

Elements of agriculture and vegetation / By George Fordyce, M. D. Fellow Of The Royal College Of Physicians; Physician to St. Thomas's Hospital; and Reader on the Practice of Physic, in London. To which is added an appendix for the use of practical farmers.

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Fordyce, George, 1736-1802.
Royal College of Physicians of London

Publication/Creation

London : J. Johnson, 1789.

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be mixed with other substances, was in itself always the same in all its properties, and that this matter was by a new operation induced by the action of the duodenum, and the fluids it met with there, to have its elements again disunited, and reunited so as to form the three essential parts of the chyle, which, therefore, could not be influenced in the smallest degree by the food, and that these three essential parts of the chyle were always the same, and therefore when converted into the blood, the blood *a fortiori* could not be in the smallest degree influenced by the food. And moreover, that provided a sufficient quantity of food was employed, and the organs of digestion were sufficiently powerful in their action, and the fluids applied were properly added, a sufficient quantity of blood would be formed, and that too large a quantity of food did not produce too large a quantity of blood.

F I N I S.

E L E M E N T S
O F
A G R I C U L T U R E
A N D
V E G E T A T I O N.

By GEORGE FORDYCE, M. D.

FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS;

Physician to St. THOMAS'S HOSPITAL; and Reader on the
Practice of PHYSIC, in LONDON.

TO WHICH IS ADDED

A N

A P P E N D I X

FOR THE USE OF

PRACTICAL FARMERS.

THE FOURTH EDITION.

L O N D O N:

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

M,DCC,LXXXIX.



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TO THE
RIGHT HONORABLE
JAMES STEWART MACKENZIE,

LORD PRIVY SEAL FOR SCOTLAND.

THE FOLLOWING ATTEMPT IN A SCIENCE
NOT LESS HONORED BY HIS ENCOURAGEMENT

THAN USEFUL IN ITSELF,

I S,

WITH DUE RESPECT AND GRATITUDE,

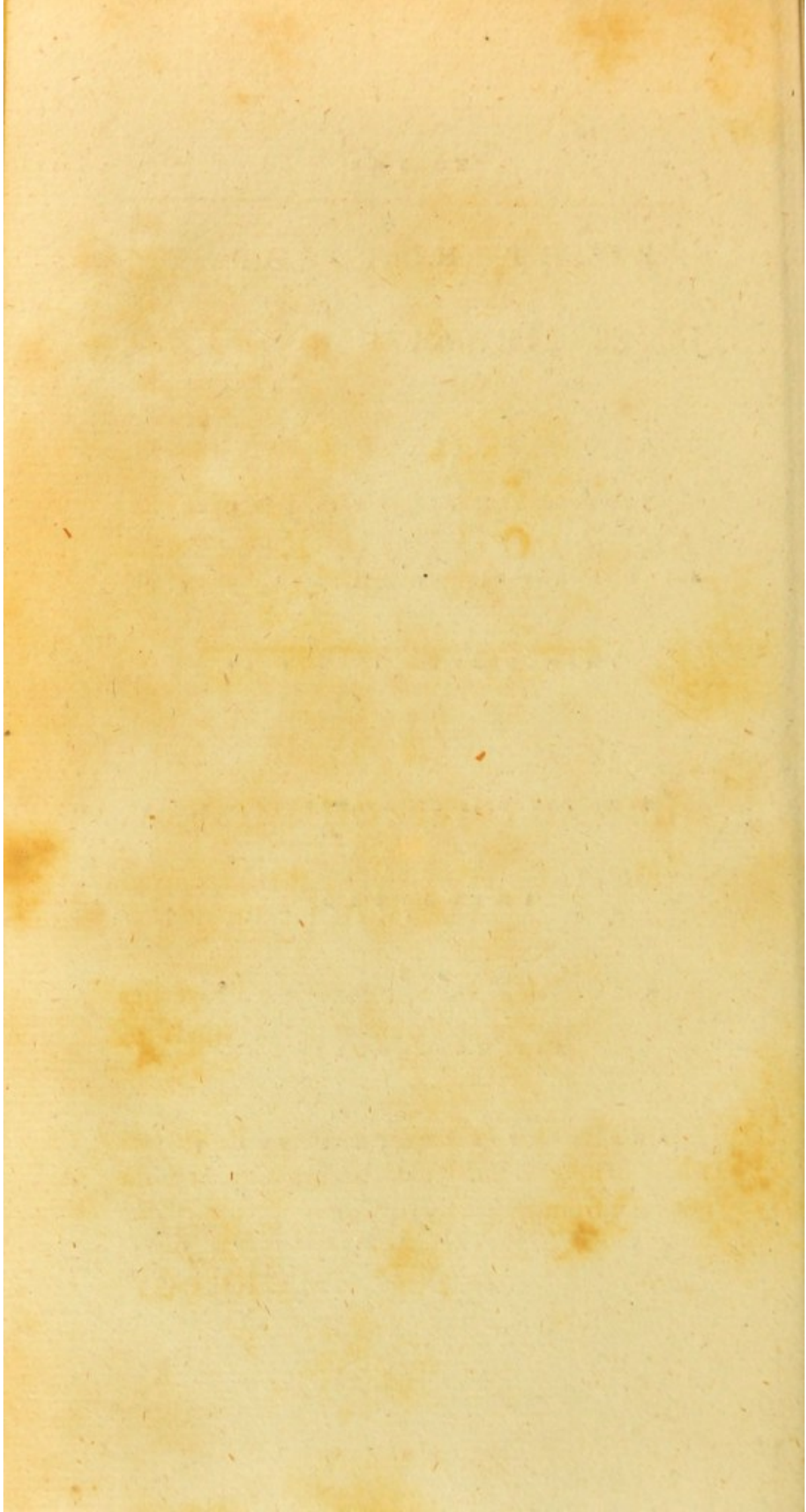
INSCRIBED

BY

HIS MOST OBLIGED

AND MOST HUMBLE SERVANT,

GEORGE FORDYCE.



E L E M E N T S

O F

A G R I C U L T U R E, &c.

P A R T I.

E L E M E N T S O F C H E M I S T R Y.

Necessary to be understood for the Explanation
of the Principles of AGRICULTURE.

MECHANICS, treat of the Properties
belonging indifferently to all kinds of
Matter.

CHEMISTRY, treats of those Properties
which belong to particular Bodies only, and do
not arise from their Organization.

A 3 P H Y S I O L O G Y,

PHYSIOLOGY, is the Doctrine of animated Matter, comprehending those properties which the same matter has not when dead, and which are neither Mechanical nor Chemical.

SUBSTANCES combine together;

First, MECHANICALLY, by being divided into small Particles, and mixed by *External* Force.

Secondly, CHEMICALLY; by an Attraction of the Particles of one Body to those of another,

The Particles of Bodies do not touch, but adhere by Attraction. Vid. Fig. 1.

MECHANICAL COMBINATION is of two kinds.

First, MIXTURE; when the Particles of one of the Bodies attract one another stronger, than they do those of the other; in this Case if they be both Fluid, the one which is least in Quantity, is broke down into Spheres; *Example*, As Oil is when mixed with Water. Vid. Fig. 2.

Secondly, DIFFUSION; when the Particles of the one Body, attract those of the other, as strongly, as they do one another, in this Case they intermix together equally: *Example*, As Solution of blue Vitriol mixes uniformly with Water; or in the same Manner as Serum and Water. Vid. Fig. 3.

In Mechanical Combination, the Properties of the Elements remain exactly the same as before the Mixture and the Properties of the Compound depend on them.

When of different specific Gravity, they remain mixed from Friction, and the Attraction of the Particles of the one, in the largest Quantity to one another. Vid. Fig. 4.

In CHEMICAL COMBINATION the Substances unite by an Attraction, which takes Place between themselves, without any external Power.

A Particle of each Element unite together, so as to form but one Particle considered Mechanically. Vid. Fig 5. *Example,*

Nitrous Acid,	}	Form NITRE, which is to be considered Mechanically, as one simple Substance.
and		
Fixt Vegetable Alkali.		

The Properties of the Compound do not depend on the Properties of the Elements.

