half an hour, even when the boiling heat was employed, to expel completely the fixed air from a phial of impregnated water; and I have observed that it has retained its peculiar flavour several days, when left in a basin, with a large surface open to the external air.



## EXPERIMENT IX.

BUT to obtain more satisfactory evidence upon this subject, I filled a bottle with mephitic air, and placed it in a heat of about ninety eight degrees of Fahrenheit's thermometer. A bent glass tube, a quarter of an inch in diameter, properly luted at each end, formed a communication between this bottle and one of lime water; to the bottom of which it extended. An intestine motion soon ensued; air bubbles were slowly conveyed into the lime water; and a white precipitation was gradually formed. In an hour and a half the lime water was become turbid, but was quickly rendered quite milky by blowing air into it from the lungs. The mephitic water still retained its volatile and acidulous taste; and when a greater degree of heat ( $108^{\circ}$ ) was applied to the bottle which contained

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ed it, a brisk intestine motion was renewed.

### EXPERIMENT X.

A SMALL quantity of mephitic air, which had been exposed ten days to the atmosphere, in a phial uncorked, still retained its acidulous taste; and when immersed in water heated to a hundred and forty degrees of Fahrenheit's thermometer, emitted air bubbles very copiously. The phial remained in the water till it ceased to discharge any air; but a very slight agitation again renewed the intestine motion; and it rendered lime water, when mixed with it, as white as milk.

THE judicious writer, to whose useful paper I have before referred, has recommended an attention to the fragments, scales, or films, which the stone in the



kidneys or bladder may cast off, and also to the contents and sediment of the urine; that a discovery may be made whether the proper solvent be an acid, or an alkaline *menstruum*. If it appear to be the former, the elixir of vitriol may be used in conjunction with mephitic water, to which it will be no ungrateful or insalutary addition. And there is reason to believe that this acid may be conveyed to the kidneys, without any considerable change in its properties. It is not subject to fermentation, and is disposed to pass off by urine. The successful exhibition of it in the itch, seems to evince, that it is capable of being received into the vascular system, and of being excreted, probably in a volatilised state, by the pores of the skin. Even when given to nurses, labouring under this complaint, it is said both to cure them, and the children which they suckle (*d*).

As

(*d*) Vide Dissertationem de olei vitrioli usu in quibusdam



As the vapour of chalk and oil of vitriol has been found so efficacious in correcting the *sanies*, and abating the pain of foul ulcers, when externally applied; we may reasonably presume that the internal use of the same remedy will prove beneficial, in similar affections of the urinary passages. Such complaints frequently occur in practice, and may arise, either from *calculi* in the kidneys and bladder; from the recession of scorbutic eruptions which appeared on the surface of the body; from the venereal disease; from strains, contusions, or various other causes. And water impregnated with fixed air seems well adapted, by its diuretic, healing, and antiseptic powers, to wash off and sweeten the acrid matter, to abate the defluxion on the mucous membrane, to contract the flabby edges of the ulcers, and to dispose

L 3 them



them to a speedy granulation. If the pain, inflammation, and absorption of the *pus* have excited a hectic fever, the patient may drink plentifully of Seltzer water, which is of a cooling quality, although it abounds with mephitic air; or a small quantity of Rochelle salt may be added to the mineral water artificially prepared. Thus will the increased action of the heart and arteries, which may arise from the stimulus of the fixed air, be entirely obviated, without the least diminution of its medicinal powers. And whilst the sanction of experience is wanting, reason will justify the trial of a remedy, which is at once safe, pleasant, and efficacious.

IN ulcers of the kidneys and bladder, the urine is commonly high coloured, pungent, and of an offensive smell. To ascertain whether fixed air would correct these qualities, I attempted the following disagreeable experiment.

EXPE-



## EXPERIMENT XI.

REPEATED streams of fixed air were conveyed into three pints of urine, which had been kept till it was become very putrid, and which emitted a strong, volatile odour. I examined the smell of it from time to time, whilst this process was carrying on, and compared it with a portion of the same urine, which was reserved as a standard. The pungency of it gradually abated, it acquired a brighter colour and was less turbid, but its putrid odour seemed to be increased. These observations were made in the evening, and early the next morning I awoke with a violent head ach, which was attended with vomiting and a diarrhoea. Alarmed at these effects, which I attributed to the putrid vapours of the urine, I dropt the prosecution of the experiment; but the succeeding day, Mr. Thomas Smith, a young gentleman who



will one day be an ornament to the profession of physic, undertook the examination which I had begun: And after attentively comparing the standard and the urine impregnated with fixed air, he found the latter more offensively putrid than the former, but without any degree of pungency, or volatility. As this experiment was not compleated, I am uncertain whether the urine was sweetened by the mephitic air. But it is evident that the volatile alkali, generated by putrefaction, was either neutralised, dissipated, or prevented from ascending, by the atmosphere of fixed air, which filled the other part of the vessel. Perhaps this atmosphere might be the *menstruum* of the putrid *effluvium* emitted by the urine, which being then accumulated, would appear to have its *fætor* increased. In another work, I have related an experiment made by my friend Mr. Henry, somewhat fimilar to this, and which suggested to him the like explanation.

A piece



A piece of putrid flesh was suspended twelve hours in a three pint bottle, closely corked, and filled with fixed air, which had been separated from chalk by the vitriolic acid. The beef was considerably sweetened, but the air in the bottle was rendered intolerably offensive.

THE waters of Bath, in Somersetshire, have been long and justly celebrated for their efficacy in the jaundice and other hepatic disorders. They abound with fixed air; and it may be of importance to ascertain whether they derive from this active principle, the power of dissolving the concretions of the bile, and of removing the obstructions in the liver. I was induced therefore to try the solubility of gall stones in mephitic water. But I have yet, only a solitary experiment on the subject, to offer to the reader.

EXPE-



## EXPERIMENT XII.

A GALL stone, that had been extracted from a tumour in the region of the liver, was divided into two parts. One of these, which weighed fifty one grains and a half, was immersed four days in rain water, strongly impregnated with fixed air. The other weighed twenty grains and a quarter, and was macerated in simple rain water during the same space of time. The first fragment, when carefully dried, was become heavier by one grain, having gained so much from the fixed air. In texture and appearance it remained unchanged. The second fragment had lost one eighth of a grain.

I MEAN not to draw any decisive inference from a single experiment: But it is probable that the Bath waters resolve concretions of the bile, not so much by a chemical operation, as by accelerating the



the secretions of the liver, stimulating the organs of digestion, and invigorating the whole animal system. Nature indeed observes a peculiar œconomy in the circulation of the blood through the liver; and as the bile is one of her most elaborate fluids, it must be difficult to introduce a foreign and unassimilated substance into it. From analogy however we may conclude, that this is not impracticable. The milk and the saliva are frequently impregnated with adventitious matters; and these animal liquors, like the bile, are secreted by organs of a particular structure, and for determinate and important purposes. A remedy which would pass unchanged into the system of the liver, and medicate the bile so as to render it unapt to coagulate, or enable it to resolve the concretions already formed, would be a most valuable acquisition (*e*). And the obstacles to  
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(*e*) Vide Medical Transactions, Vol. 2. p. 165.



the attainment of it should rather be regarded as incitements to our industry, than apologies for supineness and despair. Such, it must be acknowledged, they have proved; as appears from the variety of dissolvents which have been proposed, and tried. Acids, alkalis, soap, ardent and dulcified spirits, with fresh vegetable juices, have been recommended. Valsinerius found that a composition of alcohol and oil of turpentine destroyed the texture and cohesion of gall stones, more perfectly than any other *menstruum* (f); and Mr. William White of York has fully confirmed this observation, by a number of judicious experiments which he has communicated to me. Some time ago I thought favourably of this remedy, and endeavoured to promote the trial of it (g); but farther reflection has convinced me that the continued use of it

(f) Opere, Tom. 3. p. 6.

(g) Essays Medical and Experimental, Vol. 2. p. 232.



it is more likely to prove injurious than beneficial. Spirituous liquors, of all sorts, have a peculiarly unfavourable operation on the liver; and it would be absurd to seek a *specific medicine* for the diseases of the bile, in what experience has fatally shewn to be a *specific poison* to the organ which secretes it. Perhaps fixed air, under some form or other, may hereafter be found to be the *desideratum* which we have been so long pursuing. At least we may be allowed to attribute some share of the virtues which the Bath waters possess, to this ingredient in their composition; and when they cannot be employed, to recommend the mephitic water, as an innocent and efficacious substitute.



# HUMAN CALCULUS

It is more likely to prove injurious than beneficial. Spontaneous eruptions of all sorts, have a peculiarly unfavorable operation on the liver; and it would be almost to look a head wind for the delicate of the skin in what experience has lately shown to be a fatal error to the organ which is located in the right side, under some form or other, may never be intended to be the object of which we have been so long pursuing. At least we may be allowed to attribute some share of the virtues which the Bath is supposed to possess, to the ingenuity in their composition; and when they cannot be employed, to recommend the vegetable water, as an innocent and efficacious substitute.

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EXPERIMENTS  
AND  
OBSERVATIONS  
ON THE  
NATURE AND COMPOSITION  
OF  
URINARY CALCULI.



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EXPERIMENTS  
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OF  
URINARY CALCULI.

A CALCULUS, extracted from a young man about two years ago, by my friend Mr. Charles White of Manchester, had so much the appearance of chalk, that I was induced to make some experiments upon it. The *nucleus* was a bougie, which had unfortunately passed into the bladder; and a stone, of a considerable size, had been formed in less than twelve months.

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EXPE-



## EXPERIMENT I.

A FEW grains of this *calculus* produced a strong effervescence with thirty drops of oil of vitriol, and half an ounce of water. Thirty eight grains of it were calcined in a crucible, placed two hours in a wind furnace; and to this *calx* which weighed twenty four grains, were added five ounces of water. The water acquired a slight impregnation of quick lime; and after filtration deposited a small sediment, when a stream of fixed air was conveyed into it.

## EXPERIMENT II.

IN the last experiment the portion of the *calculus* employed was probably too small, to give more than a slight impregnation to so many ounces of water. Another stone therefore of a white colour,



lour, but which did not effervesce with oil of vitriol, was calcined in the same furnace during the space of *three hours*. By this process the *calculus* was reduced in weight from three hundred and nine, to ninety two grains; and though the solid particles scarcely impressed the tongue with any sense of causticity, yet they communicated to five ounces of water, a very strong taste of quick lime; and the filtered liquor became milky by blowing air into it from the lungs, and soon deposited a large white sediment.

## EXPERIMENT III.

A *THIRD calculus*, of a close texture and red colour, which did not effervesce with spirit of vitriol, and weighed seven drachms and a half, was put into the crucible, and in a few hours was entirely consumed by the fire.



## EXPERIMENT IV.

A FOURTH *calculus*, in figure like a mulberry, and which did not effervesce with the vitriolic acid, was calcined three hours, and lost more than three fifths of its weight by this process. It tasted very acrid, and made a strong lime water.

## EXPERIMENT V.

A FIFTH *calculus* which weighed two hundred and forty five grains, before calcination, was reduced to thirty grains by this operation; and the remaining powder was tasteless, and gave no impregnation to water.

FROM these experiments we may conclude that an absorbent earth often enters into the composition of the urinary *calculus*. For it is the peculiar property of this class of bodies to be convertible into quick



quick lime, by the action of fire. It does not seem probable that this substance is the product of animalization, in the human species. The shells of sea fishes and of snails furnish it indeed in large quantity; but the bones, horns, blood, skin and flesh of animals, however strongly calcined, are not changeable into lime. Mr. Rouelle has lately discovered the fixed alkali in the serum of the blood; and Dr. Lewis has observed that the ashes of flesh, and blood are readily, perfectly, and plentifully soluble in the mineral acids; and that they form with them an austere, astringent liquor, approaching to an aluminous nature. (a) The human *calculus* must therefore be considered as an heterogeneous substance, consisting of those recrementitious parts which are separated from the blood by the kidneys. Whether these parts differ essentially in different constitutions, or whether they vary only

(a) Lewis's Translation of Newmann's Chemistry, p. 494.



in the proportion which they bear to each other, is a point of difficult solution. I am inclined to adopt the latter supposition; but however this may be decided, I think it is very evident that *calculi* of the kidneys and bladder are not of animal origin alone, as they frequently contain an absorbent earth, which is not generated in the human body. This substance must therefore be considered as adventitious, and is probably conveyed into the system by the use of HARD SPRING WATER, in which it commonly abounds. In a former work, I pointed out the pernicious effects of such waters, in habits which are subject to the stone and gravel. But influenced by the most respectable authorities, (*b*) I then believed that the *calculi* of the urinary organs, partake not in the least of a fossil nature; and that their formation depends either upon some accidental

(*b*) HIST. de l'Acad. Royale des Scienc. 1700.  
Perrault Vitruve. lib. 8. c. 5. Medical Transactions,  
Vol. 1. p. 7. Sharp's Surgery, p. 75.



tal *nucleus*, or upon a peculiar, and often hereditary disposition to concrete in the animal fluids. Hence I supposed that impure waters were only *negatively* favourable to this disposition, by having no tendency to diminish it. For water, whether used as nature presents us with it, or mixed with wine, or taken under the form of beer or ale, is the great diluter, vehicle, or solvent, both of our food, and of the saline, earthy, and superfluous parts of the animal juices. And it is more or less adapted to the performance of these offices, in proportion to its degree of purity; because a *menstruum* already loaded, and perhaps saturated with different contents, cannot act so powerfully, as one which is free from all sensible impregnation. (*c*) But as an absorbent earth is found (Exp. I. II. IV.) to be often a component part of the human *calculus*, I am now convinced that

(*c*) Percival's Essays Medical and Experimental. Vol. I. 2d Edit. p. 282.



hard waters actually contribute to the formation of it. This is an opinion which the father of physic advanced, and which till lately has remained uncontroverted by his followers. *Damnantur imprimis fontes, says Pliny, quorum aquæ decoctæ, crassis obducunt vasa crustis. (d)* It was obvious indeed to infer that waters which deposite a large earthy sediment, either in the aquæducts through which they are conveyed, or in the vessels in which they are boiled or preserved, would let fall their grosser particles in passing through the kidneys, and especially whilst retained in the bladder; and that these by the continued apposition of fresh matter, connected by the animal *gluten*, and compacted by the action of those organs, would form the stone or gravel. But the separation of earthy matter in the urinary passages may be better explained by the chemical doctrine of affinities. For the vitriolic

(d) Lib. 31. c. 3.



vitriolic acid contained in *selenites*, with which hard spring waters are usually impregnated, will forsake its basis, and combine with the alkaline salts, so copiously discharged by those excretories.

THAT the stone, though it is by no means a rare disorder, does not more frequently occur in this country, which abounds with calcareous waters, is a difficulty which I must acknowledge myself at a loss to obviate. But it may be remarked that internal affections of the human body are seldom produced by a single cause; and the concurrence of many may be necessary to form a *calculus* in the bladder. (*e*) This malady however is scarcely known in Switzerland, as I have lately been informed by a letter from Baron Haller. And the springs of that Alpine region are remarkably light, pure, and free from all mineral ingredients.

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(*e*) *Raro tamen simplex est, sed plerumque ex pluribus conditionibus una concurrentibus composita. Gaubij. Pathologia. Sect. 68.*



IN the second and fourth experiments related above, the *calculi*, though they contained an absorbent earth, did not effervesce with the vitriolic acid. This must be ascribed to the glutinous matter, in which the earthy particles were involved, and by which they were defended from the powerful action of the *menstruum* employed.

APRIL 1, 1775.



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M R. J O H N A I K I N,  
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I N T E R N A L R E G U L A T I O N  
O F  
H O S P I T A L S.



LETTER

TO

MR. JOHN ALKIN,

OF THE

INTERNAL REGULATION

OF

HOSPITALS.



TO MR. AIKIN.

*Manchester, October 1, 1771.*

DEAR SIR,

I HAVE perused with great pleasure your ingenious THOUGHTS ON HOSPITALS. The importance of the subject, and the judicious manner in which you have treated it, cannot fail to excite the attention, and to secure to you the approbation of the public. It is a melancholy consideration, that these charitable institutions, which are intended for the health and preservation of mankind, may too often be ranked amongst the causes of sickness and mortality. (*a*) This observation  
you

(*a*) A THIRD of all who die at Paris, die in hospitals. In the *Hotel Dieu*, a great hospital situated in the middle



you have well illustrated, by pointing out the pernicious effects of tainted air; the false œconomy of crowding a number of sick persons into as little space as possible;

middle of that city, we behold a horrid scene of misery; for the beds being too few for the numbers admitted, it is common to see four, six, or even eight patients in a bed together, lying four at one end, and four at the other. The number annually admitted into this hospital amounts to near twenty-two thousand; (vid. Police of France, p. 83), and I am well informed that *two in nine*, of all received from 1724, to 1763, have died. In the two great hospitals of London, St. Thomas's and St. Bartholomew's, about six hundred die annually, or *one in thirteen* of all admitted as in-patients. Vid. Price on the Expectation of Lives, p. 216. In the Northampton infirmary *one in nineteen* of the in-patients (*communibus annis*) dies every year; and in that of Manchester, which is built in an airy situation, and tolerably well ventilated, *one in twenty-two*. This proportion of deaths, I apprehend, exceeds the mortality which occurs in private practice: And it will appear to be more considerable, when we recollect that, besides the patients who are dismissed as incurable, improper objects, or on account of irregularity, the event of whose cases remains unknown, the small pox, measles, lues venerea, fevers, and other dangerous and fatal distempers, are excluded from admission into these hospitals.



possible ; and the mistaken humanity of admitting patients, who labour under diseases which are contagious in their nature, incapable of relief, or liable to be aggravated by confinement in an impure atmosphere.

BUT as so many infirmaries are erected in different parts of the kingdom, on plans which cannot now be altered ; and as they are governed by established laws which, however erroneous, will still, from the force of custom, continue to be observed, it were to be wished, that some means could be devised of obviating the inconveniences which arise from their present construction, as well as mode of regulation. Permit me to suggest to you a few hints on this subject, which I shall hope to see improved and enlarged, if they fall within the design of your useful publication.