No Mechanical Power can separate the Substances so combined.

A Compound may become an Element. Vid. Fig. 7.

* When two Substances are to be combined Chemically, we call one of them the *Menstruum* the other the *Solvend*.

A Menstruum, will only combine with a certain Proportion of a *Solvend*: *Example*, Water will only dissolve a certain Quantity of Salt, and no more.

During the Combination, Heat or Cold are often produced: *Examples*, Vitriolic Acid in uniting with Water, and quick Lime in uniting with Water, generate Heat. Sal Ammoniac and Water, Air and Water, generate Cold.

A Menstruum will sometimes dissolve several Solvends at a Time, sometimes only one, as Water will dissolve several neutral Salts at once, but an acid will only dissolve one Metal at a Time.

The Elements remain combined from the Attraction which takes Place between them.

TWO SOLIDS mechanically mixed may be separated;

First, By ELUTRIATION; that is separating two Bodies in Powder by means of Water. If one of the two is of greater specific Gravity, or if the
Particles

* It can be conceived that three Particles, each of a different species of matter may unite together, so as to form one compound Particle; but there is no given example of this in Chemistry, but when a compound contains three elements, two combine, and form a Menstruum for the third.

Particles of the one, are finer than those of the other, and both insoluble in Water; if they be mixed with Water, the heaviest, or that whose Particles are largest, will subside first, and the Water may be poured off while the other is still swimming in it. *Example*, Clay and Sand may be separated in this Way; the Clay being finer than the Sand, will remain longer suspended, and therefore may be poured off with the Water.

Secondly, By DISSOLVING one of them in a Menstruum, in which the other is insoluble: *Example*, An Acid dissolves calcareous Earth, but not Sand; therefore these two Substances may be separated by pouring upon them an Acid, which dissolving the calcareous Earth, will leave the Sand.

Thirdly, By FILTRATION; if the Particles of the one, are finer than those of the other, by putting them with Water into a Filter, whose Pores will let the Particles of the one pass through along with the Water, the other remaining behind. *Example*, if Sand and Clay be mixed with Water, and poured into a proper Filter, the Clay will pass through the Water and leave the Sand.

Fourthly, By EVAPORATION, which is the converting a Body into Vapour and dissipating it.

it. If therefore a fixt and volatile Substance be mixed, we may separate them by evaporating the volatile one.

SOLIDS are Substances whose Particles have their Attraction of Cohesion, stronger than the Attraction of Gravitation.

FLUIDS have their Attraction of Gravitation, stronger than their attraction of Cohesion.

VAPOURS have their Particles repelled to a considerable Distance, by a Power, easily overcome by an external Pressure.

HEAT converts Solids into Fluids, and Fluids into Vapour.

Both these Changes generate Cold.

Evaporation is in Proportion to the Surface; for external Pressure prevents it from taking Place so readily, and there is the least Pressure on the Surface. Vid. Fig. 8.

A FLUID Mechanically mixed with a Solid may be separated;

First, By FILTRATION; (i. e.) making the Fluid pass through a Filter, whose Pores will not let the Solid pass through.

Secondly,

Secondly, By SUBSIDING ; (i. e.) if they are of different specific Gravity, letting them stand together till the Solid has fallen to the Bottom, or risen to the Top.

This Separation takes Place more or less readily, according to the Difference of specific Gravity, the Size or Number of the Particles of the Solid.

Thirdly, By EVAPORATION ; which may be performed when one is more Volatile than the other.

TWO FLUIDS may be separated from one another in the same Manner, *viz.*

First, By FILTRATION ; when one is more viscid than the other.

Secondly, By SUBSIDING ; when one is of greater specific Gravity than the other.

Thirdly, By EVAPORATION ; when they are volatile at different Degrees of Heat.

TWO SUBSTANCES chemically combined, may be separated :

First, By ELECTIVE ATTRACTION ; (i. e.) the Application of a third Substance, which will unite with one, and separate the other from it.

If calcareous Earth, as Limestone be united with an Acid, and fixt Alkali as Pearl Ash be applied

applied, the Alkali will unite with the Acid, and separate the Earth.

This can only happen when a Menstruum dissolves only one of two Solvents at a Time, the one uniting with it, repels the other, and is said to attract the Menstruum stronger.

Two Solvents may attract a Menstruum equally strongly.

In the following Tables of ELECTIVE ATTRACTIONS, the Menstruum is placed at the Top of the Column, and the Substances it will combine with, are placed under, in such Order, that if any one of them be combined with the Menstruum, any other that stands above it, will separate it; as for *Example*, If Silver be combined with an Acid, Mercury, Copper, an Alkali, or any other Substance standing above it, will separate it.

TABLE

Table of ELECTIVE Attractions.

A C I D S.

Phlogiston,

Fixt Alkali's,

Caustic Calcareous Earth,

Caustic Volatile Alkali,

Magnesia,

Zinc,

Iron, Lead, Tin,*

Bismuth, Antimony,

Copper,

Regulus of Arsenic, Earth of Alum,

Mercury,

Silver,

Gold.

Table

* The comparative Attractions of those in the same line are not known; These Tables are sufficient for our present subject.

Table of ELECTIVE Attractions.

ALKALIS, and ABSORBENT EARTHS,

Vitriolic Acid,

Nitrous Acid,

Acid of Amber,

Muriatic Acid,

Acetous Acid,

Volatile Vitriolic Acid, Tartar, Acid of Borax,

Gas, or fixed Air,

Oils.

Table

Table of ELECTIVE Attractions.

M E T A L S,

Muriatic Acid,

Vitriolic Acid,

Nitrous Acid,

Acetous Acid,

Gas, or fixed Air.

This is not the case in all the Metals.

Table

Table of ELECTIVE Attractions.

Gas, or fixed Air.

Calcareous Earth,

Alkali's.

Secondly,

Secondly, By HEAT. If two substances are combined, one of which is fixed, the other Volatile, by Heat we may often destroy the Attraction between them, and separate the Volatile one, by converting it into Vapour. If the Acid of Vinegar and Copper be combined so as to form Verdigrease, if that Verdigrease be exposed to a sufficient Heat, the Attraction will be destroyed, the Acid driven off, and the Copper left.

The Volatile Element cannot be converted into Vapour, until we have applied a sufficient Degree of Heat to destroy the Attraction, although it be Volatile *when separate*, in a much smaller Degree.

If a Compound consists of Elements, which are also compounded, these Elements may be decomposed by the Heat, and their Elements may also unite together, so as to form a Substance, which was not originally in the Compound exposed to the Action of the Fire; as for *Example*, If we distil Gum Arabic with a considerable Heat, there will come over an Oil, which did not exist in the Gum.

Thirdly, By COLD; for Menstruums often dissolve a larger Proportion of Solvends in Heat than in Cold; therefore in this case a Menstruum is saturated with a Solvend in Heat, upon cooling,

part of the Solvend will be separated; as if boiling Water be saturated with Nitre, upon cooling, part of the Nitre will separate.

SUBSTANCES may act upon one another Chemically.

First, By SOLUTION; when two Substances combine together.

Secondly, By PRECIPITATION; when a Solvend unites with a Menstruum, and separates another from it; or when upon applying two or more Compounds, the Solvents of the one, unite with the Menstruums of the other.

By Precipitation we do not mean the subsiding, but the Chemical Separation.

Substances separated Chemically, require afterwards to be separated Mechanically, by the Means already shewn.

Thirdly, By FERMENTATION; i. e. a Change of the Properties of a Compound, without any Addition to, or Separation from, the whole Mass, but by a new Arrangement of the Elements. Or when a Compound consists of Elements which are also compounded; these Elements decompose one another, and form new ones, which reunite, and produce a Compound, having different Properties from the one, subjected to the Operation.

SUBSTANCES

SUBSTANCES in order to act Chemically upon one another, must almost always be Fluid, or in the State of Vapour.

CRYSTALLIZATION, is a Disposition in Bodies when they become solid, to form themselves into particular Shapes, and to run in certain Directions.

This Power is capable of overcoming very great Resistances. Hence Water in freezing often breaks the Vessel in which it is contained.

Salts in CrySTALLizing often take up Water in their Crystals.

All Substances are capable of CrySTALLization, excepting Animal and Vegetable Mucilages.

P A R T II.

The PROPERTIES of BODIES necessary to
be known in AGRICULTURE.

I. Of *S A L T S*.

S A L T S are Substances which will dissolve in Water, and will not burn; Tartar and its Compounds are Exceptions, as they will burn although they be Salts.

Volatile Alkali and its Compounds are Exceptions, in as far as they deflagrate with Nitre.

Quick Lime is an Exception, which although soluble in Water is not called a Salt but an Earth.

S A L T S are,

First, SIMPLE or ELEMENTARY, such as cannot be divided into more simple Substances.

Secondly, COMPOUND, such as consist of other Substances more simple.

ELEMENTARY

ELEMENTARY SALTS are,

First, ACIDS ; such Elementary Salts as unite with Alkalis into neutral Salts.

Secondly, ALKALIS ; such Elementary Salts as united with Acids form neutral Salts.

COMPOUND SALTS are,

First, Neutral. Compounds of Acids and Alkalis. *Example,*

Sea Salts consist of { Muriatic Acid,
Fixt Fossile Alkali.

Secondly, Metallic, Compounds of Acids and Metals. *Example,*

Green Vitriol consists of { Vitriolic Acid
Iron.

Thirdly, Earthy Compounds of Acids and Earths. *Example,*

Selenites consist of { Vitriolic Acid,
Calcareous Earth.

S A L T S

N A M E S. The Manner in which they
are found or produced.

VITRIOLIC ACID,	It is found in the Earth in Sulphur.
Synonima,	Sulphur consisting of Vi- triolic Acid, and inflam- mable Matter ; exposed to the Air, is decomposed, the inflammable Matter flying off leaves the acid behind ;
<i>Oil of Vitriol,</i>	if therefore there be Sul- phur, or any of its Com- pounds in the Soil, Vitrio- lic Acid or some of its Com- pounds may be produced.
<i>Spirit of Vitriol,</i>	It is produced in the burning of all inflammable vegetable Substances, when reduced to a Charcoal.
<i>Oil of Sulphur,</i>	It is the only Acid found in the Air, excepting near the Sea, and where there are large Masses of putri- fying Substances, and it may be attracted from the Air by Alkali's or Earths.
<i>Spirit of Sulphur,</i>	
<i>Universal Acid,</i>	
<i>Fossile Acid,</i>	

found in SOILS are,
Their PROPERTIES*.

It unites with

First, Fixt vegetable Alkali, forming vitriolated Tartar.

Secondly, Fixt Fossile Alkali, forming true *Glauber's* Salts.

Thirdly, Iron, forming green Vitriol.

Fourthly, Copper, forming blue Vitriol.

Fifthly, Zinc, forming white Vitriol.

Sixthly, Calcareous Earth, forming Selenites.

Seventhly, Magnesia, forming Magnesia *Glauber's* Salts.

Eighthly, Clay, or Earth of Alum, forming Alum.

It attracts Alkalis and Earths, stronger than any other Acid.

* The whole properties are not laid down here, only such as are useful to be known in agriculture.

S A L T S

N A M E S. The Manner in which they
are found or produced.

NITROUS ACID.

Synonimia,

Spirit of Nitre,

Glauber's Spirit of

Nitre,

Aqua Fortis.

It is produced by the last
Stage of Putrefaction and
is found either in the putrid
Mass, combined with Cal-
careous Earth, or Volatile
Alkali, or in the Air near
it.

found in SOILS are,

Their PROPERTIES.

It unites with

First, Fixt Vegetable Alkali, forming Nitre,

Secondly, Volatile Alkali, forming Nitrous Ammoniac.

Thirdly, Calcareous Earth.

Fourthly, Magnesia.

Its Compounds deflagrate with any inflammable Substances, i. e. the inflammable Matter unites with the Acid, and precipitates the Alkali; at the same Time there is a great Separation of Air, and a considerable Degree of Heat produced.

SALTS

S A L T S

N A M E S. The Manner in which they
are produced

MURIATIC ACID,

Synonima,

Spirit of Salt,

*Glauber's Spirit of
Salt,*

Marine Acid.

It is found in the Earth,
in Mineral Waters, and in
the Sea combined with the
fixt Fossile Alkali, Calca-
reous Earth, Magnesia, or
Earth of Alum.

It is formed by the Pu-
trefaction of Animal, or
Vegetable Substances, and
is found in the putrid Mass,
combined with Calcareous
Earth and volatile Alkali.

It is found in Soot, com-
bined with Volatile Alkali.

It is found in the Air
near the Sea.

found in SOILS are,
Their PROPERTIES.

It unites with

First, Fixt Fossil Alkali, forming Sea Salt.

Secondly, Volatile Alkali, forming common
Sal. Ammoniac.

Thirdly, Iron.

Fourthly, Copper.

Fifthly, Zinc.

Sixthly, Calcareous Earth, forming fixt Am-
moniac.

Seventhly, Magnesia.

Eighthly, Earth of Alum, forming Alum.

It attracts Metals stronger than any other Acid.

SALTS

S A L T S

N A M E S. The Manner in which they
are produced.

FIXT VEGETABLE
ALKALI

It is formed in the Burn-
ing of Vegetable Sub-
stances, and is found in
their Ashes.

Synonima,

Combined with Air

It is not an Element of
the Vegetable, but is pro-
duced from its Elements
by the Operation.

Salt of Tartar,

Salt of Wormwood,

It is not found in the
Ashes of any putrid Vege-
table.

Pot-ash,

Pearl-ash,

Fixt Nitre,

When free from Gas

Caustic fixt Veg. Alkali,

Common Caustic,

Soap Leys,

found in SOILS are,

Their PROPERTIES.

It is either free from Gas, or fixed Air, when it is called Caustic; or Combined with Gas, or fixed Air, when it is called Mild.

In both Cases it unites with

First, Vitriolic Acid, forming Vitriolated Tartar.

Secondly, Nitrous Acid, forming Common Nitre.

Thirdly, Muriatic Acid, forming Digestive Salt of Sylvius.

It attracts Water from the Air.

When Caustic, it dissolves

First, Oil, forming Soap.

Secondly, Animal and Vegetable Substances, forming a Soap.

Both Mild and Caustic, it attracts Acids stronger than Volatile Alkali, Metals, or Earths.

S A L T S

S A L T S

N A M E S. The Manner in which they
are found or produced.

FIXT FOSSILE
ALKALI

It is found in the Earth
and Mineral Waters, some-
times pure, sometimes
combined with Vitriolic,
Muriatic, or Boracic Acids,
or with Sulphur.

Synonima,
Combined with Air
Natron, seu Nitrum
Plinii,

Soda
Sal Sodæ,
Barilla,
Kelp.

Upon burning any
Vegetable containing Sea
Salt, it is found in the
Ashes.

When free from Gas
Soap Leys,
Caustic Fixt Fossile
Alkali.

found in SOILS are,

Their PROPERTIES.

It is either free from Gas, or fixed Air, when it is called Caustic, or combined with Gas, or fixed Air, when it is said to be mild.

In both Cases it unites with
First, Vitriolic Acid, forming *Glauber's* Salts.
Secondly, Muriatic Acid, forming Common
or Sea Salt.

It dries in the Air.

It separates Volatile Alkali, Earths and Metals from Acids.

When Caustic it dissolves.

First, Oils, forming Castile Soap.

Secondly, Animal and Vegetable Substances, forming a Soap.

SALTS

S A L T S

N A M E S. The Manner in which they
are found or produced.

VOLATILE ALKALI.

Synonima

When dry and mild

Volatile Salt of Sal

Ammoniac,

Salt of Hartshorn,

Bones, Blood, or

any other animal

Substance,

When dissolved in

Water and mild

Spt. of Sal Ammoniac,

Spirit of Hartshorn, &c.

When dissolved in

Water and Caustic

Spirit of Sal Am-

moniac with

Quick Lime.