AIR, DIET and MEDICINE, are the  
three



three great agents to be employed, in preventing and correcting putrefaction and contagion in hospitals. A gallon of air is consumed every minute by a man in health; a sick person requires a larger supply, because he more quickly contaminates it; and it is observed that animals expire sooner in foul air, than in vacuo. Besides ventilators therefore, and sashes sliding downwards so as to open at top, apertures should be made in the wall opposite to the windows, corresponding to them in number, and of sufficient dimensions. This is an improvement lately adopted in the infirmary at Leicester, and has been found to succeed. The larger wards should have a fire-place at each end of them; and if the fly of a smoke jack were to be fixed in every chimney, it would accelerate the current or air through them. In summer time, this discharge of foul air by the pipes of the chimney, may be continued by means of a flue, communicating with a fire below.



low. I should not omit to mention, that the salubrity of the air is very much influenced by its temperature, which ought to be regulated by a thermometer, placed in the centre of every room.

BUT supplies of the purest air are insufficient to destroy contagion ; of which I could produce several undeniable proofs, from the best authority. It is necessary therefore to correct the noxious effluvia which arise from so many distempered bodies, afflicted perhaps with mortifications, carious bones, malignant ulcers, or putrid fevers. This I apprehend may be effected by sprinkling, or rather washing daily the apartments of the sick with vinegar and an infusion of dale saw-dust, or with oil of vitriol and water ; by frequently fumigating them with the steams of boiling vinegar and tar ; or if diseases of extraordinary malignancy occur, with boiling vinegar, myrrh, and camphor ; by using wood fuel, particularly fir, and



occasionally dipping the faggots in tar; by ventilating the bed cloaths of such patients as are able to sit up or walk about, and afterwards impregnating them with the antiseptic vapours above mentioned; and by obliging the sick to conform strictly to the rules of nicety and cleanliness. If any of them have been accustomed to smoaking, they should be allowed pipes and tobacco, when such an indulgence will not be injurious to them. The patients should have their linen very frequently renewed, and their shirts and sheets should be fumigated with frankincense, before they are used. The dressings of foul ulcers, &c. as soon as they are removed, should be thrown into vessels of vinegar, or of oil of vitriol and water, and carried out of the wards with all convenient expedition. It is to be wished that salves were banished from hospital practice; and I rejoice that, in a former work, you have so strongly expressed your disapprobation of them.



them (*b*). Oil, by heat, acquires a rancidity which renders it both stimulant and septic, and by these qualities it increases the acrimony and fœtor of all purulent discharges. Poultices either of carrots or white bread, or tow lightly spread over with the mucilage of starch, mixed with such a proportion of neatsfoot oil as to prevent its growing stiff, might perhaps be usefully substituted, as soft defensatives in the room of plasters and cerates. Twelve parts of the mucilage, and one of oil mix uniformly together without heat, are of a due consistence, and continue moist a sufficient length of time. In some cases it may be of advantage, to prepare the mucilage of starch with the saturnine water of Goulard; which with the neatsfoot oil, will furnish an emollient, antiseptic, and moderately astringent topic, much su-

(*b*) Observations on the External Use of Preparations of Lead.



perior, I apprehend, to the *unguentum tripharmacum*.

NEXT to the salubrity of the AIR, a well-regulated DIET may be considered as the most powerful preservative against the in-bred diseases of hospitals. In summer and autumn, when putrid distempers are most prevalent, the patients should be liberally supplied with fruit. Nor will the procuring of it be attended either with difficulty or expence, if it be intimated to the patrons of these charities, and to other well-disposed persons, that such donations will be highly acceptable.

RICE forms a considerable article in the table of diet, of almost every infirmary. But as a wholesome aliment it is much inferior to falep, which I believe is seldom if ever used. I digested several mixtures, prepared of mutton and water, beat up with bread, sea biscuit, falep,  
rice



## ON HOSPITALS. 181

rice flour, fago powder, potatoe, old cheefe, &c. in an heat equal to that of the human body. In forty-eight hours they had all acquired a vinous smell, and were in brisk fermentation, except the mixture with rice, which did not emit many air bubbles, and was but little changed. The third day some of the mixtures were sweet, and continued to ferment; others had lost their intestine motion, and were sour; but the one which contained the rice was become putrid. From this experiment it appears that rice, as an aliment, is slow of fermentation, and a very weak corrector of putrefaction: It is therefore an improper diet for hospital patients. Nor can it be considered as a very nutritive kind of food, on account of its difficult solubility in the stomach. Experience confirms the truth of this conclusion; for it is observed by the planters in the West Indies, that the negroes grow



thin, and are less able to work, whilst they subsist upon rice.

SALEP is said to contain the greatest quantity of vegetable nourishment under the smallest bulk; and from its restorative, mucilaginous, and demulcent qualities, it deserves to be considered as a *medicinal diet*. It obtunds the acrimony of the fluids, and at the same time is easily assimilated into a mild and wholesome chyle. In diarrhœas, and in the dysentery, it is highly serviceable, by sheathing the internal coat of the intestines, by abating irritation, and gently correcting putrefaction. In the symptomatic fever, which arises from the absorption of pus, from ulcers in the lungs, from wounds, or from amputation, salep used plentifully, is an admirable demulcent (c).

(c) Vide Percival's Observations on the Orchis Root, Georgical Essays, Vol. IV. Essays Medical and Experimental, Vol. II.

CHEESE,



CHEESE, I apprehend, is an unwholesome diet for convalescents, because when new it is almost indigestible; and although when mellowed by age, I have observed that it ferments readily with flesh and water, yet it separates a rancid oil, which seems incapable of any further change, and as a septic must be pernicious. For hospital patients are so liable to relapses, that the slightest error of diet may occasion them. The infusion of malt, which is strongly recommended in the scurvy at sea, may perhaps, as an antiseptic, be no less useful in hospitals. It may be allowed the patients for common drink, in lieu of table beer, which having undergone the vinous fermentation, has lost in some measure the power of correcting or sweetening putrefaction. Should this liquor prove too aperient, a few red rose leaves, or balaustines, infused with the malt, will obviate this effect, without communicating any disagreeable flavour. The



flour of malt might also be employed for making gruel, milk pottage, or puddings.

WITH respect to animal food, all salted and smoke dried meats are, I believe, generally disallowed. Pork should likewise be forbidden, as it is the most putrescent kind of flesh, and tends to diminish perspiration. Care should be taken also, that the meat which is killed for the use of infirmaries, be more than usually blooded, that it may not by becoming soon tainted, concur with other unavoidable causes, in the production of putrid diseases.

CONCERNING MEDICINES little more can be suggested, than that in prescribing them, regard should be had not only to the present symptoms, but also to the putrid tendency, and contagious nature of hospital diseases. And as the course of infection is usually slow, the physician should



should carefully watch its first accession, and by suitable remedies instantly check its progress. — In malignant fevers, besides administering the Peruvian bark in substance or decoction, a light infusion of it, well acidulated, may be directed for the common drink of the patient. But in less urgent cases, vinegar, or cream of tartar whey will be a more grateful diluent, and sufficiently antiseptic. It would be a farther means of correcting putrefaction, and would answer other useful purposes, if the sick were to wash their faces, and bathe their feet and hands every morning and evening, in a decoction of bark, or of chamomile flowers, mixed with vinegar.

I HAVE thus, my dear friend, very imperfectly drawn the outlines of a plan for rendering hospitals upon their present establishment, more salutary to the sick, and consequently more useful to the public; and I flatter myself you will improve



improve and finish it. Permit me, before I conclude, to mention an ingenious contrivance, used in the infirmary at Leicester, which contributes greatly to the ease and convenience of the patients. The bed-steads, which are of iron painted, are so made, that the backs, by means of a screw, may be raised or lowered, with the greatest facility. This improvement was suggested by Dr. Vaughan, and executed under the direction of Dr. Ash at Birmingham.

*I am with sincere Esteem and Friendship,*

DEAR SIR,

*Your faithful, affectionate,*

*and most obedient Servant,*

THOMAS PERCIVAL.



ON HOSPITALS 186

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EXPERIMENTS

AND

OBSERVATIONS

ON THE EFFECTS OF

FIXED AIR,

ON THE

COLOURS AND VEGETATION

OF

PLANTS.

THOMAS PERCIVAL



THE influence of fixed air on vegetation is a new, curious, and very interesting object of inquiry. I was led into it, by a train of experiments, which the following passage, in Doctor Priestley's Observations on Various Kinds of Air, suggested to me. "A red rose, fresh



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fresh gathered, lost its redness, and became of a purple colour, after being held over fermenting liquor about twenty-four hours; but the tips of each leaf were much more affected than the rest of it. Another red rose turned perfectly white in this situation; but various other flowers, of different colours, were very little affected. These experiments were not repeated, as I wish they might be done, in pure fixed air, extracted from chalk by means of oil of vitriol."

March 16th, 1775. I EXPOSED a tulip, forty-eight hours, to a stream of fixed air, separated from chalk by means of oil of vitriol. The colours and odour were preserved unchanged; the leaves were curled at the edges, but remained firm and undecayed. Another tulip, gathered at the same time, from the same root, and similar in colour, soon became faded, flaccid, and lost its odour in the common atmosphere.

THE



THE same experiment was made with a purple crocus ; with a white and yellow jonquil ; with the hepatica ; with a polyanthus of a purple hue ; and with a stock July flower. They were all perfectly preserved in the vessel of fixed air ; whilst specimens of the same flowers speedily lost their bloom, and turned soft and shrivelled in the open air.

THE Italian Narcissus, a delicate flower, which grew in a hot house, retained its colours forty-eight hours in the fixed air ; but the petals (or leaves of the flower cup) were very much contracted.

A PALE red rose, taken from a hot house, was exposed twenty-four hours to a stream of fixed air, without suffering any change of colour. It was carefully compared with another rose, collected from the same tree (*a*).

THE

(*a*) MR. HENRY exposed several red roses, in the summer of 1774, to a stream of pure fixed air, and did not



THE result of this experiment differs from that related by Dr. Priestley. But it is probable, that the fixed air, separated from fermenting liquors, is less pure and unmixed than that obtained from chalk by the addition of oil of vitriol; and that its effects may be varied by the adventitious matters with which it is combined.

THE preservation of flowers by mephitic air was an event which I little expected, at the commencement of these trials. And as an active mind is seldom satisfied with the bare observance of effects, without inquiring into the causes which produce them, I was naturally led into a train of reasoning on this curious subject. It was well known to me, that vegetables, before the putrid fermenta-

not find any change produced in their colour. See his excellent translation of Lavoisier's *Essays Physical and Chemical*, which he has enriched with various useful notes, page 130.

tion



tion begins, emit a very large proportion of fixed air (*b*). But this separation can only take place by the mediation of some body, which is capable of carrying off what is discharged. A wet sponge will never become dry in an atmosphere saturated with moisture; and red hot wood ceases to burn in inflammable air, which is already loaded with phlogiston. I was induced, therefore, to suppose, that the flight of mephitic air from flowers, which seems to constitute the first stage of their decay, is prevented or considerably retarded by surrounding them with the same species of air, and by excluding from them the common atmosphere, its proper vehicle (*c*).

BUT the prosecution of my experiments discovered to me, that fixed air not

(*b*) SEE Priestley's Observations, Vol. I.

(*c*) SEE this subject, so far as it relates to putrefaction, farther illustrated in the second volume of these Essays, page 84.



only retards the decay, but actually continues the vegetation of plants, and affords them a *pabulum*, which is adequate to the support of life and vigour in them for a considerable length of time.

Tuesday. A SPRIG of MINT was suspended, with the root upwards, in a vessel of fixed air. The succeeding day it was as fresh and verdant as when first gathered. Another sprig, collected at the same time and from the same bed, which lay upon my table, was quite withered. Friday, the fourth day, a curve was formed in the middle of the stalk, and the top of the sprig had risen about an inch perpendicularly towards the mouth of the vessel. Saturday, the mint continued to grow and to ascend, looking vigorous and fresh: the root, which was very small, appeared quite dry, so that the nourishment, probably, was imbibed by the leaves. Tuesday, having been absent two days, the plant  
was



was not supplied with fresh streams of air: it was still in vigorous vegetation. Friday, the eleventh day of the experiment, the plant was taken out. It was perfectly fresh, but whilst it lay on my study table the leaves grew soft and flaccid, and in less than six hours it seemed to be withered. The mercury in Fahrenheit's thermometer, during the course of this experiment, stood from 60 to 69 degrees in the shade and open air, at two o'clock in the afternoon.

March 23d. TWO SPRIGS of MINT with their roots, fresh gathered from the same bed, and nearly alike in size, were each put into a half ounce phial, filled with rain water. One of them was suspended four days and an half in a vessel of fixed air, and frequently supplied from chalk and oil of vitriol with fresh streams of it. The other was placed near it, in the common atmosphere of my study. And a few sprigs of



mint, with their roots, were at the same time laid upon the table. The latter withered in about twelve hours; and in twenty-four hours were dry and quite shriveled. The sprig in the fixed air flourished greatly; shot out fresh leaves from the part immediately above the neck of the phial; expanded its leaves; looked verdant; and when taken out of the fixed air, had gained in length more than half an inch. The sprig in the common atmosphere looked sickly; the leaves were contracted, had a brown and curled appearance, and several of them were become dead and rotten.

March 28th. THE flourishing sprig of mint, which had been suspended in the fixed air, was now placed in the common atmosphere of my study; and the other which was so much faded, was put into the vessel of fixed air. In two hours time the leaves of the former began to droop and grow flaccid, like a  
plant



plant taken from a hot-bed; and in twenty-four hours they were in a withered state. The latter sprig was much revived by the fixed air; but did not vegetate in nearly so vigorous a manner as the first had done. It was kept four days in the vessel, and daily furnished with fresh supplies of fixed air.

April 1st. THE water, in which the sprig of mint grew that had been suspended in fixed air, became impregnated with this active principle, as appeared from its acidulous taste, and from its producing an instant precipitation when mixed with lime-water. This incited me to try how a plant would vegetate in mephitic water, with its leaves and branches exposed to the common atmosphere. A sprig of mint was, therefore, put into a phial, containing about six ounces of it. The stalk passed through a perpendicular groove, cut in a cork, which stopped the mouth of the bottle,



to prevent the escape of the fixed air. In two days the leaves of the mint became curled at the edges; and the plant seemed to be in a less thriving state, than another sprig of mint placed in rain water, which served as a standard. Suspecting that the stalk of the mint was compressed and injured by the cork, I renewed the experiment, using fresh sprigs of mint, and other portions of water; and leaving the mouth of the phial, which held the mephitic water, open to the external air. The vegetation of the plant, in this water, was now very vigorous; and the growth of it, in six days, considerably exceeded that of the standard.

April 8th. THE experiment of March 23d was repeated; and the sprig of mint, placed in a phial containing half an ounce of rain-water, and suspended in a vessel constantly supplied with fresh streams of fixed air, grew above an inch within the space of six days. Another sprig, in half  
an



an ounce of simple rain-water, was in a much less healthy state, and had scarcely acquired any perceptible increase in that time.

April 14. THIS experiment was repeated with a sprig of BALM, which flourished and grew fast in the fixed air.

IT has been shewn, that a plant grows faster in mephitic, than in simple unimpregnated water. The following experiments seem to evince, that the fixed air is absorbed by the roots of the vegetable; and that it affords them real nourishment.

April 18th. A SPRIG of MINT, with a short root, was put into a six ounce phial, full of rain-water, strongly impregnated with fixed air. Another phial of the like size was filled with the same mephitic-water, and placed without a cork, contiguous to the former, upon a shelf in



my study. At the end of four days they were carefully examined; the sprig of mint was in a very flourishing state, and the water in which it grew had lost its acidulous taste; yet it produced a precipitation when mixed with lime-water. But the standard of mephitic-water still retained a considerable degree of pungency; and when poured into lime-water, rendered it quite milky.

AN AURICULA, fully blown, and just gathered from my garden at Hart-Hill, was suspended by a string in the vessel of fixed air, and frequently supplied with fresh streams of it. The bloom of this delicate flower continued perfectly unimpaired during eight days; when it was withdrawn, as the prosecution of the experiment interfered with another which I had in view. The auricula when taken out of the fixed air, withered in a few hours.

May



May 2d. A LILAC, before the flower was blown, was put into the vessel of fixed air, and occasionally but not frequently supplied with fresh streams of it. It weighed, at the commencement of this experiment, two scruples thirteen grains and an half; and when taken out, at the expiration of seven days, only thirty-three grains; having lost one scruple and half a grain of its weight. The flower was a little withered, as much, I conjectured, as it would have been by lying in the open air about six hours. The stalk was dry. This flower was without any green leaves; and it is not improbable that the absorbent vessels are confined to these leaves (*d*).

A TULIP, about half blown, was put into the vessel with the lilac. It seemed not to flourish, but opened so much in the vessel that, at the end of seven days, I found a difficulty in taking it out

(*d*) SEE Grew's Anatomy of Plants. Hales's Statical Essays. Hunter's Georgical Essays.



of the aperture, through which at first it had passed very readily. The tulip had no leaves: its colour remained unchanged.

May 10th. A BRANCH of LILAC, which weighed eighty-six grains and an half, was put into the vessel. Some of the flowers were blown; but most of them remained in a closed state. I plucked off four green leaves before the branch was exposed to the fixed air, to see whether it would grow and flourish by the absorption of the flowers and stalk alone. It should be remarked that the stalk of the lilac is woody and not very succulent.

May 18th. THE air had not been renewed during forty-eight hours, owing to my absence from Manchester. Several of the flower cups of the lilac were more open than at first; but the flowers were somewhat withered, probably as much as they would have been by lying eight  
or



or ten hours in the open air. The whole branch had lost eighteen grains of its weight.

A PURPLE FLOWER, unblown, was suspended in the vessel with the lilac. It weighed two scruples and ten grains; and was without leaves. The stalk was succulent.

May 18th. THE air had not been renewed during forty-eight hours, yet the flower was perfectly fresh, and its purple colour remained unchanged. Several of the flower cups were opened, and the seeds displayed. It had lost six grains of its weight.

HAVING thus opened a path into a new and fertile region of science, I shall discontinue my researches for a while; with a resolution however to resume them in the spring of the succeeding year. In the mean time I shall think myself happy



py if I can prevail upon my philosophical friends to engage in the same pursuit, by offering them, as a clue, these few experiments ; together with the following observations and conjectures, which have occurred to my mind, during the prosecution of them.