It is found in the Juices
of Animals, combined with
Muriatic, and Phosphoric
Acids.

It is found in Soot
combined with Muriatic
Acid.

It is formed in the last
Stage of Putrefaction, and
is found in the putrid Mass,
combined with Nitrous,
or Muriatic Acids.

It is never found in Soils
uncombined, on Account
of its Volatility.

found in SOILS are,

Their PROPERTIES.

It is either free from Gas, or fixed Air, when it is called Caustic; or combined with Gas, or fixed Air, when it is said to be Mild.

In both Cases it unites with

First, Nitrous Acid, forming Nitrous Ammoniac.

Secondly, Muriatic Acid, forming common Sal Ammoniac.

Thirdly, Phosphoric Acid.

When Caustic it precipitates Magnesia, Earth of Alum, and all the Metals from any Acid, but not Calcareous Earth.

When Mild it also precipitates Calcareous Earth.

C

SALTS

S A L T S

COMPOUND SALTS are Combinations
Body, when that Compound has the Pro-

NEUTRAL SALTS; or Compounds of Acids

N A M E S. The Manner in which they
are found or produced.

VITRIOLATED

TARTAR,

Its Elements,

{ *Vitriolic Acid.*
Fixt Vegetable
Alkali.

It is contained in the
Ashes of all vegetables,
and is formed on applying
fixt Vegetable Alkali to a
Soil, by precipitating a
Metal, or Earth, from the
Vitriolic Acid, if any Me-
tallic or Earthy Salt be con-
tained in the Soil; or by
attracting the Vitriolic
Acid from the Air.

GLAUBERS SALT,

Its Elements,

{ *Vitriolic Acid,*
Fixt Fossile Alkali.

It is found native in
Mineral Waters.

It is produced by the
Burning of a Vegetable
containing Sea Salt, and is
found in its Ashes.

found in SOILS are,

of any Elementary Salt, with any other
perties of a Salt.

and Alkalis found in Soils, are,

Their P R O P E R T I E S.

It is difficultly solubile in Water, requires a
great quantity of Water to dissolve it, and re-
mains dry in the Air.

It dissolves easily in a small Proportion of
Water, and dries in the Air.

S A L T S

N A M E S. The Manner in which they
are found or produced.

NITRE. It is formed by applying
Synonima, fixt Vegetable Alkali to a
Sal. Peter, Soil, it precipitating Vo-
 Elements. latile Alkali, Calcareous
 { *Nitrous Acid,* Earth, or Magnesia, from
 { *Fixt Veget. Alkali.* the Nitrous Acid.

CUBIC NITRE. It is formed by applying
 Elements, fixt Fossile Alkali to a Soil,
 { *Nitrous Acid,* as common Nitre.
 { *Fixt Fossile Alkali.*

NITROUS AMMONIAC. It is produced by the last
 Elements, Stage of Putrefaction.
 { *Nitrous Acid,*
 { *Volatile Alkali.*

found in SOILS are,
Their PROPERTIES.

It remains dry in the Air, and deflagrates
with any inflammable Matter.

Properties the same as Common Nitre.

It attracts Water from the Air, it deflagrates
with any inflammable Matter, or upon being
heated red hot.

NEUTRAL SALTS

N A M E S. The Manner in which they
are found or produced.

DIGESTIVE SALT of

SYLVIUS.

Elements,

{ *Muriatic Acid,*
{ *Fixt Veget. Alkali.*

It is formed by applying fixt Vegetable Alkali to a Soil, containing common Salt, or any Ammoniacal, Earthy, or Metallic Salt, with the Muriatic Acid: the fixt Alkali, separating the Volatile Alkali, Earth, or Metal, from the Acid.

COMMON SALT.

Synonima,

Common Sea Salt

Which is impure
containing Salts
with Magnesia.

It is found Naturally in the Earth, and in almost all Spring Waters; hence almost every Soil contains it.

Bay Salt,

Sal Gem,

Elements,

{ *Muriatic Acid,*
{ *Fixt Fossile Alkali.*

COMMON SAL AMMONIAC. It is formed by Putre-

Elements,

{ *Muriatic Acid,*
{ *Volatile Alkali.*

faction, and is also found in Soot.

found in SOILS are,
Their PROPERTIES.

It remains dry in the Air.

It remains dry in the Air.

It remains dry in a dry Air.

S A L T S

METALLICK SALTS, or compounds of

N A M E S. The Manner in which they
are found or produced.

GREEN VITRIOL.

Elements,

{ *Vitriolic Acid,*
{ *Iron*

It is formed by the De-
composition of Pyrites, or
is found in Mineral Wa-
ters.

MURIA FERRI

Elements,

{ *Muriatic Acid,*
{ *Iron.*

It is found in Mineral
Waters.

EARTHY SALTS, or Compounds of Acids

SELENITES,

It is found Native.

*Synonima,**Gypsum,**Paris Plaister,**Elements,*

{ *Vitriolic Acid*
{ *Calcareous Earth.*

It is formed by Expo-
sure of Calcareous Earth
to the Air, from which it
attracts Vitriolic Acid,
and is also formed by the
Precipitation of Magnesia,
Earth of Alum, or Metals
from Vitriolic Acid by
Calcareous Earth.

found in SOILS are,

Acids and Metals.

Their PROPERTIES.

It coagulates Vegetale Juices, and hardens their Solids.

It coagulates Vegetable Juices, and hardens their Solids.

and Earths, are

It requires a very large Proportion of Water to dissolve it, is with difficulty soluble in Water, and remains dry in the Air.

EARTHY

E A R T H Y S A L T S

N A M E S. The Manner in which they
are found or produced.

NITROUS SELENITES, It is formed by Putre-
faction.

Elements,

Nitrous Acid,
Calcareous Earth,

LIQUID SHELL.

Synonima. It is found Native, and
formed by Putrefaction.

Fixt Ammoniac,

Elements,

{ *Muriatic Acid,*
{ *Calcareous Earth,*

found in SOILS are,

Their PROPERTIES.

It deflagrates, and attracts Water from the
Air.

It attracts Water from the Air.

EARTHY

EARTHY SALTS

NAMES. The Manner in which the
are found or produced.

MAGNESIA
GLAUBER'S
SALTS.

Synonyma,

Epsom Salt, and the
purging Salt of most
Mineral Waters.

Elements,

{ *Vitriolic Acid,*
 Magnesia.

MOTHER OF NITRE.

Elements,

{ *Nitrous Acid,*
 Magnesia.

It is found Native in
Soils, and very frequently
in Spring Waters, and it
is produced by exposing
to the Air, any Neutral
Salt, containing Vitriolic
Acid, dissolved in a large
Proportion of Water, to
the Air,

It is produced, by the
Exposure of a Solution
of any Neutral Salt, (con-
taining Nitrous Acid) in
a large Proportion of Wa-
ter, to the Air.

found in SOILS are,

Their PROPERTIES.

It attracts Water from the Air.

It deflagrates with any inflammable Substance,
and attracts Water from the Air.

SALTS

S A L T S

N A M E S. The Manner in which they
are found or produced.

MURIA MAGNESIÆ*. It is found Native, and
is produced by the Expo-
 Elements, sure of a Solution of any
 Muriatic Acid, Neutral Salt, (containing
 Magnesia. Muriatic Acid) in a large
 Proportion of Water, to
 the Air.

COMMON ALLUM. It is found Native, and
formed by the Exposure of
Clay, containing Pyrites,
to the Air.

A L L these SALTS prevent Putrefaction, ex-
Magnesia, is one Element; these on the other
All COMPOUND SALTS, dissolved in Water, (so
tity of Water in Proportion to the Salt,) and ex-
Neutral Salts the Alkali is converted into Magne-
an Earthy Salt. In the Earthy and Metallick
Earth, or Metal subsides, leaving the Water
Spring Water.

This Decomposition is greatly forwarded by
The *Metallick Salts* are decomposed in this
Earthy; and the *Neutral* are the slowest in their
All these salts, except the Alkalis, tend to
late their Juices; the Metallic Salts and Allum
them, the other Earthy Salts and the Neutral

* It is thirty Years and upwards, since I first formed Names
of the compound Salts; from their Elements but I did not
think at the time of the first Publication of these Element of
Agriculture that it would be proper to apply them here as this

found in SOILS are,

Their PROPERTIES.