### SPECULATIONS.

I. THE Florist, who is anxious to obtain a prize at some of the great meetings held for the encouragement of Horticulture, may perhaps avail himself of the powers of fixed air ; and either quicken the growth of his favourite flower, if yet immature, or preserve it in all its beauty till the expected day of decision. But it will be necessary to inform him, that the mephitic air should be frequently renewed, or it will be corrupted by the perspiration of the vegetable. For plants, like animals, form an atmosphere around them, which proves unfavourable to their health



health if not removed. An auricula was suffered to remain in the same fixed air many days. Its colours seemed not much changed; but a mouldiness was visible in the flower cups; the leaves were soft and flaccid; and the fine bloom of the flower was lost. These effects I ascribed to the cause above mentioned. But my gardener has since suggested a doubt to me, by informing me that auriculas grow mouldy when the seed is completed. And it is possible that in this experiment the flower had finished its proper office, and was gone into a natural not premature decay.

2. PERHAPS valuable seeds, collected in distant climates, may be preserved by fixed air; and transported to other regions in the most perfect state of vegetation?

3. Is there any analogy between the torpid state of animals, during winter,  
and



and the preservation of flowers, stripped of their leaves, by means of fixed air? The vital principle seems to be preserved in both; and the juices of each are slowly consumed in the support of it.

4. THE *gas* of fermenting liquors appears to differ in some respects from pure fixed air. It affects the head and stomach more powerfully; changes the colours of flowers, and is presently fatal to sprigs of mint which are exposed to it.

5. A PLANT in distilled water, Dr. Woodward observes, will not grow so fast as in water that is not distilled. And if the water be distilled three or four times, the plant will scarcely vegetate at all. Distilled water is deprived of its fixed air; which is probably one of the constituent parts of this element, essential to the nourishment of plants.

6. LAND



6. LAND well drained, cultivated, and manured, is constantly in a state of intestine fermentation (*e*). The exhalations which arise from it may, perhaps, in part, consist of fixed air; and this principle may be found to prove a very powerful agent in the process of vegeta-

(*e*) CULTURE has a remarkable effect on climate. Draining land lessens evaporation, and consequently diminishes moisture and cold. *Cold* and *barren* are terms always associated together, when applied to soils. The felling of trees, clearing away underwood, and cropping of hedges, occasions a more free circulation of air, and a drier climate. The perspiration of trees, and exhalations from wet land, render the air colder; and cold air is less capable of dissolving moisture: when warmer air, therefore, which is saturated with aqueous vapours, passes over any colder region, the water will be precipitated in drops of rain. Hence uncultivated countries, *cæteris paribus*, are most rainy.

THESE remarks are not entirely foreign to the subject of this essay. And I have introduced them here to exhibit the importance of agriculture, in a point of view, in which it is seldom beheld, either by the speculative or practical farmer; who are little aware that they have an interest in every improvement made by their neighbours,

tion.



tion. Frost meliorates soil chiefly by retaining these exhalations, the loss of which impoverish and exhaust it. Snow also, when it lies long on the ground, prevents the dissipation of them, and thus affords time and opportunity for their absorption by the roots and leaves of plants.

7. DOCTOR PRIESTLEY has discovered, that vegetables thrive admirably in putrid air, and also in that which has been corrupted by the breath of animals, and by the burning of candles ; and that they restore such air from a highly noxious, to a salutary and respirable state. This effect he supposes to be produced by their inhaling those *effluvia*, which are so fatal to animal life, and not by any addition to the atmosphere, which surrounds them. From the foregoing experiments, we have reason to presume, that this wonderful, and most useful power of plants, is extended to another species



species of noxious air ; and it will be the first object of my future trials to ascertain this curious and important truth. Such discoveries heighten our admiration of the wisdom and goodness of the Deity, by affording us fresh proofs that nothing is created in vain. “ From the oak of the forest, to the grass of the field, every individual plant is serviceable to mankind ; if not always distinguished by some private virtue, yet making a part of the whole which cleanses and purifies our atmosphere. In this the fragrant rose and deadly night-shade co-operate : nor is the herbage, nor the woods that flourish in the most remote and unpeopled regions unprofitable to us, nor we to them ; considering how constantly the winds convey to them our vitiated air, for our relief, and for their nourishment.” (*f*).

(*f*) See a discourse on different kinds of air, delivered at the anniversary meeting of the Royal Society, November 30th, 1773, by Sir John Pringle, Baronet, P. R. S.



8. As fixed air is so favourable to the growth of vegetables, perhaps it may equally contribute to the nourishment and support of animals. It is separated from our food, during the process of digestion; and it may only be injurious to us when too copious; as excess in the quantity of water proves hurtful to the roots of plants.

N. B. It may be proper to inform the reader, who would choose to repeat my experiments, that they were generally made with the apparatus for impregnating water with fixed air, invented by Dr. Nooth, and sold by Mr. Parker, glass-man, in Fleet-street, London.

MAY 20th, 1775.



MISCELLANEOUS  
OBSERVATIONS  
CONCERNING THE  
ACTION  
OF DIFFERENT  
MANURES.

I. I APPREHEND, that oily substances cannot produce any considerable effect on land, unless they be previously combined with mucilages, or converted into soap by means of quicklime or fixed alkalis. In this state they meliorate the soil in several ways, viz. by affording a lasting *pabulum* for plants; by fitting it to receive, and preventing the too speedy evaporation of the dews and rains; and by presenting the food of



vegetables in a due proportion to the absorbent vessels of their roots.

2. SALINE substances, as they are soluble in water, and capable of admission into the vascular tubes of plants, act more immediately on the earth. Whether they afford any real nutriment to vegetables, or whether their operation depends upon a stimulating power, by which they quicken vegetation, I am at a loss to determine. For that plants are endued with *irritability* is evident from various facts. The sensitive tribe of vegetables afford us ocular demonstration of it; and electricity is well known to accelerate the growth of plants, by promoting the ascent of their juices.

3. COMMON SALT is universally esteemed an excellent manure; but I think it would be still more powerful, if a proper quantity of Epsom salt were added to it. By this combination it  
would



would more exactly resemble sea-water, which amazingly fertilizes the marshes over which it flows. The grass of such marshes is purgative to horses and to cattle ; which affords a presumptive proof, that sea-salt, mixed with the bittern, may be received into the vessels of plants in a much larger proportion than when purified and refined. The combination here recommended, will act as a powerful septic, when mixed with the corrupted vegetables, and other putrefying substances on the surface of the earth ; and by this fermentation will improve the soil.

4. QUICKLIME is not classed by the modern chemists amongst the salts, though it has some properties in common with them. It may act as a manure by combining with and dividing the particles of clay, and thus forming a species of marle ; by uniting with the oily substances contained in the soil, and render-



ing them soluble in water ; and by absorbing the dews and rains, and preventing them from sinking too speedily into the earth, by which the food of plants is washed from their radical fibres.

5. LIME and the fixed alkalis are more powerful agents, than neutral salts, in preparing the food of vegetables, by their operation on the oils and mucilages which exist in the soil, and which have been supplied by manures, or derived from the atmosphere.

AUGUST 20th, 1770.

TABLE

REMARKS



## REMARKS

### ON DIFFERENT

## ABSORBENTS.

**L**ANGIUS and Homberg, two able chemists have attempted to ascertain the comparative powers of various absorbents. But the acids which they employed being of the mineral class, and totally different from those which exist in the human body, no accurate conclusions can be drawn from their trials, concerning the medicinal action of such absorbents (*a*). The following table exhibits the result of some experiments, which I made about two years ago (February 1774) on this subject.

(*a*) See Lewis's new Dispensatory, page 64.

TABLE.



## 216 OF ABSORBENTS.

## T A B L E.

Absorbents.	Distilled Water.	Drops of White Wine Vinegar.
Ten grains of Earth of Alum, - half an ounce,	-	13.
Magnesia, - - -	-	24.
Calcined Magnesia, - - -	-	42.
Prepared Chalk, - - -	-	14.
Compound Powder of Crabs Claws. - -	-	10.
Salt of Tartar, - - -	-	90.
Volatile Sal Ammoniac, - - -	-	110.
Ten drops of Lixivium Tartari, - -	-	50.
Spirits of Hartshorn. - - -	-	45.

THERE is such a diversity in the purity of the same species of absorbents, as well as in the strength of different vinegars, that I am sensible these experiments are vague and indeterminate; though they were made with much attention, and the drops of acid here set down, were the medium quantity of several trials. However, as the subject admits not, so neither does it require mathematical certainty. And, we may, with safety and advantage, in this, as we are obliged



obliged to do in many other instances, found both our reasoning and practice on *data*, which approach near to truth.

THE method which I pursued in making the experiments, from which the foregoing table is deduced, was to add six or eight drops of the acid to the absorbent; then to pour half an ounce of distilled water upon it; and afterwards to instil *guttatim*, as much vinegar as barely to occasion a perceptible prevalence of the acid. In such combinations the continuance of the effervescence is no test that saturation has not taken place. Three hundred drops of white wine vinegar were added, in the way above described, to ten grains of volatile sal ammoniac. Every additional drop still produced air bubbles; by which appearance I was so much deceived, that I should have continued to add more vinegar, had I not found, by tasting the mixture, that it was extremely sour. And



And when I put into it a few grains of the volatile salt, a very brisk effervescence ensued. From this trial it should seem, that the particles of the alkali combine with the acid more slowly and gradually than is commonly supposed; and this observation will be found to merit the attention of apothecaries.

THE combination of vinegar, or juice of lemons, with *lixivium tartari*, yielded very little fixed air in my experiments. This mixture, therefore, is not well adapted to be given in the act of effervescence.

THE mixtures of vinegar and earth of alum, also, emitted very few air bubbles. But the same acid with chalk, or compound powder of crab's claws, swelled much, and effervesced violently.

THE earth of alum, which I employed in these experiments, was prepared  
in



in the following manner. Two pounds of roch alum, freed, by washing, from all external impurities, were dissolved in about five gallons of soft water. To this liquor, whilst hot, four pounds and a half of a filtered solution of pot-ashes were gradually added. The precipitated earth was repeatedly washed in hot and cold water, till it was entirely divested of saltiness; and afterwards placed upon chalk stones, to be thoroughly dried. The alum, reduced to this state, weighed only four ounces, six drachms, and twelve grains.

AT the time when I was engaged in these inquiries, I received from a gentleman, just returned from Jamaica, a quantity of the essential salt of lemons, which he had made himself, by evaporating, in the sun, the juice of that fruit, till it assumed a crystallized form. This acid was very grateful to the palate; and I dissolved such a quantity of it in distilled



led water, as to produce a liquor nearly resembling fresh lemon juice. One scruple of it, as exactly as I could judge, seemed to be equal to a lemon of a common size.

AN ounce phial, filled to the brim with the acid liquor thus made, weighed two ounces, five drachms, and half a grain. But an equal quantity of a saturated solution of the earth of alum in the same liquor, after being carefully filtered, weighed eight grains heavier; and a like solution of pure magnesia (*b*) twelve grains and an half. From hence it appears, that magnesia is much more soluble, in the vegetable acid, than the earth of alum. But the liquor is extremely nauseous to the taste; whereas the solution of the earth of alum is not unpleasant, having a slight degree of sweetness and stypticity.

(*b*) THE magnesia I had from Mr. Henry, who is well known to prepare it with great skill and attention,

As



As the sensible qualities of alum, and of its earth, in combination with the vegetable acid, so nearly resemble each other, we may presume, that they are similar in their medicinal powers. And I have employed this absorbent with considerable advantage, in such cases of acidity as arise from an *atonia* of the stomach and intestines. But we sometimes observe, that the same disordered state of the bowels, generates an acid in the stomach and *duodenum*, and a highly putrid acrimony in the lower intestines. A gentleman, after a moderate dinner of chicken, and a supper of apple tart and new milk, was affected, in the night-time, with great flatulency. His discharges of wind upwards were attended with the most corrosive acidity; those downwards were uncommonly putrid and noisome. His complaints terminated in a *diarrhœa*; and his evacuations were hot, sharp, and intolerably fœtid. A lady had a rheumatic fever, about the middle



middle of last summer, which, towards the conclusion, assumed a putrid type. Her stools were frequent and very offensive; and she had the most black and aphthous tongue I ever saw. Clysters of fixed air were injected; acids, vegetable and mineral, were freely administered; and by these, and other means, the *diarrhœa* was restrained. A sudden change took place in the state of her bowels; and an acid acrimony seemed now to prevail as much as the putrid one had done before. In such cases as these, an intelligent physician will consider, chalk, crab's eyes, and other septic earths, as contraindicated; and will be glad to avail himself of such an absorbent as will, at the same time, corroborate and resist putrefaction. The earth of alum might be deemed, *à priori*, to possess these powers in a very considerable degree; but from experiments I find, that, even when combined with the vegetable acid, it is a very weak antiseptic.



tic. I saturated an ounce of lemon juice with it; another ounce with pure magnesia; and a third with *lixivium tartari*; and then added to each half an ounce of raw mutton, chopped very small. The phials containing the mixtures were slightly corked, and placed in a heat of about 100 degrees of Fahrenheit's scale. A fourth phial, which was intended for a standard, contained the same quantity of mutton, and an ounce of distilled water. In twenty-one hours, the mixture with the earth of alum was in brisk fermentation; the liquor was of a brown colour; much froth was collected on the surface, and it smelled offensively, like faded cheese.

THE mixture with magnesia did not ferment much; the liquor was of a bloody colour, and had a very offensive and putrid smell.

THE saline mixture was perfectly sweet,  
and



and had undergone only a flight fermentation.

THE standard was extremely putrid, and the liquor very bloody.

IN forty-eight hours the aluminous mixture was more putrid and offensive than that which contained the magnesia. The saline mixture continued perfectly sweet.

I VARIED this experiment afterwards, by leaving the vegetable acid out of the mixtures; and using only the earth of alum, chalk, and magnesia. They all powerfully accelerated the corruption of the flesh; the earth of alum proving the most, and magnesia the least septic.

A VERY ingenious Chemist has lately proposed to the trial of the faculty a new saline preparation, namely, the vegetable alkali dissolved in water, and perfectly saturated



saturated with fixed air, which he has demonstrated to be an acid (*a*). This compound he recommends as a febrifuge and antiseptic in fevers, and other disorders of a putrid tendency. I was so much pleased with the idea of this neutral julep, that I immediately prepared a small quantity of it; by mixing ten drachms of the *lixivium tartari* with about a quart of pure water, and strongly impregnating the solution with fixed air, by means of Dr. Nooth's apparatus. The nauseous flavour of the alkali is almost entirely corrected by this process, and the liquor has a grateful and acidulous taste. The *lixivium tartari* seems to attract a very considerable quantity of fixed air (*b*);

(*a*) SEE Mr. Bewley's excellent Letters, in the Appendix to Dr. Priestley's Second Volume of Observations on various kinds of Air.

(*b*) THIS will appear very evident by comparing together the effervescence produced in the neutralized and unneutralized *lixivium tartari*, when the vitriolic acid is added to equal quantities of each of them.

Q

and



and as the mephitic acid has a weaker relation to it than any other, it will be separated in the stomach; and this elegant saline julep will thus produce the good effects of a tonic and absorbent. But when it is thought expedient to give this julep in a large quantity, not more than a drachm of *lixivium tartari*, should be added to each pint of water. And even in this proportion, the alkali may prove too diuretic except in dropfical cases, to which it seems to be well adapted. The pleasantest beverage I have yet been able to prepare, is made by dissolving a drachm and an half of the fossil alkali, and twenty-five grains of bay salt, in three pints of pure water, which is then to be strongly impregnated with fixed air. This liquor exactly resembles very good Seltzer water; and may be drunk to satiety in hot climates; in hectic, inflammatory, or putrid disorders, without danger, and with great advantage.



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## MISCELLANEOUS

## OBSERVATIONS,

## CASES,

## AND

## INQUIRIES.



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MISCELLANEOUS  
OBSERVATIONS,  
CASES,  
AND  
INQUIRIES.  
FIXED AIR.

FROM the observations advanced in a preceding essay on the solution of urinary *calculi*, it appears highly *probable*, that fixed air may be conveyed, by the ordinary course of circulation, to the kidneys and bladder. But I can now speak *decisively* concerning this interesting point. For a young gentleman (Mr. Thomas Smith) has, at my desire, taken



large quantities of mephitic water daily, during the space of a fortnight. And whilst he continued this course, his urine was strongly impregnated with fixed air, as appeared from the precipitation which it produced in lime-water; from the bubbles which it copiously emitted when placed under the receiver of an air pump; and from the solution of several urinary stones, which were immersed in it.

DR. PRIESTLEY'S favourable opinion of this new lithontriptic medicine may be collected from the following paragraphs, which I have extracted from the second volume of his Experiments and Observations on air, page 216.

“ IT might be questioned, whether  
 “ the fixed air contained in our aliments  
 “ can be conveyed by the course of cir-  
 “ culation into the blood, and by that  
 “ means impregnate the urine. I have  
 “ found, however, that it may do it;  
 “ having



“ having more than once expelled, from  
 “ a quantity of fresh made urine, by  
 “ means of heat, about one fifth of its  
 “ bulk of pure fixed air, as appeared by  
 “ its precipitating lime in lime-water,  
 “ and being almost wholly absorbed by  
 “ water; and yet a very good air pump  
 “ did not discover that it contained any  
 “ air at all.

“ It must be observed, however, that  
 “ it required several hours to expel this  
 “ air by heat; and, after the process,  
 “ there was a considerable whitish sedi-  
 “ ment at the bottom of the vessel.  
 “ This was probably some calcareous  
 “ matter, with which the fixed air had  
 “ been united; and by this fixed air,  
 “ the calcareous matter, which would  
 “ otherwise have formed a stone or gra-  
 “ vel, may have been held in solution.  
 “ And, therefore, drinking water, im-  
 “ pregnated with fixed air, may, by im-  
 “ pregnating the urine, enable it to

having

Q 4

“ dissolve



“ dissolve calcareous matters better than  
 “ it would otherwise have done; and  
 “ may, therefore, be a means of pre-  
 “ venting or dissolving the stone in the  
 “ bladder, agreeable to the proposal of  
 “ my friend Dr. Percival.”

SIR JOHN PRINGLE informs me, that he has known great benefit to accrue from the use of honey in cases of the gravel, or when the kidneys are loaded with sand. He directs about a pound and a quarter of this remedy to be taken every week, and continued for a considerable space of time. And as it perfectly coincides with the artificial mineral water, being diuretic and containing much fixed air, he recommends to me the trial of them together. My readers will, I doubt not, be much pleased with this valuable hint.



MAY not mephitic water prove an active and useful remedy in such species of dropfies as originate from obstructions in the liver, or from a general *atonia* of the solids, and poverty of the fluids? From its stimulant and penetrating powers, it should seem well adapted to pervade the minutest series of vessels; as a strengthener, it will give vigour to the organs of digestion; and as a diuretic, will tend to carry off, by urine, the superabundant serosities. In the *anasarca* and *ascites* the blood is generally of a loose texture, and the coagulable lymph is sometimes so much dissolved, that the whole mass assumes the appearance of gelly. As fixed air has been shewn, by Dr. Hales and Dr. Macbride, to be a bond of union to the particles of matter, may not mephitic water contribute to supply the animal fluids with this cementing



menting principle? Other tonic and diuretic remedies may be combined with this grateful liquor; and if the patient's thirst be immoderate, and his case attended with imminent danger, he may be allowed to drink of it to satiety (*a*). The waters of Bath, in Somersetshire,

(*a*) *Sanatur, indulgens sibi, dirus hydrops.*

THE following passage is extracted from a letter which I have lately received from my learned friend Dr. Baker.

“ HAVE you heard of a M. Bacher? Such is said to have been his success in dropfies, that the French government has been induced, from the report made of the effects of his *tonic pills*, to purchase the secret of their composition; trials being first made under the eye of the court physicians. The chief ingredient in the pills is the black hellebore; but Bacher says, that without the assistance of *diluents* he could do nothing. “ *Le malade bu-voit a sa soif,*” is the language of every page. This puts me in mind of some cases, which I published, in the second volume of the Medical Transactions; and I have lately been informed from Vienna, that Dr. Colin has more success than others with the same medicines, probably because his patients are allowed to drink *ad libitum*.”

have



have been found to be signally serviceable in œdematous swellings of the legs, which have succeeded intermittents; and also in anasarcas, when the strength has not been too far impaired (*b*). I have repeatedly experienced the salutary effects of Buxton water in similar cases: and as these celebrated springs owe their virtues in part to the fixed air which they contain, their efficacy in dropries affords sufficient encouragement to the trial of mephitic water in the same disorders.

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FIXED AIR, conveyed by a proper tube into the nostrils, seems likely to prove the best topical application in the OZÆNA; whether the disease be seated in the *antrum Highmorianum*, or in the frontal sinuses. It will be easy to guard the patient against drawing into his lungs too

(*b*) See Falconer on the Bath Waters.



large a quantity of this air, by directing him to breathe with his mouth open during the operation.

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EXTRACT OF A LETTER FROM  
DR. ROTHERAM OF NEWCAS-  
TLE UPON TYNE.

I HAVE been very attentive to what you and Dr. Priestley have so well said upon fixed and factitious air ; and hope it will be found a most valuable acquisition to our art. Yet let me crave your pardon and patience for a moment, whilst I lay down my reasons for applying it in a manner, which you seem but slightly to insist upon, but by which, I flatter myself, I have done substantial service.

THE lungs are, undoubtedly, the principal organ, by which a constant and  
necessary



necessary communication between the fresh air and the blood is carried on : that every inspiration conveys, into the blood, some particles from the air, which are necessary to life : and that every expiration carries off particles which are noxious, or, if I may be allowed the expression, excrementitious ; so that the same air cannot, without injury, be breathed twice over. This part of the animal œconomy is so well known, that I need not expatiate, with you at least, any farther upon it ; nor upon the obvious conclusions which flow from it. But from hence, I think we may fairly argue, that in putrid fevers, or in simple inflammatory fevers, where we often find a general tendency of the animal fluids to putrefaction ; and when certain kinds of factitious air are known to impede, resist or overcome this putrescency ; the most effectual way of applying it should be to throw it liberally into the lungs, that it may be distributed through  
the



the whole course of the circulation, and given not merely as a topical but general medicine to comprehend every intention which can be answered by it.

WE have had a very disagreeable fever, often attended with putrid symptoms, raging in this town all the last winter; but at present, thank God, it is greatly abated. As I make it matter of principle to attend as many of the poor as I am able; I have seen great numbers. They have commonly begun with the usual symptoms of shivering, drowsiness, erratic pains, &c. sometimes with a *diarrhœa* and *tenesmus*; the pulse always quick, but seldom so full or hard as to indicate bleeding with propriety; and where it has been done, I generally thought mischief attended it, by sinking the pulse, and bringing on symptomatic or colliquative sweats, which I always found very difficult to manage. The putrid symptoms commonly appeared upon the  
sinking



sinking of the pulse; in a great many, ulcerations of the throat with *aphthæ*; black, fœtid, and sometimes bloody stools; in some cases, large and numerous vesications; and in one or two, livid *petechiæ*. The mouth, tongue, lips, and teeth covered with a dry, foul, black crust; the cadaverous smell, incontinence of stool and urine, *subsultus tendinum*, cold sweats, and death. I cannot avoid attributing some of these mischiefs to the constant use of an alkaline water, which, notwithstanding the remonstrances I formerly made against it, was brought into this town, and has for some time been in common use for brewing, &c. but you will see my objections to it in the 31st page of my Inquiry, under the article of Cox-lodge water.

AFTER some unsuccessful cases, I generally found the following method to answer best. In whatever stage I was called,



called, I scarcely deliberated in ordering a vomit or two, as I found the patient could bear it; occasionally gave carminative glysters, with strong decoctions of chamomile, &c. and saline draughts, with rather a predominant share of acid, taken in the time of effervescence every six hours. At first I gave twenty-five or thirty drops of *vin. antimonial.* in each saline draught; but I afterwards thought proper to lay it aside. I mostly found blisters to do evident harm, I therefore totally refrained from them; and when I found the pulse sinking, and the putrid symptoms appearing, gave moderate quantities of port wine, and in some cases plentiful draughts of bottled cyder. But I certainly found the greatest benefit from the liberal use of factitious air, which I applied in the following manner, viz. I took a narrow-necked jug, which held at least two quarts, and filled about half with chalk and water, mixed to about half the consistence



sistence of common whitewash; and raising the patient in bed, or setting him in a chair, if able, placed the jug under his head, and dropped in about half an ounce of oil of vitriol at a time, stirring and continuing it gradually for a quarter of an hour, or until it occasioned a little gentle irritation and cough; and this I repeated ten or twelve times in the day. If the patient was too weak to be raised, I mixed and stirred it in a larger open vessel, by the bed-side, till the agreeable smell of the effluvia was sensibly felt through the whole room; and I look upon this as a good prophylactic to the nurses and attendants.

WHEN I have been called in the first stage of the fever, I think, I have not once failed, by persevering in this method, of keeping off every putrid appearance through the whole course; and though, as you justly observe, it alters not the usual time of the crisis; nor has

R

it



it always prevented the fatal termination of fevers; yet the guarding against these dreadful putrid appearances is a very material point gained. But I have still something stronger to add; in some very recent cases, where I have not been called till the eleventh or twelfth day, after the patient had been above eight days delirious; with the black foul crust, foetid breath, total insensibility of stool, or urine, livid countenance, and almost every dreadful putrid appearance; by six hours unremitted application of these fumes, and sometimes washing the mouth with port wine, large sloughs have been cast off, frequently mixed with blood; the mouth and fauces rendered fresh as a rose, the breath perfectly sweet; and, in short, the putrescency totally vanquished. I assure you, dear Sir, I do not magnify, but am happy in having several full and living proofs to produce.

IN



IN these desperate cases, I make the effervescence as strong as the people in the room can agreeably or conveniently bear it, using frequently two or three pounds of the oil of vitriol in the day, which we buy here for seven-pence per pound; and, therefore, I never spare it to the poorest patients, whose sordid diet and habitations more especially require it."

J. ROTHERAM.

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### PREPARATIONS OF LEAD.

THOUGH I entertain a very high opinion of the usefulness of Saturnine preparations, externally applied, and frequently prescribe them; yet I am fully convinced that they *sometimes* produce the specific effects of lead upon the body. And I could wish that more attention were paid to the operation of such topical remedies, especially when applied to constitutions to which we are strangers.



There are indeed some habits which appear very little disposed to be affected by this mineral poison, of which I have given several examples in my *Observations and Experiments on Lead*, and can now add two others. The first was communicated to me by Mr Barker, surgeon in Bakewell; the second, by the late Dr. Small, an excellent philosopher, and a physician of great eminence at Birmingham.

Two smelters, who have worked *nineteen years* at the smelting mills, have constantly, during that time, roasted the cheese, and broiled the bacon, and other provisions which they used, on the hot pigs of lead, without the least apparent inconvenience. They are stout, healthy men, and have never experienced any pains in their bowels. And, as this method of dressing meat renders it remarkably sweet and palatable, Mr.

Barker



Barker could not prevail upon them to discontinue it.

A GENTLEMAN, who had been long troubled with the heart-burn, discovered, from repeated trials, that his malady was relieved by swallowing a large quantity of saliva. To increase this secretion, he chewed, many hours every day, a piece of lead, which being neither hard, friable, nor offensive to the palate, suited his purpose better than any other substance. This practice he continued many years, with great advantage, and without injury, in any respect, to his health.

BUT the same learned physician informed me, that he had seen three instances of the fatal effects of Goulard's Extract of Lead externally applied. Two of the cases were incipient white swellings; the third was a tumour of a more uncommon kind. Each of the patients



became paralytic, and two of them were convulsed several days before death. I lament that Dr. Small did not favour me, in his letter, with a more circumstantial relation of these cases; but his judgment and accuracy may be relied upon with confidence.

FROM the present universal use of the Saturnine Water of Goulard, it may be thought surprising that such melancholy examples as these do not more frequently occur. But this preparation happily contains so small a portion of lead, that it is capable, in the most irritable habits only, of producing its peculiar effects. An ounce phial, filled to the brim with the *Extractum Saturni*, weighed sixty-five grains and an half heavier than the same quantity of the vinegar with which it was prepared. A hundred drops of this Extract, the quantity usually mixed with a quart of rain-water, are about the fifth part of an ounce,



ounce, and may be supposed to suspend thirteen grains of lead, if no change be produced, by combination, in the specific gravity of the compound. Each ounce, therefore, of the vegeto-mineral water contains only four tenths of a grain of this metal.

THE *Aqua Saturnina*, employed in the following case, was strongly impregnated with lead, having an ounce of the Extract in every quart of water. On Thursday February 16, 1775, Mr. P——, a young man of a delicate habit of body, had a tea-kettle full of boiling water thrown upon his leg, by which the cuticle was separated from the knee to the toes. Oily applications were immediately used; but the pain and inflammation were so great the following day, as to require the assistance of the ingenious surgeon to whom I am indebted for this account. A gentle laxative was directed; the patient's leg and foot



were well washed every three hours with Goulard's Saturnine Water, and afterwards covered with linen soaked in the same lotion, and wetted with it from time to time. The relief obtained by these means encouraged the young man's friends to use the lotion in an immoderate quantity; for, in six days, no less than 7 quarts of water were consumed. On Wednesday night, the sixth from the first application of this remedy, the surgeon was called to his patient, and found him violently afflicted with the colic, trembling of his limbs, continual nausea, and frequent vomitings. He had been coſtive three days, and had neglected to take a purgative medicine preſcribed for him. It may be proper to point out the progreſs of theſe ſymptoms, as they ſeem to mark the gradual operation of the lead. On Monday the conſtipation commenced, and a ſlight tremor was perceived in the ſcalded limb: the tremor continued on Tueſday: on Wednesday



Wednesday the colic supervened, which grew extremely severe and alarming in the evening, and was aggravated by the sickness and reachings which accompanied it. Directions were given to discontinue the lotion; the *Ceratum Sambucinum*, spread upon linen, was applied to the parts affected, and the following draught was administered every four hours.

*R. Ol. Ricini V. O. Subact. 3fs.*

*Aq. Mentb. Pip. Simp. 3 i.*

*Tinct. Thebaicae gutt. vii.*

*Syr. e Meconio 3 i. M. F. haustus.*

SEVERAL motions were procured by the repetition of this draught; the complaints of the patient became more moderate; and the colic entirely ceased before the next evening. But a forenefs of the *abdomen* remained, and the body was left in a very irritable state. The scalded leg and foot, in eight days, were  
more



more healed, than is usual after such accidents, in three weeks, when unctuous remedies are employed.

I HAVE seen and examined the patient, whose case is here related, and can attest the faithfulness and accuracy of this account.

THE facts which I have now adduced, in conjunction with those contained in my treatise on the poison of lead, afforded a strong presumption, that Saturnine preparations, externally applied, are not so perfectly innocent as they are too generally asserted and believed to be. One positive proof, well authenticated, outweighs a thousand negative ones; especially when such positive evidence is acknowledged but rarely to occur. And I shall be happy in the idea of having done some service to the community, if I can excite more attention to the operation, and more caution in the use of these  
topical



topical remedies, which are deservedly esteemed, and universally employed. My design is not to disparage them, but only to recommend a just discrimination of their effects. Whenever tremors of the limbs, paralytic affections, costiveness, yellowness of the countenance, or pains in the bowels, succeed the application of any Saturnine composition, the use of it should be for a while suspended, or entirely discontinued; and the proper antidotes to the poison of lead should be sedulously administered. Thus will the danger be obviated on its first approach; and we shall not be reduced to the sorrow and disgrace of having cured an ulcer, a burn, or a contusion, by inflicting the most excruciating tortures, or perhaps at the expence of life.

It has been observed in the Medical Essays, published by a Society in Edinburgh; “that though opium produces  
 “such certain effects in the stomach,  
 “yet



“yet it is not clear, that it has any operation externally, even when applied to the bare nerves in a part excoriated by a blister.” This has been urged as an argument against the topically poisonous action of lead. But the observation is not founded in truth, and is contradicted by facts which daily occur in medical practice. For what physician is a stranger to the powers of opium when applied to the nerve of an aching tooth, or to the eyes in an *ophthalmia*?

DR. HEBERDEN remarks, in his very ingenious lectures on poisons, that lead affords a singular instance of a poison which only affects the nerves of motion: “tremblings, strong spasms, and palsies, are its usual consequences; but I apprehend it has been seldom or never found to injure the understanding, or to make the patient delirious, till he becomes so, as is common in most distempers, by the near approach of death.” I believe this observation,



tion, with respect to the human species, is as just as it is curious; but cats become frantic by swallowing lead.

I HAVE observed, that pestles and mortars, for the use of apothecaries and others, are made of the Burslem pottery. This must be attended with pernicious consequences; because the lead in the glazing will be dissolved by the acids, which are frequently employed in medicine; and the particles of it will be abraded by constant friction. Perhaps these particles may also be of such a size and sharpness, as to injure, by their mechanical action, the coats of the stomach; for the glazing is very unequally diffused over the surface of the coarser ware.

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### S M A L L P O X.

DR. HAYGARTH, to whom I communicated my *Tables of the comparative Mortality*



# 254 OBSERVATIONS, CASES,

*Mortality of the Small Pox, &c.* has adopted the plan, and pursued the same inquiry at Chester. The following tables will shew how exactly our observations coincide.

## C H E S T E R, 1774.

Total of deaths by the small pox, - - - 202.

Deaths by the small pox under one year old, 51.

*viz.*

	Males.	Females.
Under 1 month,	0.	0.
Between 1 and 2 months,	1.	1.
2 and 3,	1.	0.
3 and 6,	2.	2.
6 and 9,	12.	10.
9 and 12,	6.	16.
	—	—
Total	22.	29.

In the secondary fever of the small pox a *warm bath*, prepared of a decoction of chamomile leaves and flowers, with a proper quantity of butter-milk added to it, produces the happiest effects. It cleanses



cleanses the skin from the putrid *sordes* which covers it; softens the pustules; opens the pores; promotes perspiration; and proves highly refreshing to the patient.

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### POISON OF COPPER.

JOHN BERRY, aged three years, on Saturday, July 9th, 1774, swallowed an halfpenny. The succeeding day he had severe vomitings, and could retain nothing upon his stomach. As deglutition was performed with the utmost facility, and as the child was sensible of no uneasy irritation in the *œsophagus*, I concluded that the vomitings were owing to a solution of the copper in his stomach. A purgative was given him just before he went to sleep, but the greatest part of it was quickly rejected. The next morning he vomited a large quantity of a green coloured



coloured fluid, which had the smell of verdigrise. After this discharge the vomiting ceased; and his appetite being very voracious, he eat heartily of solid food. He used a good deal of violent exercise during the course of the day; and in the evening a clyster was injected. With the stool which followed it, the halfpenny was discharged, covered with verdigrise. The green mould of cheese may sometimes be produced by verdigrise. A lady, who is very fond of faded cheese, lately eat some which she thought had a peculiar and disagreeable taste. On cutting farther into the mouldy part, a pin was discovered in the centre of it. The salt contained in the cheese probably produced the verdigrise, by the solution of the surface of the pin (c).

(c) I cannot omit this opportunity of recommending to the reader, an attentive perusal of Dr. Falconer's very ingenious and useful Observations and Experiments on the Poison of Copper.

FATAL



FATAL EFFECTS OF YEW  
LEAVES.

ON Friday, March 25th, 1774, three children of James Buckley, a labouring man at Longfist, near Manchester, were killed by taking a small quantity of the fresh leaves of the yew tree, or *taxus officinalis* of Caspar Bauhin. The oldest child was five, the second four, and the youngest three years of age. They were all supposed to be affected with the worms; and this poison was given them, by the recommendation of some ignorant person, as a powerful remedy for that disorder. The *dried leaves* were first employed; and a spoonful of them, mixed with brown sugar, was divided into three equal doses, which the children took at seven o'clock in the morning. At eight, they had each a mess of pot-  
S tage,



tage, prepared of butter-milk, which, having been kept several days, was become very sour. No complaints were made by the children; nor did any bad effects ensue. Two days afterwards the mother collected *fresh leaves*, and administered them in the same dose, as before, and at the same hour. At eight o'clock the children breakfasted of nettle-pottage, that is, oatmeal gruel with fresh nettles boiled in it, a mess well known in this country. At nine, they began to be uneasy; were chilly and listless; yawned much; and frequently stretched out their limbs. The oldest vomited a little, and complained of gripings in his belly; but the others expressed no signs of pain. The second child died at ten o'clock; the youngest about one; and the oldest at three in the afternoon. No agonies accompanied their dissolution; no swelling of the *abdomen* ensued; and after death they had the appearance of being in a placid sleep. These particulars



lars I learned from the unfortunate parents of the children; whose ignorance led them too long and too fatally to rely on the trifling and inefficacious means of relief, suggested to them by their neighbours (*d*).