It attracts Water from the Air.

It remains dry in the Air.

cepting those in which Calcareous Earth, or Hand forward it.

that the Solution shall contain a very large Quantity of the Air, are decomposed; viz in the Air, with which the Acid combines, and forms Salts, the Acid flies off into the Air, and the pure; hence River Water, &c. are purer than

Heat.

Manner the most readily; next to these the Decomposition.

harden Animal and Vegetable Solids, and coagulate most powerfully; next to these the Acids; after Salts are least apt to have this Effect.

Book was indeed only the Notes taken from a course of Lectures on the subject by one of my Right Honourable Hearers, and designed for those only who wished to bring Agriculture to greater perfection, to whom new Names would be unnecessary and useless.

INFLAM-

INFLAMMABLE Substances

N A M E S. The Manner in which they
are found or produced.

S U L P H U R A. It is found Native in the
Earth pure ; or combined
with Metals, particularly
Synoniua, Iron, Copper, or Arsenic
forming P Y R I T E S ; or
combined with Calcareous
Brimstone, Earth, or Fossile Alkali
forming *Hepar Sulphuris* in
fœtid Mineral Waters.

Elements, It is found in the Ashes
of Vegetables when they
are not burnt white, com-
bined with fixt Alkali,
forming *Hepar Sulphuris*.
{ *Vitriolic Acid,*
 Phlogiston, (i. e.
 Pure inflammable
 Matter.)

OIL is an inflamable Fluid, not soluble in
Water. The only Oil that is ever found in Soils,
is *Fossile Oil*, and that very seldom.

found in SOILS.

Their PROPERTIES.

It decomposes upon being moistened and exposed to the Air in its pure State, and also when combined with any of these Substances, the Phlogiston flying off into the Air, and leaving the Acid, which unites with any Metal, or absorbent Earth there may be in the Soil, or with the Clay.

It is insoluble in Water.

OIL, as a Fluid not soluble in Water, would get into the Ends of the Vessels of Plants, shut up their Pores, and prevent the Absorption of the Water.

D

EARTHS

E A R T H S

N A M E S. The Manner in which they
are found or produced.

CRYSTALLINE.	It is found Native, al-
Synonima,	ways in Cryftals, (whole
<i>Flint,</i>	or broke down ;) or in
<i>Sand,</i>	Maffes formed from Cry-
<i>Gravel,</i>	ftals.
<i>Quartz,</i>	
<i>Precious Stones,</i>	
ASBESTIS, TALC.	They are found Native.
and FUSIBLE SPAR	
CLAY.	It is found Native.

If a Mafs of it be heated red hot, it becomes
its Properties cryftalline Earth.

Soap Earth agrees in its Properties with Clay,
fusible in Wäter, seperates from it with greater
Particles.

By Culture, Clay becomes more diffusible in

found in SOILS are,

Their PROPERTIES.

It unites with Acids with great Difficulty.

Combined with Vitriolic Acid it forms Allum.

It is insoluble in Water.

It is always hard enough to strike Fire with Steel.

It is perfectly insoluble in Water and Acids.

Its Powder moistened with Water, has no Tenacity, nor does it harden when dried or heated by the Fire.

Excepting that they are softer, and more friable, they agree with Chrystalline Earth in Properties.

It is soft and in fine Powder.

If it be mixed with water, it forms a tenacious Mass, which hardens upon drying, and does not diffuse so readily in Water again as Sand.

hard, and burns into a Brick, and resembles in

of which it is a Species, only it is much more difficult, is of a smoother Texture and finer

Water.

The Earth consists principally of Strata of these Earth are sometimes found pure, but more com-
feldomer find pure Clay, than pure Sand.

A B S O R B E N T E A R T H S

N A M E S. The Manner in which they
are found or produced.

CALCAREOUS

EARTH.

Synonima,

When combined
with Gas.

Animal Earth,

Marble,

Limestone,

Chalk,

Marle,

When free from Gas.

Quick Lime.

It would appear that the
greatest Part of this Earth
is produced from the Exu-
viæ of Animals, particu-
larly the Shells of Fishes.

It is also produced by
burning Animal or Vegeta-
ble Substances; and by the
last Stage of Putrefaction.

The Earth, so produced,
did not subsist in the Ani-
mal or Vegetable, (except
in the Bones, but is formed
by putrefaction.

Substances, in which the Clay, and Crystalline
monly there is a Mixture of the two; and we

found in SOILS are,

Their PROPERTIES.

It may be had combined with Gas, or fixed Air,
when it is called *Mild*, or free from Gas, or fixed
Air when it is said to be *Caustic*,

In both these Cases it unites with,
First, Vitriolic Acid, forming Selenites,
Secondly, Nitrous Acid.

Thirdly, Muriatic Acid, forming fixt Am-
moniac.

It will separate any Metal, from any Acid.

Quick Lime or Calcareous Earth free from
Gas, is formed from Limestone, Chalk, &c. by
exposing them to about a red Heat; the Attrac-
tion between the Earth and Gas is destroyed, and
the Gas driven off.

If the Calcareous Earth be mixed with any
other Substance, which has the Effect of a Flux,
a moderate Heat must only be used, as otherwise
the Surface of the Limestone would melt, and

ABSORBENT EARTHS

NAMES.	The Manner in which they are found or produced,
--------	--

found in SOILS are,

Their PROPERTIES.

form a Crust, which would prevent the Evaporation of the Gas: This is to be known, by throwing a Piece of the Stone into a common Fire, and blowing against it with a Pair of Bellows; if there be any such Substance, the Surface will melt.

A white Heat for the above Reason is too great to burn any Limestone with.

Calcareous Earth, produced by the burning of any animal Substance, cannot be burnt into Lime, except it be first dissolved in an Acid, and separated by an Alkali.

Quick Lime, like dry Neutral Salts, unites with Water, and Crystallizes, and the Crystals in shooting break down the Mass, and separate from one another, so that the whole appears to fall into a fine Powder; and if one Third of the Whole consists of Lime, it is sufficient to break down the remaining Part; hence, if Limestone contain one third Part of Calcareous Earth, it may be burnt into Lime; or if it consist wholly of Calcareous Earth, and one third Part of it be burnt, it will fall down; and Lime is seldom thoroughly burnt.

ABSORBENT EARTHS

N A M E S, The Manner in which they
 are found or produced.

found in SOILS are,

Their PROPERTIES.

If Limestone contains no other absorbent Earth, except Calcareous, the Quantity of that Earth, is known by throwing one hundred Grains into an Ounce of Muriatic Acid, diluted with four Ounces of Water, letting the whole stand till there is no more Effervescence, throwing what remains into a Filter; when the Fluid has filtrated through, pouring upon what remains half a Pint of Water, letting that Filter off also, then drying and weighing what is left in the Filter, the Weight lost gives the Proportion of the Calcareous Earth.

If there be any other Absorbent Earth, upon pouring into what filtrated through two Ounces of Caustic Volatile Alkali, a Precipitation will take place; this Precipitate is also to be separated by Filtration, and its Weight deducted from the Calcareous Earth.

The Quantity of Lime burnt is known, by putting one hundred Grains into a filtrated Solution of two Ounces of Sal Ammoniac in half a Pint of water, boiling them together in a Glass,
or

ABSORBENT EARTHS

NAMES. The Manner in which they
are found or produced.

found in SOILS are

Their PROPERTIES.

or Stone Vessel, for an Hour, or until there is no smell of Volatile Alkali; taking Care to add Water as the former evaporates; afterwards filtrating what remains; after the Filtration, pouring upon what is in the Filter, half a Pint of Water, letting that Filter off also; then drying and weighing what remains in the Filter, the Weight lost is the Lime burnt.

If Calcareous Earth is found in a loose Mass, so as to break down very readily, it is with Difficulty burnt into Lime, as the Fuel can hardly burn if mixed with it; and if it is mixed with Clay, it will burn into a Brick, which will both prevent the Evaporation of the Air, and the falling of the Lime; in both these cases it is called Marle.

Calcareous Earth, when mixt with Clay, gives a greater Friability to it than Sand does; hence Marle falls easily down in Water.

Quick Lime dissolves in Water in the Proportion of about five Grains to a Pint.

ABSORBENT

ABSORBENT EARTHS

N A M E S.	The manner in which they are found or produced.
------------	--

found in SOILS are,
Their PROPERTIES.

It unites with Sulphur, forming *Hepar Sulphuris*.

It unites with Animal and Vegetable Substances, forming a Soap.

It prevents Putrefaction.

It attracts Acids stronger than Volatile Alkali or Magnesia.

If it be exposed to the Air, it attracts from it the fixable Air, and reverts to the State it was in before it was burnt.

Mild Calcareous Earth, forwards Putrefaction.

It is insoluble in Water.

When Calcareous Earth is reduced to a Powder, and applied to a Soil, it is apt to be washed through it.

Caustic Volatile Alkali will not precipitate Calcareous Earth, if dissolved in an Acid; but fixt Vegetable Alkali will; this distinguishes it from the other Earths.

Vitriolic Acid will not dissolve it so as to form a clear Solution; and if this Acid be added to a Solution of it in any other, it will make a Precipitation.

ABSORBENT

ABSORBENT EARTHS

N A M E S. The Manner in which they
are found or produced.

MAGNESIA.

It is produced by the Decomposition of any Salt containing Magnesia, by Exposure to the Air, or applying to it an Alkali, or Caustic Calcareous Earth.

EARTH of ALLUM.

It is produced by the Decomposition of Allum, and is in fact argillaceous Earth, either separated or altered, by being combined with an acid, and in a soil is to be considered as very different, as it easily unites with any Acid it may find, and forms a Salt very poisonous to Plants.

found in SOILS are,

Their PROPERTIES.

It may be had combined with Gas, or fixed Air,
or free from Gas, or fixed Air.

In both Cases it unites with

First, Vitriolic Acid, forming Magnesia Glau-
ber's Salts.

Secondly, Nitrous Acid.

Thirdly, Muriatic Acid.

It is insoluble in Water.

It assists Putrefaction.

It may be had free from Gas, or fixed Air, or
combined with Gas, or fixed Air.

In both Cases it unites with Vitriolic Acid,
forming *Allum*.

AIRS.

A I R S,

A I R is a V A P O U R not condensible in
bination.

A I R is of several Kinds, *Viz.*

N A M E S. The Manner in which they
are found or produced.

RESPIRABLE AIR.

FIXABLE AIR.

INFLAMMABLE AIR.

There are also several other Kinds of Air.

A I R S.

the Heat of the Atmosphere without Com-

Their PROPERTIES.

That which serves for the Life of Animals and
* Vegetables, and Inflammation of Fuel.

That which is contained in Alkalis, and Absorbent Earths when they are Mild. It will neither serve for the Respiration of Animals, nor Vegetables, nor the Inflammation of Fuel, but it is not poisonous.

Separates from Metals while they combine with Acids, is often found in the Earth near Mines, and is poisonous to Plants.

E Animal

* It has lately been supposed to be pernicious to Vegetables; but no dependance can be had in experiments made by making Plants grow in Glafs Bottles, or under Receivers; since we find that a Plant shut up in a Green House, 100 Feet by fifty, and covered entirely with Glafs, will not grow to any perfection, if the doors and windows are kept close shut.

Animal and Vegetable SUBSTANCES.

N A M E S. The Manner in which they
are found or produced.

ANIMAL FIBRES.

VEGETABLE FIBRES.

VEGETABLE and ANI-
MAL MUCILAGENOUS
JUICES.

BITTER, ASTRINGENT,
RESINOUS, &c. JUI-
CES OF VEGETABLES.

found in SOILS are,

Their P R O P E R T I E S.

Diffolved in Water, form a Solution, which
Jellies.

They form when diffolved in Water, a Solution which is Gummy.

They form a gummy Solution in Water, but if putrified, a Gelatenous one.

They prevent Putrefaction,

Animal and Vegetable SUBSTANCES

N A M E S. The Manner in which they are found or produced.

MUCILAGE. It is produced by the Putrefaction of Animal or Vegetable Substances and is applied to Soils in

First, The Dung of Animals.

Secondly, Putrid Animal or Vegetable Fibres or Juices.

Thirdly, The Roots of Plants, if they putrify in the Soil.

Fourthly, The Exsudation from the Roots of the Plants, growing in the Soil, if it putrifies.

Fifthly, The Insects in Soils, if they putrify.

Sixthly, The Dung of the Insects.

Seventhly, The Animal and Vegetable Substances contained in Rain Water and Dew, if they putrify.—There are two Stages of Putrefaction, the first produces Mucilage, the second converts it into Calcareous Earth, Muriatic and Nitrous Acids, and Volatile Alkali.—Vegetable Substances, before they putrify, go through the Sacharine, Vinous, and Acetous Fermentations, but Animal Substances putrify immediately.—Two, or more of these Fer-

found in SOILS are,

Their P R O P E R T I E S.

Gives Viscidity to a large Proportion of Water.

It prevents the Evaporation of Water.

It gives Tenacity to Sand, and Friability to Clay.

It cannot be separated from Water by Filtration.

Animal and Vegetable SUBSTANCES

N A M E S. The Manner in which they are
found or produced.

Fermentations, may go on in the same Mass, at the same Time; as for Example; What is already converted into Wine, may be converted into Vinegar, while another portion of the Mass is converting into Wine.—The Sacharine, Vinous, and Acetous Fermentations, generate Heat, but the Putrefactive does not.—In order that any Substance should be formed by a Fermentation perfectly, it is necessary that the Operation go on neither too fast, nor too slowly.—The Substances forwarding Putrefaction increase the Quantity of Mucilage, by making Animal or Vegetable Matters putrify, which would either not have putrified at all, or which should have putrified too slowly. But they also tend to destroy it, by making the Mucilage proceed to the second Stage of Putrefaction, and so convert it into Earth and Salts.

They tend more to forward the first, than the second Stage of Putrefaction.

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found in SOILS are,
Their PROPERTIES.

E 4

PART

P A R T III.

The STRUCTURE and OECONOMY of
VEGETABLES, necessary to be known
in AGRICULTURE.

THE principal Vessels of Plants are of two
Kinds, *Tubes* and *Cells*.

The TUBES run from the Roots to the different Parts of the Plant in separate Bundles, communicating with one another, but not joining and branching, as in Animals.

These Tubes contain principally the mucilaginous and saccharine Juices, serving for the Nourishment of the Vegetable.

The Tubes being capillary, if empty, and immersed in Water, or any other Fluid, have a Power of filling themselves by the Attraction of their Sides to the Fluid ; but this will not by any
means

means account for the Circulation in Vegetables : There is therefore a Power similar to the muscular Power in Animals, by which this Motion (at least in Part) and all the other Motions of Vegetables are performed.

The CELLS contain the peculiar Juices of Plants, and most probably these are formed in them by Fermentation: They communicate with the Tubes, or rather the Tubes terminate in them.

In the Root of a Plant the Cells surround the Tubes, which are only open at the extreme Points of the Fibres, and Fluids cannot be absorbed by them any where else.

The Tubes are not simply open at the End of the Fibres, but there is a particular Configuration, which adapts them to absorb Fluids; so that if the Ends of all the Fibres of the Roots of any Vegetable be cut off, the Growth of that Vegetable is stopped, till fresh Fibres are formed.

Unless there be a number of Fibres in the Root, a Plant will seldom flourish, inasmuch as a sufficient Quantity of Nourishment cannot be absorbed.

More numerous Fibres may be made to break out by.

A suf-

A sufficient Tenacity in the Soil;

Richness of Soil;

Cutting the Fibres; in which case they do not go on, but branch out into new ones;

Poisoning the weak Fibres, and

Cutting the Branches.

But the Fibres are rendered too weak for the Support of the Plant, by

Too great a Tenacity of the Soil;

Applying Poison in too great a Quantity;
and

Cutting the Branches too much.