(*d*) BROOKES, in his Natural History, asserts, that the yew is not a poisonous tree, vol. VI. page 396.

CATIVULCUS, ~~king of the Eburones~~, destroyed himself by it, as appears from the following passage in Cæsar's Commentaries. *Cativulus Rex dimidiæ partis Eburonum, qui unà cum Ambiorige consilium inierat; ætate jam confectus, quum laborem aut belli aut fugæ ferre non posset; omnibus precibus detestatus Ambiorigem, qui ejus consilii auctor fuisset, TAXO, cujus magna in Galliâ Germaniâ-que copia est, se exanimavit. Comment. lib. 17. Sect. 29.*



AN EXTRA UTERINE FŒTUS,  
VOIDED BY STOOL, TWENTY-  
TWO YEARS AFTER PREGNAN-  
CY.

MRS. — of Row-Cross, near Mottram, July 1751, when in the sixth month of her pregnancy, and twenty-fourth year of her age, received a sudden fright, which occasioned a severe pain in her loins, and was soon succeeded by a flooding, but without a miscarriage. These symptoms were relieved by the medicines, then directed for her by an experienced and judicious surgeon. But the *abdomen* afterwards became much distended; and continued so about half a year, when it subsided all at once, whilst she was in a recumbent posture. Her *menfes* in a short time appeared, and  
returned



returned at the stated periods, with sufficient regularity; but they were always attended with violent pain. Milk also flowed from her breasts during several years. In 1757, she was afflicted with great flatulence, and often with hysterical fits. Her uterine discharges were become very putrid, and her health and strength seemed to be gradually impairing. She consulted me in May 1772; and received great benefit from an emetic, an infusion of the Peruvian bark, and from frequent doses of the acid elixir of vitriol. My advice was again desired in May 1773. At this time she laboured under the hæmorrhoids; complained of great pain in her loins, and about the *os sacrum*; had frequent flushings in her face, and was much troubled with sickness and thirst. The apothecary had taken eight ounces of blood from her arm, and had given her some aperient medicines. I directed leeches to the hæmorrhoidal veins; an electuary, com-



posed of the lenitive electuary and flowers of sulphur; an infusion of columbo root; and the following clyster, to be injected every night at bed-time.

R. *Ol. à Pedib. Bov.* 3 *iv.* *Tinct. Thebaic.*

*V. O. subact.* 3 *i.* *M. F. Enema.*

May 12th. SHE began this course of medicine.

13th. SHE discharged by the *anus* two bones of a child's head.

14th. SHE voided, in the same way, another bone of the head.

17th. SHE discharged the trunk of the body, wanting some of the *viscera*, of a female *fœtus*.

19th. SHE parted with a thigh bone.  
The



The patient was not afterwards sensible of any farther discharges of this nature.

June 7th. I saw her: her pains were then abated; her appetite was improved; and her strength seemed to be daily increasing. In this state of convalescence, she continued two months; and then, from some cause which the distance of her place of abode has yet prevented me from learning, she suddenly relapsed, and died in a few days.

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### THE RARITY OF THE AIR A CAUSE OF HÆMORRHAGES.

IN the second part of the sixty fourth volume of Philosophical Transactions, Dr. Darwen has favoured the public with several well conceived experiments, which afford a satisfactory proof, that



air does not exist in the fluids of the human body in an elastic state; or in such a state as to become elastic by any change, yet experienced, in the weight of the incumbent atmosphere. Hence he concludes, that the accounts of hæmoptoes, and other discharges of blood, from persons who have ascended high mountains, are either not to be depended upon, or to be ascribed to violent exercise, or to some other accidental cause.

THE relation of such hæmorrhages are too well authenticated, in my opinion, to admit of doubt or controversy; and they may be explained upon rational and philosophical principles. The pressure of the external air must be allowed to be a cause of resistance, to the propulsion of the blood, through the vascular system. If this pressure be diminished, and the action of the heart remain the same, it is obvious that the fluids will be propelled with greater force, and that the small  
vessels



vessels will be more distended by them. This effect we see partially produced by the cupping glass; which occasions a *plethora* in the vessels over which it is applied, by diminishing the resistance to the circulation of the blood through them. Upon the tops of high mountains the rarity of the air diminishes this resistance universally; but those vessels of the body will be most distended by the *vis à tergo*, which belonging to the tenderest organs, are least capable of resistance. Hence those of the lungs, nostrils, eyes, &c. are most liable to be ruptured.

HEAT is observed to distend the vessels, and to enlarge the bulk of the human body. This effect it produces, not by rarifying the air contained in the blood, but by its expansile power; and by its stimulus on the heart and arteries. All bodies are dilated by heat; and mercury.



cury, though freed from air, quicker than almost any other.

### ELECTRICITY.

WHEN the gout leaves the extremities, and invades other parts of the body, sinapisms, blisters, and volatile epithems, are often applied to the wrists or to the feet, to recal the disorder to its usual and natural seat. The same remedies are also employed to solicit the gout to the extremities, when it has yet made only irregular attacks on the system. Might not slight, or even severe shocks of electricity, be highly serviceable on such occasions? The stimulating applications, abovementioned, chiefly affect the skin; whereas the electrical stroke instantly pervades the tendons, articulations, and  
other



other internal parts, supposed to be the seat of this disorder.

IN palsies, proceeding from the recession of the gout, we should be less liable to disappointment in our expectations from electricity, when thus partially applied, than by the general shocks so indiscriminately given.

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#### A POISONOUS SPECIES OF MUSH-ROOM.

AUGUST 1772. ROBERT USHERWOOD, of Middleton, near Manchester, a strong healthy man, aged fifty years, early in the morning gathered and eat what he supposed to be a mushroom. He felt no symptoms of indisposition till five o'clock in the evening; when, being very thirsty, he drank near a quart of  
table



table-beer. Soon afterwards he became universally swollen; was sick; and in great agonies. A severe vomiting and purging succeeded, with violent cramps in his legs and thighs. He discharged several pieces of the *fungus*; but with little or no relief. His pains and evacuations continued, almost without intermission, till the next night; when he fell into a sound sleep, and awaked in the morning perfectly easy and free from complaint.

I HAVE sent to Mr. Hudson, author of the *Flora Anglica*, a species of *fungus*, which the poor man thinks exactly resembles what he swallowed. And it appears to this ingenious botanist to be the *Agaricus Clypeatus* Linn. Spec. Plant. pag. 1642; of which there is a good figure in Scheffer's *Icones Fungorum*.

COFFEE.



## C O F F E E.

OCTOBER 19th, 1774. A PHYSICIAN was affected with a severe head-ach, in consequence of having been disturbed in the night. At two o'clock in the afternoon he took eighteen drops of laudanum, and immediately afterwards, three dishes of very strong coffee. He lay down upon the bed, and endeavoured to compose himself to sleep. His pain abated in half an hour; and in an hour was entirely removed: but he felt not the least disposition to sleep, although he is often drowsy after dinner, and sometimes indulges himself in sleeping at that time.

November 1st. He repeated, on a similar occasion, the use of laudanum  
and



and coffee, in the like quantity as before. The effects were precisely the same; ease from pain, but no disposition to sleep.

November 16th. HE took eighteen drops of laudanum, when under the head-ach, but without coffee. The opiate composed him to sleep in an hour; but did not entirely remove the pain in his head. These facts confirm a remark which I have made in a former volume, that coffee is taken in large quantities, with peculiar propriety, by the Turks and Arabians, because it counteracts the narcotic effects of opium, to the use of which these nations are much addicted (*e*).

THE following curious and important observation is extracted from a letter with which I was honoured by Sir John Pringle, in April 1773. "On reading

(*e*) Volume second, page 128.



your section concerning coffee (*f*), one quality occurred to me which I had observed of that liquor, confirming what you have said of its sedative virtues. It is the best abater of the paroxysms of the periodic asthma, that I have seen. The coffee ought to be of the best Mocco, newly burnt, and made very strong immediately after grinding it. I have commonly ordered an ounce for one dish; which is to be repeated fresh after the interval of a quarter, or half an hour; and which I direct to be taken without milk or sugar. The medicine in general is mentioned by Musgrave, in his *Treatise de Arthritide anomala*; but I first heard of it from a physician of this place, who having once practised at Litchfield, had been informed by the old people of that place, that Sir John Floyer, during the latter year of his life kept free from, or at least lived easy

(*f*) Id. page 122.



under his asthma, from the use of very strong coffee. This discovery, it seems, he made after the publication of his book upon that disease." Since the receipt of this letter, I have frequently directed coffee in the asthma with great success.

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### WORMS DISCHARGED FROM THE LUNGS.

MR. JOSEPH HANFORTH of Stockport, aged forty-nine years, had been long troubled with a cough, and with a fullness and oppression at his breast. He frequently expectorated lumps of black, grumous blood; which gave him relief. In February 1774, the oppression increased, and in the night he discharged, by coughing, two masses, one



one of the size of a nutmeg, the other smaller. They were of the colour of chocolate. When the larger substance was opened, it was found to contain a considerable number of worms, like maggots, in a very lively state. His cough and expectoration still continue; but the oppression at his breast is not so troublesome; and the discharge of coagulated blood is less frequent. This patient's complaints were not attended with any hectic symptoms; and he is unable to give any account of the origin of them. The late Doctor Watson of Stockport saw, and examined the worms which he discharged. Schenkius, in his *Observationes Medicinales de Pulmonibus*, Lib. II. p. 249, relates a case somewhat similar to that of Mr. Hanforth. The reader may also consult Morgagni, Epist. XIX. Art. 41. Epist. XXI. Art. 43. *Lieutaud Hist. Anat. Med.* Vol. II. p. 46, Obs. 572; p. 79, Obs. 720.



## MILIARY FEVER.

THAT the miliary eruption is *frequently* fabricated by close rooms, heating remedies, and forced sweats, is a truth acknowledged by almost every modern practitioner; and the danger and absurdity of such a method of treatment, in every species of fever, cannot be too strongly enforced. But some very ingenious Physicians have supposed that the miliary fever, *invariably* and in *all instances*, is derived from the causes above recited; and they have flattered themselves and the public, that by a cooling and antiseptic regimen it may be banished entirely from the catalogue of diseases. This is an expectation which, I fear, experience will not warrant. Neither hot rooms, cardiac remedies, nor profuse sweating, produce at all times the miliary eruption; and I have seen it occur when the antiphlogistic regimen has been pursued



purfued to its full extent. Of this the following cafe, which I have felected from feveral others, affords a ftriking proof.

February 4th, 1770. MRS. L. aged 30, laboured under the ufual fymptoms of a *febricula* or flow fever, for which ſhe took faline draughts, antimonials, and yeſterday a cathartic, which operated five times. She had four fainting fits previous to this evacuation; and ſoon afterwards a miliary eruption, of the white and red kind, made its appearance on her breaſt, arms, and the trunk of her body. Her pulse, when I firſt ſaw her, beat 120 ſtrokes in a minute, and were extremely feeble; her heat was moderate; her tongue furred; her head painful; and ſhe laboured under a conſtant oppreſſion about the *præcordia*. Her houſe was in an elevated and airy ſituation; the weather was cold; ſhe lay in a large and well-ventilated chamber, at



a distance from the fire; and with no more bed cloaths than she used in health. The following medicine was directed.

R. *Sp. Mindereri Sescunciam*; *Elix. Pargoric. drachmas tres*; *Sp. Volat. Aromat. drachmam unam.*

M. *Sumantur Coch. ij. minima omni Sescuibora ex haustulo Seri Lactis Vinos. tenuis.*

IN a few hours I found her much relieved. She no longer complained of any oppression at her breast; her skin was moist; and her pulse fuller and slower. The miliary eruption was considerably increased; and her arms and hands were become stiff and swollen.

It is unnecessary to proceed with the detail of this case, which terminated in the recovery of the patient. The circumstances related fully evince that a miliary eruption may occur in a cold season



season of the year ; with a free access of air ; and under an antiphlogistic method of cure.

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### COLUMBO ROOT.

THE efficacy of the Columbo root in a variety of disorders, has now been experienced by the public ; and it affords me great satisfaction that I have been instrumental in exciting the attention of Physicians to a remedy of such acknowledged utility. But the high price which this root bears ; the general demand for it ; and the small quantity that remains of it in England, will occasion such adulteration of it as may prove very injurious to its reputation. Besides, the bitterness of the Columbo is much impaired by keeping ; it is liable to rot, and to become worm eaten ; and from these causes it may lose all its medicinal virtues.



## 278 OBSERVATIONS, CASES,

I have seen many specimens of it, which must fail, when administered, to answer the views of the prescriber. Whether we are likely to obtain any sufficient supplies of this remedy, I am uncertain. Applications have been made to the captains of several ships, bound to India; but our ignorance of the natural history of the root is a great obstacle to the acquisition of it. The practitioners of physic in the East Indies cannot, without danger, prosecute botanical researches in a climate where all nature swarms with life. And they employ the natives of the country to collect their simples; whose interest it is to conceal the manner of their production, and their place of growth. Mr. Ives, in his voyage to India, mentions the columbo root in the following terms, page 482. “*Radix Indicus Amarus*. This is the root of the *Cocculus Indicus*. When quite fresh it is an emetic; when dry a cathartic.” These characters are so opposite to the known qualities



qualities of the columbo root, that I apprehend Mr. Ives must be mistaken in his account of it. And I have desired Doctor Lind, of Haslar hospital, who is personally acquainted with that gentleman, to make farther enquiries of him concerning the *Cocculus Indicus*. The Doctor has executed my commission, with the most obliging and friendly attention. But he has not been able to obtain, either from Mr. Ives or Mr. Bogue, who had the charge of the naval hospital in India, and who is lately returned from thence, any satisfactory information.

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### ANGINA PECTORIS.

IN November 1773, I was desired to visit a gentleman near Knutsford, in Cheshire, aged upwards of fifty; who had been for several years subject to frequent attacks of a most alarming and op-



pressive sensation in his breast, which he knew not how to describe. This symptom was attended with a pain about the middle of the *sternum*, inclining to the left side; and he was generally affected, at the same time, with a pain in his left arm where the deltoid muscle is inserted. As I visited the patient only once, and took no notes of his case, I cannot give a minute detail of it, and must content myself with saying, that I apprehended his disorder to be what Dr. Heberden hath so accurately described under the name of *Angina Pectoris*. Various anodyne and antispasmodic remedies were prescribed; but these produced only a temporary alleviation of his complaints. And it was observed, that nothing afforded such instantaneous ease, during the paroxysms of his disorder, as venesection or vomiting. In July 1774, he died; and his body was examined by Mr. Allen, an ingenious surgeon in Knutsford,



ford, who has favoured me with the ensuing account of the dissection.

THE left lobe of the liver was considerably enlarged, and full of indurated, white, tumors; and nearly one half of the right lobe was beginning to be affected in a similar manner. The gall-bladder was distended with bile; the stomach was hard and schirrous, as far as it was in contact with the liver; the lungs were pale and livid; and the blood-vessels as distinct as if they had been injected with Prussian blue. The heart and *aorta descendens* were in a sound state; very little water was found in the pericardium, or mediastinum; and there was nothing preternatural in the appearance of the diaphragm.

THIS gentleman had lived freely, but was not subject to the gout.

DR. HEBERDEN has favoured me with  
the



the following remarks upon this case. "The dissection of this sufferer by the *angina pectoris*, as well as that of a few others, which I have heard of, teaches us, that the disease is neither owing to inflammation, nor to any mal-conformation of the parts. We must not therefore seek for the cure amongst the means which lower the *vis vitæ*; and we need not despair of finding it elsewhere. But we should not expect to find it very soon, when we consider how little success has attended all our searches after a remedy for the gout, and for some other distempers, with whose natures we have had, for some thousand years, such abundant means of being acquainted."

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#### SOLUTION OF WATER IN AIR.

AN eminent Philosopher informed me some time ago, that the solvent power

er



er of air on water, is a discovery of a much older date than is commonly supposed; and that it was well known to Dr. Edmund Halley, about the beginning of the present century. The following quotation, which I have extracted from the second volume of Lowthorp's abridgement of the Philosophical Transactions, will sufficiently evince the truth of this assertion.

“ VAPOURS being raised by warmth,  
 “ let us, for a first supposition, put, that  
 “ the whole surface of the whole globe  
 “ were all water very deep, or rather  
 “ that the whole body of the earth were  
 “ water, and that the sun had his di-  
 “ urnal course about it; I take it, that  
 “ it would follow, that the air of itself  
 “ would imbibe a certain quantity of a-  
 “ queous vapours, and retain them *like*  
 “ *salts dissolved in water*; that the sun  
 “ warming the air, and drawing a more  
 “ plentiful vapour from the water in the  
 “ day



“ day time, the air would sustain a great-  
 “ er proportion of vapours, as *warm wa-*  
 “ *ter will hold more dissolved salts*; which  
 “ upon the absence of the sun, in the  
 “ nights, would be all again discharged  
 “ in dews ; *analogous to the precipitation*  
*of salts on the cooling of liquors (g).*

---

### AFFECTIONS OF THE EYES.

MR. WARD, aged forty-eight years, formerly an Attorney, and a very studious man, has been gradually losing his eye-sight during twenty years; and is now capable only of distinguishing light from darkness. The pupils of his eyes are more dilated than is natural, in the dark; and they are contracted in an e-

(g) SEE Lowthorp's abridg. of Phil. Tran. vol. II. p. 127.



qual proportion in a strong light. *There* is a small speck or obscurity just discernible in the centre of the pupil of the left eye, like an incipient cataract, but insufficient to affect vision in a material degree. He has suffered no pain in his eyes; and can ascribe his blindness to no other cause, but close study and application. Can this disease be denominated a *gutta serena*? It seems to be seated in the *retina*; but from the ready contraction, and dilatation of the pupils, it should appear that the nerves are strongly affected by the stimulus of light, and yet are incapable of conveying to the mind the usual sensations produced by luminous objects. In palsies, such partial affections of the nerves sometimes occur.