As Roots can only absorb Nourishment from the Points of their Fibres, the Cells surrounding them serve to defend the Tubes from Water, which they do, if the Soil be moderately dry; but in very moist Soils, the Water soaks through to the Tubes, stops the Circulation in them, and rots them.

The Roots of some Plants will bear a much greater Quantity of Moisture than those of others.

In Trees and Shrubs, the Stems, which are above a Twelvemonth old, are to be considered as Roots, having the same Structure.

At that Part where the Root is converted into a Stem, the Tubes devaricate, and are placed on the Outside; being covered only with a thin Bark, which is of the same Texture, and answers the Purposes

Purposes of the Leaves, the Cells forming the Pith, being contained in the middle.

Water constantly evaporates from the Leaves and the Bark of the Stem, and carries along with it the volatile Parts of the Juices, and some small Portion of the more fixed; but they attract Water from the Atmosphere at the same time, so as in some Cases to nourish the Plant totally, and the Roots also throw out a Part of the Juices into the Ground.

There is a considerable Difference betwixt that which evaporates into the Air, and that which exfudes into the Ground; as the former contains Water with the essential Oil of the Vegetable, and the latter the mucilaginous Juices.

The Exfudation from the Roots takes Place in the greatest Quantity,

First, While the Leaves are flourishing, hardly any thing flowing out after they begin to decay.

Secondly, In Plants that are moderately succulent.

Thirdly, In perennial Plants, at the Time of the flowing of the Sap,

Of the GROWTH of PLANTS.

A SEED consists of

The Husk, a Membrane covering the other Parts.

The COTYLEDONS, one, two, or three
Masses of farinaceous Matter.

The EMBRYO (i. e.) the young Plant, consisting of a *Radicile* and *Plumule*.

The EMBRYO lies in a dormant State (i. e.) alive, but not exerting its Life, until it is put in proper Circumstances; which are

of { Heat,
Moisture, and
Exposure to the Air.

It requires different Degrees of these to make different Seeds grow.

The Embryo may die.

First, If a Seed once begins to grow, and is stopped, the Embryo dies.

Secondly, The Embryo may also die from Age (i. e.) if the Seeds are kept too long; and in some Seeds, this happens in twelve Months, in others not in twelve Years.

Thirdly, Or it may be destroyed by Insects.

Fourthly, Or it may undergo Fermentations from Moisture.

Fifthly, Or it may be killed by Poisons.

In all these cases the Vegetation of the Seeds is destroyed.

When a Seed is put in the proper Circumstances for growing, the farinaceous Matter in the Cotyledons is converted into Sugar, the Embryo

bryo swells, and the Radicle pushes forwards, till it gets through the Husk, and afterwards runs perpendicularly downwards, till it breaks out into Fibres.

These Fibres run in different Directions, but never penetrate above a certain Depth from the Air.

The PLUMULE, when the Radicle has got into the Earth, rises upwards; sometimes bringing along with it the Cotyledons, which are in some Cases converted into the Seed Leaves.

During this Time the Plant is nourished principally by the Cotyledons; for if the Root be destroyed, the Plumule will rise up, and when it gets above Ground, and its Leaves spread, fresh Roots will be thrown out.

If a Plant be cut off below the Cotyledons, it will hardly ever push out fresh Leaves, but it rots, and is destroyed; on the other hand, if it be cut off above the Cotyledons, it generally shoots afresh, and continues to grow; therefore, if Plants, whose Cotyledons come above Ground, as Turneps, be cut, or eat to the Ground by any Animal, they decay; but if such, whose Cotyledons remains below Ground (the Grasses for Example) are cut, they will shoot out afresh.

After

After the Plumule is come above Ground in the Grasses, there is a Knot or Swelling formed above the Cotyledons, where the Stem divides into, or throws off, several Branches and fresh Roots; and as soon as the Leaves of these spread, the first Root dies. This is called *Tillering*.

These Branches are more or less numerous, according to

- The Richness of the Soil;
- The Tenacity of it;
- The Room the Plant has to grow in;
- The Moisture of the Soil; and
- The Earliness of the Season.

Each of these Branches may be made to divide a second Time,

By sowing the Seed early in the Autumn; it in this Case branching out, in the Autumn, and again in the Spring;

- By cutting the Stem;
- By cutting the Roots;
- By Transplantation;

By great Moisture in the Soil; hence Corn, after it has flowered, will sometimes branch out a second Time after heavy Rains.

If a Grass be made to branch out a second Time, in a poor Soil, or a dry Season, the Branches are apt to run up weak.

Most

Most perrennial Plants (excepting Trees and Shrubs) become so by branching out afresh every Autumn, the old Roots and Plants dying.

ROOTS push forward with considerable Force, which however is not equal in all Parts; and a sufficient Resistance stops them, and makes them branch out laterally.

If the Resistance from the Tenacity of the Soil be too great, they break out into a vast Number of Branches, too weak to support the Plant; and if too little, they run out into long Fibres, having too few Ends or Mouths to absorb sufficient Nourishment.

The Root always runs where there is the least Resistance.

The STEMS go on flourishing more or less, according to

First, The Moisture of the Soil;

Secondly, The Heat;

Thirdly, The Soils being adapted to the Roots;

Fourthly, The Richness of the Soil, and its Freedom from noxious Substances;

Fifthly, The Time the Seed has been kept, *viz.* the shorter the Time it has been kept, the more luxuriant the Plant.

The

The STEM pushes out from it the FLOWER-STEM, which arises either laterally as the Leaves spread, as in Peas; or terminates the Stem; And in this Case either there is only one, as in Grasses; or several, as in Turneps and Cabbages.

When the Flower-Stem arises laterally, the Leaves continue to flourish after the Flower is dropped off, and of consequence until the Seed is perfected, and the whole Plant dies; but when the Flower-Stem is terminal, the Leaves begin to wither as soon as the Flower drops off. Hence, as the Nourishment is taken entirely from the Ground, without any Exsudation of any thing imbibed from the Air into it, after this Period, Grasses and other Plants having terminal Flowers, enrich the Soil till they flower; but afterwards impoverish it, perhaps in some Degree in Proportion to the Weight of the Seed.

In Grasses no new Leaves spring out from the Stem after the flowering; and those which have already sprung out, begin to lose their Juices, and decay.

GRASS should therefore be cut for Hay as soon as it is fully in Flower. Different Grasses flower sooner or later; therefore if two Grasses grow on the same Field, either one or other must be cut too soon or too late.

All

All Plants have Male and Female Parts of Generation ; the *Chives*, or Male Part ; the *Pointal*, or Female Part.

The CHIVES are Bags, containing a Powder ; they open just as the Flower opens, and the Powder impregnates the Female Part.

This Impregnation is prevented,

First, By Cold ;

Secondly, By very violent Rains ;

Thirdly, By Weakness of the whole Plant ;

Fourthly, By Weakness of the Roots ; so that in moist Soils, or very rainy Seasons, when the Plant appears to be flourishing greatly, and a sufficient Quantity of Flowers are thrown out, the Impregnation does not take Place, and the Seed or Fruit either drops off entirely, or is small and shrivelled, the Roots being rotted by the Moisture.

Fifthly, By the want of Air.

When the Leaves and Stem of a Plant flourish greatly, it seldom produces many Flowers.

In Grasses, as the Nourishment is drawn from the Roots after they flower, if the Roots are rotted by Moisture, the Seeds will not be perfected : In the ripening of the Seed, the farinaceous Part of the Cotyledon is produced.

Plants cannot live without AIR ; it produces probably the same effect in them that it does in Animals.

The Action of the Air appears to be principally on the smooth Surface of the Leaves, or the Bark of the Stem.

The Air is rendered effete * by the Plant ; so that there must be a continual Supply of fresh Air, otherwise the Stem runs out to a great Length, is exceedingly small and weak, the Leaves endeavour to spread out to a great Distance, no Impregnation takes Place in the Flowers, the proper Juices are not formed, and the whole Plant is destroyed.