THE Rev. Mr. S. of Rochdale informs me that the pupils of his eyes do not sensibly contract in the light, or dilate in the dark. And he observes that much  
more



more light is requisite to him for distinct vision, than to others, whose eyes are differently formed. In the dusk of the evening, when others see tolerably well, he can scarcely distinguish any objects. The pupils of his eyes are very small.

*Vicar of Ongar in Essex in the same  
situation from the same cause.*

### ASYLUM OR LOCK HOSPITAL.

AN asylum or lock hospital, for the reception of female patients labouring under the venereal disease, has been lately established at Manchester; and it is to be wished that so laudable an example may be followed in other places. To shew the utility of such institutions; and to obviate the objections which have been made to them, the following advertisements were written, and are prefixed to the two reports of the hospital above mentioned.

M A N-



MANCHESTER 1774.

WHOEVER reflects on the variety of diseases to which the human body is incident, will find with concern, that a considerable part of them are derived from immoderate passions and vicious indulgences. Sloth, intemperance, and irregular desires, are the great sources of evil, which contract the duration, and im-bitter the enjoyment of life. But humanity, whilst she mourns over the vices of mankind, incites us to alleviate the miseries which flow from them. The private hand of charity is never shut, when sickness complicated with poverty presents itself; and hospitals are established in every part of the kingdom, for the reception of the wretched, whether innocent or guilty.

A NEW institution founded on these  
benevolent



benevolent principles, consonant to sound policy, and favourable to the interests of virtue, now claims the attention, and encouragement of the public: the object of it is to provide relief for a loathsome and painful distemper, often fatal when neglected; but which admits of an almost certain cure, when the patient is under confinement, and subject to proper regulations. This asylum, it may reasonably be hoped, will withdraw from their haunts those wretches, who seduce unwary youth, contaminate them with disease, spread wide infection, and entail shame and misery on a feeble posterity. To the penitent sufferers it will afford a pleasing refuge, will give opportunity to confirm their wavering resolutions, and will restore them to health, to peace, and usefulness. Happy will the governors be in dismissing such with this benevolent injunction,

GO, AND SIN NO MORE.



1775.

THE public has been already informed of the nature and design of this excellent INSTITUTION; which is founded on the wisest *policy*, approved by *reason*, and recommended by *humanity*. It provides relief for a painful and loathsome distemper, which contaminates in its progress, the innocent as well as the guilty, and extends its baneful influence to future generations. It restores to virtue and religion those votaries whom pleasure has seduced, or villainy betrayed; and who now feel, by sad experience, that ruin, misery, and disgrace, are the WAGES of sin.—Over such objects, pity sheds the generous tear; austerity softens into forgiveness; and benevolence expands at the united pleas of frailty, penitence, and wretchedness.



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LONDON

Printed by J. B. Nichols, 1788



A LETTER TO DR. PERCIVAL  
FROM WILLIAM SAUNDERS,  
M. D. PHYSICIAN TO GUY'S  
HOSPITAL; CONCERNING THE  
SOLUTION OF STONES OF THE  
BLADDER BY FIXED AIR.

DEAR SIR.

I HAVE at last found leisure to com-  
ply with your request, that I should  
transmit to you an account of some im-  
portant discoveries and improvements  
which I have made in applying the use  
of fixed air, or more properly the me-  
phitic acid to the practice of medicine,  
and more especially for the purpose of  
dissolving the human calculus. The  
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this useful medicine, in pulmonic disorders, gangrenous sore throats, and malignant fevers, and it affords me no small pleasure, that my experiments have not only met with your approbation, but have been confirmed by your prosecuting the same subject with equal success, so as to put it out of all doubt that we are now in possession of a more efficacious and pleasant solvent for the human calculus, than any hitherto in use, and that it reaches the urinary passages in its full force communicating its solvent power to the urine. I shall hope likewise to make it appear, that it possesses every advantage over the lixivial and other boasted solvents now in use, it being salutary to the constitution and checking that tendency to putrefaction which is so prevalent in calculous habits, and which is so much increased by alkaline salts and the septic regimen, generally recommended along with them.

I WAS



I WAS first led to prosecute this subject from the following experiments of Dr. Hales, and which I have repeated with the same success.

“THOUGH I have not herein succeeded so far, as to encourage any one to attempt the dissolving therewith gravel-stones in the bladder: yet I thought it might not be improper to give an account of the small progress I had made herein; since it might possibly be a step towards the happy and important discovery, by exciting and engaging others in the same pursuit; who among the infinite variety of menstrums that may be compounded, may haply hit upon some, which may more easily dissolve most gravel-stones at least, if not the larger and harder *Calculi*. If we could make no farther advance than this, it would be of considerable benefit to mankind, by taking away, when it first falls into the

U 4

“ bladder,



“ bladder, the *Nucleus*, on which larger  
“ and harder stones are in time formed.  
“ And this would be effected, if with a  
“ few injections of a safe and proper  
“ menstruum, we could only dissolve a  
“ small part of a large gravel-stone, late-  
“ ly fallen from the kidneys, so as to  
“ make it fit to pass off through the  
“ *Urethra*; which it would also do with  
“ more ease to the patient, by having  
“ thereby its surface and sharper points  
“ softened and made mucilaginous, and  
“ stimulating. This is what the fer-  
“ menting mixture I am going to give  
“ an account of, will do on some of the  
“ softer stones, but not without too ma-  
“ ny repeated injections, to make it prac-  
“ ticable with safety to the patient.

“ THAT I might with the greater  
“ accuracy and readiness vary and adjust,  
“ as occasion required, the several pro-  
“ portions of the fermenting mixtures,  
“ I divided the capacity of several glass  
“ vessels,



“ vessels, out of which I poured the li-  
 “ quors, into cubic inches, making  
 “ marks with a file on the outside of the  
 “ glasses, at each division. I divided al-  
 “ so the capacity of a large tube into  
 “ quarter cubic inches; it was half inch  
 “ diameter, and sealed at one end. I  
 “ made also several divisions on a short  
 “ tube, which was quarter of an inch  
 “ diameter, the capacity of each division  
 “ containing ten drops of oil of sulphur;  
 “ so that by dipping one end of this  
 “ tube in liquor to any of these marks,  
 “ and then stopping the other end with  
 “ my finger, I could readily take up ten,  
 “ twenty, thirty, forty or fifty drops, or  
 “ any intermediate number.

“ I WILL now give a short account of  
 “ some of the principal experiments I  
 “ made; in doing of which I did not  
 “ confine myself to such mild mixtures,  
 “ as might probably not be injurious to  
 “ the bladder; but chose to begin with  
 “ the



“ the strongest fermenting mixtures, in  
 “ hopes that if I should find any of these  
 “ would dissolve the *Calculus*, by gradu-  
 “ ally weakening and lowering such mix-  
 “ ture, I might possibly bring it to such  
 “ a degree of mildness, as might make  
 “ it not injurious to the bladder, and  
 “ yet retain in some measure its dissolv-  
 “ ing quality. Or if I should not be so  
 “ happy as to succeed so far, yet I thought  
 “ it most probable, that I might find  
 “ dissolvents, among these stronger mix-  
 “ tures, which might at least give some  
 “ farther insight into the nature of the  
 “ *Calculus*.

## EXPERIMENT II.

“ I. A CUBIC inch of oil of vitriol,  
 “ and double its quantity of water, when  
 “ mixt together, made so hot a ferment,  
 “ that I could hardly bear to hold my  
 “ hand at the bottom of the bolthead;

“ yet



“ yet it had no effect on a piece of the  
“ hardest kind of *Calculus*. And it was  
“ the same when the heat and ferment was  
“ renewed by throwing in some filings of  
“ iron,

“ 2. THE like proportions of oil of vi-  
“ triol and water, with several kinds of  
“ powdered vitriolic stones or *Pyrites*,  
“ made violent ferments, but had no ef-  
“ fect on this very hard *Calculus*.

“ 3. IT was the same with oil of vi-  
“ triol, and other acid spirits, when pour-  
“ ed on several alkaline bodies, such as  
“ powdered *Belemnites*, *Asteria*, coral  
“ and oyster-shell, &c.

“ 4. BUT oil of vitriol mixed with  
“ unrectified spirit of C. C. though it  
“ would not dissolve the above-mention-  
“ ed very hard piece of *Calculus*, yet  
“ with ten or twelve fresh mixtures, it  
“ rotted and dissolved several pretty thick  
“ *Laminæ*, or cloves of other *Calculi*;  
“ which



“ which though not of so compact a texture as the other, yet were so hard, that I could not make any impression on them with my nail: but this was too pungent a mixture to give any hopes that the bladder can bear any degree of it.

“ 5. SPIRIT of rye-bread being found by chymists a dissolvent so powerful as to dissolve several kinds of stones and hard substances, and yet withal so mild, that it may with great safety be held in the hollow of the hand; I prepared a good quantity of it, both unrectified and rectified, and made it one in a great variety of briskly fermenting mixtures, in hopes that by thus putting its parts in a brisk motion, it might have made some impression on the *Calculus*, but it had none.

“ 6. I MADE a preparation of tartar of vitriol, by mixing one part of oil of



“ of vitriol, with twice its quantity of  
“ hot water, in which were pieces of  
“ *Calculus* and tartar; the *Calculus* emit-  
“ ted bubbles, but not the tartar: then  
“ I poured in gradually *Ol. Tart.* when  
“ both *Calculus* and tartar emitted for  
“ some minutes a great quantity of bub-  
“ bles. The tartar was also at once dis-  
“ solved, and the *Calculus* was very rot-  
“ ten and brittle, but it was not of the  
“ very hard kind; *Sal Tartar*, which is  
“ a fixt alkali, being less corrosive than  
“ spirit of harts-horn, which is a vola-  
“ tile alkali.

## EXPERIMENT. III.

“ I. I MADE a solution of it in  
“ water, in the proportion of an ounce  
“ of *Sal Tartar* to four of water; and  
“ made many brisk fermentations, with  
“ several portions of this alkaline mix-  
“ ture, by pouring in of the strongest  
“ acid



“ acid spirits, as spirit of nitre, spirit of  
“ salt, spirit and oil of vitriol, and oil  
“ of sulphur. I found oil of vitriol and  
“ oil of sulphur most effectual to my  
“ purpose; and of these two, I chose  
“ rather to make use of oil of sulphur  
“ than oil of vitriol, as being the purer  
“ acid of the two, and less noxious to  
“ animal bodies than oil of vitriol.

“ 2. I FOUND, after the mixture of a  
“ great variety of proportions of these  
“ liquors, that the following were the  
“ properest for my purpose, *viz.* one  
“ cubic inch of water, one third of a  
“ cubic inch of solution of *Sal Tartar*,  
“ and twenty-five, or sometimes thirty  
“ drops of oil of sulphur; also six cubic  
“ inches of water,  $\frac{3}{4}$  cub. of the solu-  
“ tion of *Sal Tartar*, and fifty drops of  
“ oil of sulphur.

“ 3. THESE proportions fermented  
“ briskly, and made air bubbles arise ve-

“ ry



“ ry fast from the *Calculi* for eight or  
“ ten minutes, as would also several o-  
“ ther proportions, though I did not find  
“ any so effectual as these, which after se-  
“ veral fresh affusions of them, would dis-  
“ solve some *Calculi* which were hard to  
“ the touch. They would also dissolve  
“ several gravel-stones, though not all;  
“ nor had they any effect on many of  
“ the hardest *Calculi*.

“ 4. IF air do not arise briskly from  
“ the *Calculus*, upon pouring on any of  
“ these mixtures, the rule to adjust the  
“ proportions accurately, is to drop in a  
“ few drops of oil of sulphur; if this  
“ addition make more air arise from the  
“ *Calculus*, it is a sign some of it was  
“ wanting; but if more air does not  
“ arise, then it is a sign that more solu-  
“ tion of *Sal Tartar* is wanting.”

“ 5. IT fermented best, when half  
“ the water was poured on the solution  
“ of



“ of *Sal Tartar*, and the spirit of sulphur  
“ was dropped into the other half, and  
“ then both mixtures poured together.  
“ Warm water was better than cold,  
“ though it fermented longer cold.

“ 6. WHEN there was a double quan-  
“ tity of oil of sulphur, I have not found  
“ it more powerful in dissolving; and  
“ when the solution of *Sal Tartar* was  
“ much stronger, the ferment was less.

“ 7. THE liquor has no effect on the  
“ *Calculus* after the ferment is over, as I  
“ have found by laying several *Calculi* to  
“ soak in it for a whole year. So that the  
“ effect it has on the *Calculus* while it is  
“ fermenting, seems not to depend on  
“ the fitness of the particles of the men-  
“ struum to enter the pores of the *Calcu-*  
“ *lus*, but rather on certain harmonic  
“ proportions between the vibrations of  
“ the fermented liquor, and the tone or  
“ degree of tenseness of the parts of the

“ *Calculus*:



“ *Calculus* : just as when two strings  
“ are equally tense, the striking of one  
“ will make the other sound ; or, as I  
“ have often observed, the different pipes  
“ of an organ will make different boards  
“ vibrate, according to the uniformity  
“ there is between the tenseness of the  
“ fibres of the several boards, and the  
“ tone of the different pipes.

“ 8. AND in like manner we may  
“ not unreasonably suppose, that when  
“ there is the like uniformity between  
“ the vibrations of the fermenting liquor,  
“ and those of the parts of the *Calculus* ;  
“ that the *Itus* and *Reditus* of these vi-  
“ brations increasing in this case each  
“ other's force, some parts of the *Calculus*  
“ are thereby thrown off into elastic air.  
“ In confirmation of this conjecture, I  
“ have observed air to arise briskly from  
“ a *Calculus* with twenty or ten drops of  
“ oil of sulphur ; and yet with fifteen  
“ drops little or no air arose, notwith-  
“ standing



“ standing the proportion of the other  
“ ingredients of the fermenting mixtures  
“ was the same in all three cases.

It sufficiently appears, from attending to these experiments, that the *Calculus* was dissolved during the effervescence from the application of the fixed air; for the solvent power ceased after the effervescence was over, and the neutral salt formed by the combination of the acid and alkali had no menstrual power. I was confirmed in this opinion by the two following experiments, which seem to me perfectly decisive upon that subject.

#### EXPERIMENT I.

TEN grains of a human *Calculus* were put into two ounces of distilled water, and after standing for some hours, there was found no diminution of its weight, and the water showed no precipitation

upon



upon the addition of a solution of silver in the nitrous acid, or of a very caustic alkali, prepared by Mr. Lane.

## EXPERIMENT II.

TEN grains of the same *Calculus* was added to two ounces of distilled water, saturated with fixed air; it lost three grains of its weight, and there was a precipitation upon the addition of the caustic alkali.

THIS last experiment has been repeated upon different *Calculi*, and they have been always found dissolved in a greater or smaller proportion, admitting of that variety which might be expected in the solubility.

THESE two experiments are sufficient to prove the solubility of the human *Calculus* in the mephitic acid, and, to-



gether with such as you have made, ought to rouse and excite the industry of medical people to a subject that promises such singular advantages to mankind.

DR. HALES, whose candour and judgment in conducting experimental enquiries cannot be too much admired, was entirely ignorant of the chemical properties of fixed air, and its effects, in combination or mixture with other bodies. I was encouraged in favouring the opinion, of its possessing a very universal solvent power, from the experiments of Mr. Cavendish and Mr. Lane, and from its appearing, when pure and separate, in a permanent state of elastic vapour, and its readiness to return to that form from its state of mixture, confirmed me more in this opinion; it being a general principle in chemistry, that the power of solution and mutual combination, is greatly assisted by the bodies employed  
being



being made to assume the state of vapour. The very ingenious experiments of Mr. Bewly, as related in Dr. Priestley's second volume on air, have thrown much light upon the chemical history of this body, and have put it beyond all doubt, that it is an acid of a particular kind, possessing a weaker attraction to alkalis, calcareous earths, magnesia, and other bodies, than any other acid; and that, therefore, in common with other acids, it loses its solvent power in mixture or combination with other bodies. It was necessary to make this observation, in order to explain, why caustic alkalies and quick-lime lose their active powers in combination with this acid; and that, therefore, mild alkalies and calcareous earths ought rather to be considered as, in some degree, in a state of neutrality with this acid, whose power of attraction is so weak, and whose tendency to resume its proper elastic form is so great, that it does not totally destroy



the distinct and original properties of alkalies, or earths, with which it is united. I was much pleased with my success on this subject, because I had discovered, from various chemical trials, on the human calculus, and the urine of persons labouring under that disease, that there was a diversity in the nature and properties of their component elementary parts, and that the strongest lixivium was insufficient to dissolve some calculi, which readily yielded to the application of fixed air. Of this fact I was particularly informed by my friend Mr. Lane, who has directed the public to the best method of preparing the lixivial solvent, and who has likewise engaged his attention to many useful and ingenious inquiries upon this subject.

It appears, from your experiments, that you found fixed air a very universal menstruum for the human calculus; from which I am disposed to think, that you  
have



have not extended your experiments to that variety which may afterwards occur. I am persuaded, that in all human calculi there is a very large proportion of animal mucus, and more particularly in those of a laminated structure; while such as put on a more shining chrystalline form contain a larger proportion of saline and earthy matter.

It is impossible to determine absolutely in what cases one solvent should be preferred to another, until the urine and its contents have been properly examined; and as it is sufficiently proved by your own observations, that fixed air is conveyed by the powers of circulation unchanged to the bladder, impregnates the urine, and communicates to it its solvent power, we may reasonably conclude, that when the urine of a particular person impregnated with fixed air, does not deposit its terrestrial parts, or, when it has deposited them, the fixed air can be



made to redissolve them, the mephitic solvent is best adapted to such a constitution. If on the other hand, such be the nature of the *Calculus* concretions, that they consist chiefly of earthy matter laminated and cemented by animal mucilage, the lixivial solvent will exert a more powerful operation in softening and destroying the cohesion of the *Calculus* in such a manner as sometimes to promote the separation of its parts, and thereby facilitate its evacuation.

I AM confirmed in this opinion from having found by experiment, that the mucus which is discharged so plentifully by calculous patients, is readily soluble in the caustic lixivium, and that in attempting to dissolve the human *Calculus* in the same lixivium, I generally perceived that it was rendered softer, and its texture discharged without any diminution of its earthy parts. I think it highly probable that advantages might arise from alternating



ternating the use of various solvents, and that after sufficient trials have been made by the lixivial solvents, in many cases the mephitic acid might be employed with additional advantages, the former diminishing the cohesion, and thereby facilitating the menstrual power of the latter.

THIS method of prescribing will obviate the objections which might arise from their being taken at the same time, because they enter into that union with one another, as to diminish, if not perfectly to destroy their powers of solution. If a more powerful and active solvent than any hitherto known shall be discovered, it is highly probable that such a discovery can only be made by a rational and chymical inquiry into the powers of different bodies of combining with the contents of the urine, and preserving them in a fluid state out of the body. It is well known that all the empirical  
remedies



remedies now in use, and recommended for dissolving the human *Calculus*, are alkalis rendered more or less caustic by a combination with quicklime, and that in order to disguise them, they are variously impregnated with bitter and other vegetable substances, and variously tintured and coloured by different bodies, which can communicate to them no additional powers. To some an opiate is added, to take off that irritation which lixivial medicines produce in the urinary passages. The lixivial remedies employed for dissolving the human *Calculus* are extremely destructive to some constitutions. There are instances of their having produced the most putrid diseases, and increasing a disposition to scorbutic complaints.

THEY sometimes bring on the most dangerous hæmorrhages, and the regimen employed, being chiefly animal diet; the putrescent state of the fluids is thereby greatly increased



increased. I have likewise frequently observed so much irritation and pain, as to produce considerable inflammation in the bladder by the same means, If therefore future trials with the mephitic acid shall meet with the same success experienced both by you and myself, it ought to be very generally preferred, because the regimen best adapted to assist its operation is of the vegetable kind, and the free use of wine and fruits, the most powerful antiseptics may be at the same time admitted in the form of diet; besides it appears from Dr. Macbride's experiments, that the mephitic acid itself is the most powerful remedy in putrid and scorbutic disorders, and may therefore be employed with the greatest advantage in restoring a patient to perfect health, who may have suffered by persevering in the use of the lixivium.

It now remains, that I should say somewhat on the best method of prescribing



scribing this useful remedy. In the first place, the patient should be directed to prefer the use of such water as contains it in the largest quantity, such as Bristol water, Seltzer water, Rathbone place water; and as it cannot be difficult to find water of this kind in most places, it should be made one chief article of their diet. All hard water which becomes softer by being exposed to the air or even by boiling, and deposits a calcareous earth is of this kind, and the acidulæ of all countries have been considered as the most powerful lithontriptics.

AT Chiselmhurst, in Kent, on the estate of Lord Camden, there is a large spring of water which contains a very large proportion of fixed air, it is very hard when immediately taken from the spring, it however becomes soft by being long exposed to the air, so as to dissolve soap for the purpose of washing, and is employed and preferred for all culinary purposes,

its



its power of dissolving marble and other stony matters is so great, that it cannot be confined in vessels of these materials. It has been found, on repeated trials, that it acted upon the human *Calculus*; I should therefore recommend the use of this or any similar water in preference to any other. Of these material facts I was particularly informed by his Lordship. The skilful Physician may suggest a great variety of forms in which this salutary acid may be introduced. The most eligible manner of prescribing it is by impregnating water with it in the manner recommended by Dr. Nooth, with his apparatus improved by Mr. Parker of Fleet Street. Saline draughts may be taken in their state of effervescence, and it may be still more agreeably prescribed in the form of brisk vinous liquors, such as Champagne, Perry and the like.

I wish it however to be understood that the united observations of many practitioners



tioners on its internal use are still necessary to establish a very universal solvent of *Calculi* in the human bladder, and I give my consent to the publication of this letter, more with a view of exciting a general inquiry into the powers of a probable remedy, than of confidently boasting of the superior efficacy of this acid, as established by pathological observations; at the same time some cases have occurred, which might lead to the most favourable opinion of its efficacy, but I rather choose to postpone the publication of these till its virtues shall be better ascertained by farther trials, fully sensible of the fallacy and difficulty attending observations made, and conclusions drawn from a few cases.

WE shall be usefully employed if by a rational inquiry of this kind, we can extricate the present practice, in such cases, from the hands of empirics, and prevent a deluded public from blindly con-  
fiding



DR. SAUNDERS.

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finding in the boasted remedies or *nostrums* on this subject, all of which, so far as I have examined by analysis, are the lixivium in disguise; a medicine, in my opinion, very unfriendly to the constitution, by destroying acidity, and, probably proving septic to the body by neutralizing fixed air, and entering into mixture with it.

*I am,*

DEAR SIR,

*With much Esteem and Affection,*

*Your most obliged,*

*and humble Servant,*

Jeffries Square,  
St. Mary Axe,  
LONDON,  
Feb. 1. 1776.

WILLIAM SAUNDERS.



A SECOND LETTER FROM DR.  
SAUNDERS TO DR. PERCIVAL,  
ON THE PREPARATIONS OF LEAD,  
AND OTHER CHEMICAL SUB-  
JECTS.

DEAR SIR,

**B**EING informed that you are preparing for the press, a Volume of Essays on philosophical and medical subjects on the same plan with those already published, I am happy in this opportunity of communicating to you, a few striking facts and experiments on some of the preparations of lead, a subject which has already engaged your attention. Much has been written on the efficacy of the preparations of lead, on external application, and their operation  
and



and effects are so well understood by surgeons, that little remains to be said upon this subject; it being however generally admitted, that the *Acetum Lythargyrites* or Goulard's extract is in its operation and powers the same as the *Saccharum Saturni*; I am desirous of correcting this popular error, by explaining the difference between these two preparations.

METALLIC bodies acquire their causticity by an union with acids, with which they enter into a state of mixture; the activity is proportioned to the quantity of acid and the degree of solubility in the metallic salt. The variety in this respect in some metallic salts is so great, even where the acid in combination is the same, that the causticity acquired by a moderate proportion of metal is almost destroyed, when a larger proportion is added: This is illustrated by attending to the difference between corrosive sublimate and calomel, which are both preparations

Y



parations of mercury with the same acid. This reasoning will apply to the subject of lead.

IN the preparation of the *Acetum Lythargyrites*, the acid is fully saturated with lead; in the preparation of the *saccharum saturni*, the acid is in a much larger proportion to the lead. The *Acetum Lythargyrites*, when diluted by the purest distilled water, gives out a copious precipitation which, from experiment, I find to be Cerusse. The *Saccharum Saturni* remains dissolved in distilled water, and is therefore applied topically in a state more immediately active, both from its greater proportion of acid, and its preserving its solubility under high degrees of dilution. I find from experiment that, by adding a very small proportion of distilled vinegar to the *Aqua Saturnina* of Goulard, the white precipitate is redissolved, and that the solution procured in this manner is more active, but



but less adapted to remove inflammation, and abate irritation, as a sedative, than the *Aqua Saturnina* itself. I was first led to apply to this subject from an aversion to the use of turbid liquors, especially when the precipitation is produced by the pharmaceutical treatment of chymical mixtures. I am, however, perfectly convinced, that no degree of dilution of *Saccharum Saturni* will answer the many valuable purposes to be obtained from the use of the *Acetum Lythargyrites*. In the operation of medicines on the human body, a slow and gradual action is often to be desired, in preference to a more immediate operation from the same remedy applied in a more soluble form. It is upon the same principle that the *Flores Zinci*, when diffused in water, in many cases, produce a better effect than a solution of the *Vitriolic Album* in any state of dilution, and that the *Kermes Mineral*, and some other preparations of antimony of a slow solubility, produce



a more lasting operation, and possess more powers than even the *Tartar Emetic*, except in such cases where immediate and active evacuations are required, as in the beginning of fevers and acute diseases. Water alone therefore in the case of the *Aqua Saturnina* proves a precipitant of lead by attracting the acid, and reducing the preparation to a state of Cerusse, an intermediate state between Lead and the *Saccharum Saturni*, so that Cerusse diffused in water more nearly resembles the *Aqua Saturnina* of Goulard, than a solution of the *Saccharum Saturni* does. There is however an advantage in external application from the use of powdery bodies, in their state of precipitation, because they are in a more subtle form than any body can be rendered by mechanical triture. I have sometimes been of opinion, that various chemical mixtures are formed by the union of the same metal in its application to different proportions of the same acid, and that *Calomel*

may



may be considered as the union of Mercury with *Corrosive Sublimate*, in which the acid was so much attracted and engaged, that it entered into a very imperfect union with the additional quantity of Mercury in *Calomel*; and that therefore the Mercury employed which produces *Calomel*, diminishes the activity of *Corrosive Sublimate* without acquiring solubility itself, and without losing much of its own phlogiston; hence the precipitates from *Calomel* and *Corrosive Sublimate* by alkaline substances differ so essentially in their nature. In the same manner the *Saccharum Saturni* may be considered as a union of *Cerusse* with *Vinegar*, whereas Goulard's *Acetum Lythargyrites* is a union of *Lead* with *Vinegar*.

To the same principle may be referred the power of fixed air in re-dissolving calcareous matter, after it had proved, in a smaller proportion, a precipitant for quick-lime. So that although chalk



may be considered as a combination of quick-lime and fixed air; calcareous matter dissolved in water by fixed air is a union of chalk and fixed air. We even find that although quick-lime attracts fixed air stronger than the caustic fixed alkali; yet the caustic fixed alkali attracts fixed air more strongly than chalk does, and therefore precipitates chalk held in a state of solution by fixed air. This will probably best explain why the caustic alkali should prove a precipitant of calculous matter dissolved in the mephitic acid. I have mentioned those facts with a view to illustrate that it is a principle in chymistry, that various mixts are formed from the combination of two bodies in different proportions to one another. It is upon a similar principle that metallic salts are rendered less active by abstracting their acid, either by attraction or calcination. An attention to these circumstances derived from a knowledge of the chymical history of bodies may lead to  
some



some future improvements in the pharmaceutical treatment of many valuable remedies, and enable us to render chymical preparations more or less active, or more or less soluble, as the indications of cure may seem to require.

alkali; yet the caustic fixed alkali attacks fixed air more strongly than chalk does, and therefore precipitates chalk held in a state of solution by fixed air. This will probably best explain why the caustic alkali should prove a precipitant of calculeous matter dissolved in the mephitic acid. I have mentioned those facts with a view to illustrate that it is a principle in chymistry, that various mixts are formed from the combination of two bodies in different proportions to one another. It is upon a similar principle that metallic salts are rendered less active by abstracting their acid, either by attraction or calcination. An attention to these circumstances derived from a knowledge of the history of bodies may lead to

some



331 EXPERIMENTS, &c.

Logwood, were boiled during ten minutes, in half a pint of pure river water;

EXPERIMENTS ON DYING BLACK,  
BY MR. JAMES CLEGG, OF RED-  
DIVALES, NEAR BURY. IN A  
LETTER TO DR PERCIVAL.

DEAR SIR,

**L**IME having been proved to increase the solvent power of water, upon astringent vegetables, for medical purposes, I was desirous of knowing if it would be equally useful in the art of dying black; to this end I made the following experiments.

EXPERIMENT I.

FOUR penny-weights of each of the following astringents ; viz. Galls, Sumach, Oak Bark, Bistort Root, and Logwood,



Logwood, were boiled during ten minutes, in half a pint of pure river water; upon mixing the decoctions with a saturated solution of martial vitriol, in the proportion of  $\frac{1}{3}$  of the solution to  $\frac{2}{3}$  of the decoction, they struck colours differently inclining to blackness, in the following order; *viz.* Oak Bark, Bistort Root, Sumach, Galls. I then boiled the same weight of all the astringents, in the same quantity of lime-water; and upon mixing them as above, the colours they produced were inferior to those with plain water, the astringency of the logwood, or whatever gives it the property of striking black with green vitriol, was entirely destroyed; it produced not the least blackness with any quantity of vitriol.

## EXPERIMENT I.

Logwood, Oak Bark, Bistort Root, and Galls, *viz.* following astringents; each of the FOUR penny-weights of the

EXPE-



## EXPERIMENT II.

FOUR penny-weights of each of the astringents above-mentioned, were triturated in plain water, and four others in lime-water; the measures of water used were equal to those left, after boiling, in the last experiment; and, upon being mixed with martial vitriol as in the last experiment, the colours produced, by this means, were superior to those produced by boiling. Those triturated in lime-water were judged to be the deepest, which agrees with Mr. Henry's experiments; but we must again except the Logwood, which gave no colour by trituration, more than by boiling in lime-water.

EXPE-



## EXPERIMENT III.

ALL the above mixtures, having been written with as inks, and exposed six months to the air; those boiled in lime-water had faded much; those triturated in lime-water, and in plain water, had faded a little; those boiled in plain water evidently preserved their colour best.

UPON slightly rubbing the faded writing, with a fresh astringent liquor, they recovered their original blackness; by which it appears, that it was the astringent parts of those Inks which had faded.

Does it not appear, by these experiments, that, though lime-water tends to deepen the colour produced by some astringents and martial vitriol, it by no means adds to the duration of those colours;



lours ; and as lime-water, either by trituration or coction, entirely destroys the property, in logwood, of striking black with martial vitriol, it can by no means be of service, in the black dye, where logwood is a material ingredient.

Does it not also appear, that a slight boiling is preferable to trituration, for the purposes of dying, when a durable colour is wanting.

HAVING observed a solution of iron, in a *vegetable* acid, struck a deeper black, upon mixture with an astringent, and produced its effect much more expeditiously, than a stronger solution of martial vitriol ; it occurred to me, that the iron, being more slightly combined with the vegetable acid, than with the vitriolic, made it more easy, for the astringent matter to decompose the former, and produce an ink ; if this was the case, I suspected, that lime-water deepened the colour



lour of astringent and chalybeate mixtures, not so much by its action upon the astringent, as upon the chalybeate, the lime uniting with the superabundant acid, and leaving the iron, with so much of the acid, as is necessary for the formation of an ink, to be more easily attacked by the astringent matter of the vegetable.

BUT if this theory was well founded, it followed, from analogy, that any substance, which had a greater affinity with the vitriolic acid than iron had, would produce the same effect, in some degree, as lime. To determine this :

#### EXPERIMENT IV.

I TOOK two vessels, containing equal measures of a strong astringent liquor, composed of galls and logwood ; into one vessel I put a small quantity of pearl ash-

es ;



es; the other remained as a standard. Pieces of linen and cotton cloth, after maceration in these liquors, were thrown together into a strong solution of copper-as; they were soon after taken out, and washed in cold water; when dry, the pieces prepared in ashes were, all of them, much deeper than the others.

I MADE use of different kinds of pearl and pot ashes, as well as many kinds of astringents; the ashes had the same effect, whatever astringent was made use of, and the strongest alkali always produced the deepest colour; and though ashes, used with an astringent, always gave a deeper black, than the same astringent without ashes, yet logwood, which without ashes gave not so deep a colour as galls with them, gave a much deeper black than galls with the same addition.

THERE was a remarkable difference, in this case, betwixt lime and ashes, in their effect



effect upon logwood; with lime it gave no blackness, but with ashes it produced a deeper black, than any other astringent I made use of.

BEING desirous of trying the duration of colours, produced by astringents, in which different quantities of pearl ashes had been dissolved;

## EXPERIMENT V.

IN two pints of river water, I boiled one ounce of logwood, during ten minutes; I then added half an ounce of Aleppo galls, and boiled them together ten minutes longer; the liquor having stood to cool, was decanted off, and divided into six equal quantities. No. 1 remained as a standard; into No. 2 I put six grains of fine pearl ashes; No. 3 twelve grains; No. 4 eighteen grains; No. 5 twenty-four grains; No. 6 thirty grains;

to



to fix drops of each of these liquors, I added two drops of a saturated solution of copperas; No. 2 and 3 struck a deep black; No. 1 and 4 black, but inferior to 2 and 3; No. 5 a brown black, No. 6 brown.

FROM this experiment it appears, that No. 5 and 6 were spoiled by an over proportion of ashes. Before I had the pleasure of seeing your experiments, wherein you demonstrate, that a quantity of acid enters into the composition of ink, I imagined the alkali decomposed the copperas too suddenly, and disengaged the iron faster, than the astringent matter could unite with it.

BUT, most probably, the alkali neutralized too great a portion of the acid.

ALL these writings having been now exposed six months to the air, in No. 5  
and



and 6 the blackness is quite destroyed,  
No. 4 is something faded, No. 1, 2, 3,  
remain nearly as they were, No. 2 and  
3 being still superior to the standard.

*I am,*

DEAR SIR,

*Your most obliged,*

*humble Servant,*

REDIVALLS,  
May 18, 1773.

JAMES CLEGG.



PROPOSALS FOR ESTABLISHING  
MORE COMPREHENSIVE AND ACCU-  
RATE PARISH REGISTERS, COM-  
MUNICATED TO DR. PERCIVAL BY  
THE REV. MR. DADE.

**R**ALPH BIGLAND, Esqr. Norroy  
King at Arms, observes, in his  
pamphlet published a few years ago, that  
“ the necessity of proper records for as-  
“ certaining the marriages, births, bap-  
“ tisms, deaths and burials of persons  
“ within their respective parishes, is  
“ abundantly evident from a transient  
“ view of our antient history, which for  
“ want of proper names, and real dates  
“ and family connexions occasionally to  
“ be referred to, is often times rendered  
“ perplexed and unintelligible, and some-  
“ times altogether inconsistent even with  
“ its own chronology.”

To



To remove this defect, Thomas Cromwell, afterwards Earl of Essex, being the King's Vicar General, in the year 1538 issued out an order to the clergy throughout England, that in their respective parishes a public register should be kept for the above purposes. How far the intentions of that Minister of State are really answered, is evident from the incorrect manner in which entries are too generally made. It has been long wished that the utility of parish registers was thoroughly investigated, that the defects in making the entries were pointed out, and such a plan laid down as might not only be useful, but easily applied to practice.

WHETHER the present form, with the observations upon it, contributes to elucidate any of these points, the public will easily determine.

EACH page is divided into six columns; *the first*, in the register for baptisms, con-



tains in large characters the christian name: in the *second column* is the surname and seniority of the infant, also in large characters. The utility of this disposition will appear to any person who has examined parish registers with a degree of accuracy. Lest the object of our enquiry should escape us, how frequently are we obliged to undergo the toil of traversing every line in each page, written perhaps in small characters, improperly spelt, and in a hand sometimes scarcely legible; whereas according to the present form, the reader will be able, with one glance of an eye, to run over the several names in each page; and will examine in a few minutes, what otherwise would take several hours to accomplish.

IN the present form it is hoped that care has been taken to identify the persons: for when we are told that Robert Lutton, James Creyke, and Elizabeth Dealtrey were baptized; or that William

Strickland,



Strickland, Mary Strangways and Richard Heblethwayte, were buried on such a day, in a succession of years, how shall we inform ourselves whether the parties were infants, adult, or aged, married or single, of what profession, or how they stood related; circumstances we are too apt, at the time of recording those particulars, to think of no moment, because their consequences are remote. Nor are our inquiries more gratified in finding John son of William Fairfax, Mary daughter of Thomas Beckwith, and James son of Robert Anderson, baptized; or Mr. John Grimston, Mrs. Jane Turner, and James son of William Fountaine were buried on such a day. Was there no necessity for carrying our researches further than twenty or thirty years, the defect might be supplied by the testimony of living witnesses, though perhaps even then not without much trouble and inconvenience; but where it happens that the occurrences are not



recent, and there are no collateral circumstances to assist us in identifying the parties, we must naturally be left in the dark. A gentleman in the West-Riding of Yorkshire, some years ago, felt the full weight of this defect. Being desirous of forming a genealogical account of his family, he applied to the register of the parish, and though he collected nearly 100 baptisms, and as many burials in the last century, there was not one circumstance that would enable him to digest them into any form, and to ascertain the respective branch to which each party belonged. Where families of the same name reside within the same parish, there will arise difficulties in proportion, and after the expiration of half a century it will be impossible to distinguish the descendants of one house from those of another. There lived some years ago, in the neighbourhood of Thirsk, three respectable families, nearly allied, of the name of Kitchingman, and on examining the  
the



the parish register, I find it verifies my assertion.

MR. BIGLAND had his eye upon these defects, when he observes, “ it is of importance to every family, not excepting the least considerable, to pay some regard to their pedigrees, and consequently that every circumstance, whether of a public or private nature, that tends to illustrate genealogical intelligence, should be attended to with the most religious exactness.”

LET us then view the last mentioned names, registered according to the form, at the end of these remarks. With the addition of collateral circumstances we shall easily distinguish the object of pursuit, whether it may regard the title of our property, or only the gratification of an enquiry natural to those who are desirous of knowing whence they are descended. We have therefore allotted the



*third column* to the name, profession, and descent of the father, and the fourth to the name and descent of the mother, the particulars of which may easily be collected when the infant is baptized. Thus shall we hope, on trials of titles to estates, and genealogical enquiries, to raise a fund of intelligence to the industrious antiquary as well as the gentlemen of the law, and perhaps they may allow this scheme to bid the fairest for supplying the place of visitations or inquiries *post mortem*.

THE *fifth column* shews the birth, and the *sixth* the baptism of the infant; the entry of each being essentially necessary. When the age bears date from the baptism only, the child may become subject to great inconvenience. Let us illustrate this suggestion.

A PERSON leaves 5000 l to a distant relation in case his son should die in his minority.



minority. It seems, from the remembrance of creditable neighbours, that the child was certainly born a fortnight before baptism, that he married in his minority, and died a week under age according to the date of the baptism, being survived by his wife and an infant son. The parents and witnesses of the birth being dead, and no particulars found sufficient to ascertain the precise day of his birth, the entry of the baptism is admitted as evidence, and the distant relation possesses the fortune, to the great prejudice of a poor relict and her helpless child.

IN parishes of vast extent, where families dwell at a great distance from the church, the winter floods and other accidents frequently delaying the baptism of the infant, it is not uncommon to see children brought to the font at three, four, and six months old; nay upon the moors, and in other remote parts, we  
have



have instances of children receiving baptism aged almost as many years: a most essential reason this, why the birth of infants should be carefully registered as well as the day of baptism. For it should be considered, that under the age of twenty-one years, a person cannot marry without consent of parents or guardians, take his freedom in any corporation, vote at an election, be a Representative in Parliament, or, in short, fill many important offices in society: and may it not happen from a concurrence of circumstances, that persons really of that age may be deprived of such benefits and lose some great and valuable privileges? If then the entry of the birth, as well as baptism, will be admitted as evidence, and effectually prevent such ill consequences, what pity it is that the birth is so frequently omitted; It is somewhat remarkable that a gentleman who was almost the first person that did me the favour to inspect the present form,  
and



and whose family is distinguished for ancient residence upon their property in the neighbourhood, told me that his baptism was registered at O——, but that after the strictest enquiries he never could be informed *when* he was born.

WHAT has been observed on the page for baptisms, will serve to illustrate that for the burials: and as an affection for the memory of those we loved prompts us to a desire of mingling our ashes with theirs, I have been particular in ascertaining the place of interment.

I HAVE only to add, that the uniformity of the page has been consulted, and that the *two last columns* in the register of burials are intended to distinguish places remarkable for longevity or the reverse, and to acquaint us what disorders mankind is subject to under particular seasons and climates; the use of which  
information



information is sufficiently evinced by Doctor Percival of Manchester.

SHOULD this form meet with the approbation of the public, I can claim no other merit than having improved upon a hint given to the community in the year 1715 by Mr. Thoresby, the ingenious author of *Ducatus Leodienfis*, or, the *Topography of Leeds*, as proposed to him by an eminent Antiquary, Thomas Kirke, Esq. of Cookbridge, near to that town.

WILLIAM DADE.



# BAPTISMS AT ST. MARY'S CASTLEGATE, YORK, FOR THE YEAR 1774.

## PROPOSALS.

351

Infant's Christian Name.	Infant's Surname and Seniority.	Father's Name, Profession, and Descent.	Mother's Name and Descent.	Born.	Baptized.
JOHN	FAIRFAX, First born of	William Fairfax, of Steeton, Esq. 3d son of Sir William Fairfax of Denton, Knight. By Mary, eldest daughter of Hugh Cholmley of Whitby, Esquire.	Mary, only daughter of Sir Walter Bethell, of Ellerton, Knight. By Jane, daughter and coheirs of William Sotheby, of Birdfall, Esq.	On Monday the 24th of January.	On Sunday the 30th of January.
MARY	BECKWITH, Second daughter of	Thomas Beckwith, counsellor at law, on Friar Wall, only son of the late Roger Beckwith of Ripon, Gent. By Jane his second wife, daughter of John Hungate, of Saxton, Esq.	Margaret, daughter and heirs of John Darley, of Buttercramb, Esq. By Frances his first wife, daughter of John Milner, of Tadcaster, Esq.	On Saturday the 22d of January.	On Wednesday the 16th of February.
JAMES	ANDERSON, Fourth Son of	John Anderson, Apothecary, in Castlegate, youngest son of James Anderson of Brigg com Linc. Gent. By Frances, daughter of William Saltmarsh, of Howden, Gent.	Sarah, late relict of William Ramfden, rector of St. Martin's in the Fields, London, and daughter of Samuel Dixon, Alderman, of Leeds, deceased.	On Tuesday the 22d of February.	On Saturday the 19th of March.



## BURIALS at ST. MARY'S, CASTLEGATE, for the Year 1774.

Christian Name.	Surname.	Descent, Profession, and Abode.	When died, and where buried.	Age.	Distemper.
JOHN	GRIMSTON.	Doctor of Physick, a married man, fourth son of John Grimston, of Grimston Garth, in Holderness, Esq. By Charlotte, 2d daughter of John Wilton, Recorder of Hull.	Died at his house without Monk Bar, on Sunday the 2d of January, and buried in the vault under the altar on Friday the 7th of January.	56 years.	Apoplexy.
JANE	TURNER.	Relict of Oliver Turner, of Wakefield, Gent. eldest daughter of the late Samuel Palmes of Naburn, Esq. By Isabel, daughter of James Strickland, of Thornton Bridge, Gentleman.	Died at Wakefield on Tuesday the 8th, and buried on Saturday the 12th of February, in the centre of the south alley.	47 years.	Pulmonary Consumption.
JAMES	FOUNTAIN.	Batchelor, and portrait painter in Coppergate, only son of William Fountain of Thirsk, woollen-draper. By Jane Stonehouse, his wife.	Died on Wednesday the 16th, and buried on Sunday the 20th of March, in the church-yard, under the east window of the chancel.	25 years.	Fever.

\* \* \* This improvement may be extended to the register for marriages, and the form, as established by an Act of Parliament, will in general allow room sufficient for inserting the descent of each party.



# LETTER FROM MR. BISSELL. 353

## EXTRACT OF A LETTER TO DR. PERCIVAL FROM THE REVEREND MR. BISSELL, OF WAVERTON NEAR CHESTER.

At the beginning of the Year 1775, the Parish of  
WAVERTON near CHESTER, contained

Inhabited Houses.	Families.	Males.	Females.	Inhabitants.
111.	116.	310.	332.	642.

From Jan. 1st to Dec. 31st 1775 inclusive there were

Christenings.	Burials.
Males 14.	Males 6.
Females 8.	Females 6.
—	—
22.	12.

### BURIALS IN 1775.

Days.	Sex.	Age.	Diseases.
Jan. 20.	A Woman	77 Years	Asthma.
Jan. 31.	A Girl	9 Weeks	Convulsions.
Feb. 9.	A Woman	67 Years	Dropsy.
March 6.	A Woman	87 Years	Decay of Age, and an Ulcer in the Axilla.
April 3.	A Woman	65 Years	Putrid Fever.
April 9.	A Man	45 Years	Uncertain.
April 11.	A Man	63 Years	Dropsy.

June



# 354 LETTER FROM MR. BISSELL.

Days.	Sex.	Age.	Disease.
June 18.	A Woman	40 Years	Consumption.
July 6.	A Boy	14 Months	Small Pox with hot Regimen.
Aug. 14.	A Boy	4 Years	Small Pox and Worms.
Nov. 11.	A Man	65 Years	Gout and Dropsy in Consequence of hard drinking.
Nov. 26.	A Man	68 Years	Dropsy.

At the beginning of the Year 1775, the Parish of Waverton near Chester, contained

Inhabited Houses, Families, Males, Females, Infants.

111. 0. 110. 310. 042.

From Jan. 1st to Dec. 31st 1775 inclusive there were

Burials.

Males 1.

Females 8.

Infants 1.

Total 10.

BURIALS IN 1775.

Days.	Sex.	Age.	Disease.
Jan. 30.	A Woman	77 Years	Althous.
Jan. 31.	A Girl	9 Weeks	Coryza.
Feb. 9.	A Woman	67 Years	Dropsy.
March 6.	A Woman	87 Years	Dropsy of Age, and an Ulcer in the Axilla.
April 8.	A Woman	62 Years	Putrid Fever.
April 9.	A Man	45 Years	Uncertain.
April 11.	A Man	63 Years	Dropsy.

June

AN



# REGISTER OF ASHTON. 355

AN ACCOUNT OF THE BURIALS AND  
CHRISTENINGS IN THE PARISH  
OF ASHTON-UNDER-LINE, DU-  
RING THE LAST ELEVEN YEARS :  
COMMUNICATED BY THE REVEREND  
MR. CRADOCK.

## BURIALS.

		Males unmarried.	Females Do.	Huf- bands.	Wives.	Widow- ers.	Wi- dows.
1765	159	60	51	10	17	13	8
1766	187	42	54	34	24	7	26
1767	159	44	45	23	21	9	17
1768	197	69	60	18	25	1	24
1769	206	79	75	16	12	9	15
1770	167	54	46	29	7	20	11
1771	178	67	43	26	23	8	11
1772	250	97	71	16	35	10	21
1773	157	48	50	18	23	6	12
1774	152	38	46	21	24	10	13
1775	241	92	96	15	20	8	10
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
	2053	690	637	226	231	101	168

A a

CHRIS-



# 356 REGISTER OF ASHTON.

## CHRISTENINGS.

	Males.	Females.
1765	121	114
1766	97	123
1767	116	111
1768	122	108
1769	157	137
1770	139	142
1771	133	143
1772	168	141
1773	174	131
1774	137	146
1775	168	164
	<hr/> 1532	<hr/> 1460

ADDI-



ADDITIONAL  
OBSERVATIONS  
ON THE EFFECTS OF  
FIXED AIR,  
IN PROMOTING THE  
GROWTH OF PLANTS.

I HAVE communicated, to many of my friends, an account of the experiments, which I made in the Spring of 1775, on Vegetation, as influenced by Fixed Air. And I flatter myself that the subject will engage the attention, and excite the trials of those, who have a taste for pursuits of this nature. Mr. Bew, who was a witness to the flourishing state of my Sprigs of Mint, growing



in Mephitic Water, has lately tried a similar experiment with two Hyacinths. And I shall lay before the reader his account of the success of it.

“ December 2d, 1775. Two Hy-  
 “ acinth bulbs, each weighing four  
 “ drachms and a few grains, were placed  
 “ in glasses made for the purpose of ve-  
 “ getating bulbous roots. One glass  
 “ was supplied with seven ounces and a  
 “ half of pump water, impregnated with  
 “ fixed air; the other with the same  
 “ quantity of rain water.

“ NEITHER of the plants had made  
 “ much progress in vegetation. Some  
 “ white fibrous roots were shooting from  
 “ the plant supplied with rain water,  
 “ but none from that which had the  
 “ water with fixed air.

“ December 17th. SEVERAL beauti-  
 “ ful white fibres were discovered, shoot-  
 “ ing



“ ing from the root supplied with fixed  
 “ air; and both plants were beginning  
 “ to vegetate.

“ THE bulb supplied with rain water  
 “ seemed, at first, to make the greater  
 “ progress in vegetation. The fibrous  
 “ roots of the other were, however,  
 “ much stronger, whiter, and more  
 “ transparent.

“ THEY were constantly supplied with  
 “ their respective kinds of water; and  
 “ at intervals, when I concluded that  
 “ the factitious air was exhausted by the  
 “ plant, the whole was poured off; and  
 “ each glass filled, at the same time,  
 “ with the same quantity of its proper  
 “ water.

“ January 1st, 1776. THE plant  
 “ immersed in the water impregnated  
 “ with fixed air, surpassed the other in  
 “ the strength and colour of its leaves,



“ which were of a lively green, and the  
 “ roots of a most beautiful transparent  
 “ white. The other plant, though ap-  
 “ parently healthy, had very few roots.

“ January 16th. BOTH plants conti-  
 “ nued to vegetate, but the one supplied  
 “ with fixed air much more than the  
 “ other. And it seemed equally forward  
 “ with some other bulbs, which had been  
 “ placed in common rain water near a  
 “ month before. An accident, however,  
 “ happened at this time, which, I ap-  
 “ prehended, would have put an end to  
 “ my experiment. My servant, in let-  
 “ ting down a large curtain before the  
 “ window where these glasses were  
 “ placed, overturned that which con-  
 “ tained the water with fixed air. The  
 “ night was rather severe, and the plant  
 “ lay ten or eleven hours out of water.  
 “ I replaced it in another glass with the  
 “ mephitic water, and continued to sup-  
 “ ply them as usual.

“ January



“ January 21st. I was much surprised to find the plant had recovered its former vigour, and was advancing a stem with buds for flowering, which the other plant shewed no signs of.

“ THE weather at this time became so cold, that I thought it necessary to remove all the plants out of the window of my parlour to a warmer part of the room, that the progress of their vegetation might not be retarded.

“ February 6th. THE glasses were replaced in the window, and each seemed in a very healthy state. That supplied with mephitic water, visibly increased every day.

“ THE plant in the rain water had advanced a stem with buds; but not more than half the size of the other.

“ February 27th. THE Hyacinth,

A a 4

“ which



“ which had been supplied with water  
 “ impregnated with fixed air, was in full  
 “ blow, appeared remarkably strong, and  
 “ diffused the delicate fragrance peculiar  
 “ to the flower. It measured, from the  
 “ bulb, full sixteen inches. I withdrew  
 “ it gently from the water, and found it  
 “ weighed two ounces, two drachms,  
 “ and five grains.

“ THE other Hyacinth was just begin-  
 “ ning to expand its flower. It measured  
 “ no more than ten inches from the  
 “ bulb; and though fresh and vigorous,  
 “ weighed only one ounce, one drachm,  
 “ and six grains.”

THIS experiment of Mr. Bew would  
 have been more decisive, if he had em-  
 ployed rain water impregnated with fixed  
 air, and not pump water. But it coin-  
 cides with the trials which I have re-  
 lated, and sufficiently evinces the power-  
 ful influence of this principle on vege-  
 tation.

It



It is a common custom with gardeners to expose pump water to the sun and air, to soften it, many hours before they use it for the purpose of sprinkling their plants and flowers. This should seem to be an injudicious practice, if the hardness of the water arise, as it often does, from the fixed air which it contains. For it will thus be deprived of that constituent part, which has been shewn to be so friendly to vegetable life. Mephitic air is found in many common springs; and such should always be selected for the uses of gardening and agriculture. In green houses, water artificially impregnated might be employed, without any great trouble or expence.



ON THE PRACTICE OF

It is a common custom with a nation  
to export pure water to the sea and  
not to return it in any quantity they  
use it for the purpose of drinking their  
plants and flowers. I should have  
said an injudicious practice, if the hand-  
let of the water were as it often does,  
from the fixed matter which it contains.  
For it will thus be deprived of its con-  
tinuous part, which has been shown to  
be so friendly to vegetable life. No-  
thing is so found in many common  
plants, and such should always be selected  
for the uses of drinking and irrigation.  
In great quantities water is usually im-  
pregnated with the sulphur, without  
any great number of spores.

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# ERRATA.

- In several places for phœnomenon read phænomenon.*
- Page 146, Line 3, *for mephitic air read mephitic water.*  
 147, 3, *ibid.*  
 165, 18, *for heterogeneous read heterogeneus.*  
 298, 12, *for and stimulating read and less stimulating.*  
 303, 6, *after both read the.*  
 314, 4, *for calculus read calculous.*  
 322, Dr. Saunders' second letter passim, *for Lythargyrites*  
*read Lithargyrites.*  
 325, 21, *for vitriolic read vitriolum.*



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