Hence, if several Plants are sown in a Soil, those which are best adapted to it will grow up strongest, rob the others of the Air, and destroy them,

The Roots also require Air ; so that if a Root be planted too deep, it will not grow, and different Roots require also different Degrees of Exposition.

It is only respirable Air that will effect these Purposes.

LIGHT

* This Doctrine has been much controverted, by those who have sought the knowledge of Plants from Experiments on them, when growing under Receivers.

LIGHT is also necessary for the Growth of a Plant, but not so much so as Air.

Most Leaves have two Surfaces, one of which is always exposed to the Light; and if the other is turned to it (by altering the Position of a Branch) the Growth is frequently stopped, until the Leaves turn themselves to it again.

This smooth Side of the Leaf therefore, being that which is acted upon by the Air and Light, would appear to be that Part by which a Plant principally lives; and in many Plants the Leaves shut themselves up, so as to cover this smooth Side on Exposure to cold Air, noxious Vapour, Darkness, or even upon being touched.

The Want of a sufficient Quantity of Light, prevents the Plant from forming its proper Juices (except Mucilage and Sugar) deprives it of its Blue Colour (the Green consisting of Blue and Yellow) leaving it either Yellow or Colour-less, makes it run up weak, and prevents the Impregnation of the Seeds.

Want of a sufficient Quantity of Air and Light, more especially prevent the Impregnation of the Seeds.

HEAT in a moderate degree, according to the Disposition of the Plant, makes the Leaves flourish, and the Stem strong, provided the Soil is sufficiently moist; in a very great Degree it

makes the Plant run up to Seed too soon, especially in a dry Soil, and prevents the Growth of the Leaves.

Heat also prevents Moisture from rotting the Roots, or any other Parts of a Plant; but it increases the Effects of most other Poisons.

Plants are subject to HABITS, the principal of which are,

First, The Seed's growing early in the Spring, and the Stems pushing up soon to flower, and producing but a few Flowers: This is acquired by their having been propagated in a dry, sandy, warm Soil.

Secondly, The Seed growing late, being long of pushing up the Stem, so that there is often not Time for the Seed to ripen: This is acquired by their having been propagated in a moist, stiff, cold Soil.

Thirdly, A Disposition to grow exceedingly strong in all its Parts; in which Case too few Flowers are often produced: And this is acquired from their having been propagated in a very rich Soil.

Fourthly, Its Disposition to grow weak, and produce small Seeds, acquired from being propagated in a poor Soil.

These affect the Grasses particularly, so that it is frequently useful to change the Seed.

P A R T IV.

Of the NOURISHMENT of PLANTS.

A PLANT will grow in Sand alone, moistened with pure distilled Water, and in the purest Air, but not so luxuriantly as in a rich Soil.

A Plant will also grow better in a Mixture of Sand and Clay, where the Tenacity is adapted to the pushing Power of its Root, than in Sand alone; and it will also grow better if a proper Quantity of Water be applied, according to the Disposition of its Roots to resist Putrefaction, but with both these Advantages, it will not flourish so well as in a rich Soil.

If in a proper Mixture of Sand and Clay, a Plant is properly supplied with Water, it will

grow better than in the same Mixture exposed to the Weather, and the Chances of being too moist or too dry; but it will grow still better in a rich Soil.

There is therefore in a rich Soil something independant of Texture, or the Retention of Water, which contributes to the flourishing of Plants.

A rich Soil contains Substances insoluble in Water; or Substances soluble in Water.

The Substances insoluble in Water cannot enter the Vessels of the Roots of Plants, and therefore can only contribute either to the Texture, or the Production of Substances soluble in Water.

The Substances insoluble in Water may necessarily only be Sand or Clay; those at any Time found are,

Sand;

Clay;

Asbestos Talc; &c.

Calcareous Earth;

Magnesia;

Earth of Allum;

Calces of Metals; particularly Iron and

Copper; and

The Fibres of Vegetables.

Those

Those soluble in Water that are found in all rich Soils, are

Mucilage;
 Nitrous Ammoniac;
 Nitrous Selenites;
 Common Ammoniac;
 Fixt Ammoniac;

These Substances all get into the Plant along with the Water; and the Salts are found in the Juices of the Plant, unchanged.

A Mucilage is also found, but very different from that contained in Soils.

Therefore a Plant may be nourished by pure Water and Air alone; but it will be more luxuriant, if it also absorbs, and digests, a Quantity of Gelatinous Mucilage.

RICHNESS of the Soil depends on

First, A proper Degree of Tenacity, which is procured by

(a) A Mixture of Clay with Sand, or any other Earth, so that it shall contain between one Fourth of Clay, and three Fourths.

(b) Mucilage, which gives Friability to the Clay, and Tenacity to Sand.

(c) The Quality of the Clay, the more diffusible it is in Water, it gives the better Texture to the Soil.

Secondly, The Quantity of Mucilage, the more there is in a Soil, the better,

One Grain in a Thousand will be of Advantage, as it will give a sensible Tenacity to a sufficient Quantity of Water, to moisten the Soil thoroughly.

Thirdly, The Quantity of Substances capable of being converted in Mucilage,

(Vide Mucilage, Page 46.)

Fourthly, The Matters in the Soil disposing these to be converted into Mucilage,

These are,

Calcareous Earth;

Earthy Salts.

If a Soil be Rich, a small Proportion of an Alkali, Neutral Salt, Caustic Calcareous Earth or Earthy Salt (except the Salts of Allum) will improve it, but these Substances, unless they be Putrescents, hurt Plants growing in a poor Soil.

These Substances may be said to be *forcers*, in as much as they not only tend immediately to produce a large Crop, but destroy the Mucilage.

They may act by destroying the weak Fibres of the Roots, and occasioning them to push out more numerous and stronger Ones.

They may prevent the Evaporation of the Water.

They

They may destroy Insects.

Possibly, they may assist the Digestion of the Plant.

A very small Proportion of them produces an Effect.

In manuring poor Soils, we are therefore to render them of a proper Texture, by adding Clay or Sand, where it can be done sufficiently cheap, taking care that they be free from Pyrites, and it is to be observed, that less Clay will be useful in sandy Soils, than Sand in Clay Soils.

FROST by the expansive Power of the Crystallization of the Water, breaks down the Masses, which form in stiff Soils.

We are to apply Gelatinous Mucilage, or Substances from whence it may be formed, or Substances forwarding the Formation of it.

(Vide Mucilage, Page 46.)

These are enriching Manures.

And in rich Soils, we may venture to apply the forcing Manures, as otherwise we should not have the whole Effects of the Mucilage.

Any Defect of Texture may be made up by Mucilage, and the Alteration Clay undergoes on Culture, but the Defect of Mucilage cannot be made up by Texture.

A Soil

A Soil, if it have all the Properties of a rich one, may have these counteracted by its containing poisonous Substances, which are,

First, Metallic Salts, or Pyrites.

Secondly, Salts containing Earth of Allum, (or Pyrites.)

Thirdly, Acids uncombined.

Fourthly, Any other Salt in too large a Proportion.

The first, second and third may be destroyed by Quick Lime; the fourth is got the better of by Time, and the washing the Soil with Water, by the Rains, unless there be a fresh Supply from Springs.

The Advantages of draining a Soil, are the preventing the Water from

Rotting the Seeds.

Rotting the Roots, especially at the Time of flowering.

Taking off the Effects of the Mucilage by too great Dilution.

The Advantages of FALLOWING are,

The Conversion of the Vegetable Fibres into Mucilage, by destroying their Life, and exposing them to the Air.

The

The destroying Weeds, by giving their Seeds an Opportunity of growing, killing them, and converting them into Mucilage.

The decomposing Pyrites, and Metallic and Alluminous Salts.

A very poor Soil will be but little benefited by Fallowing, in as much as there is nothing contained in it capable of being converted into Mucilage, except the Rain Water, it is better to employ an enriching Crop.

Fallowing for several Years would destroy a Soil, as it would convert the whole putrescent Substances into Mucilage, and that Mucilage into Salts, and these would be decomposed.

The Advantages of DRILLING are,

The giving an Opportunity to destroy the Weeds, cut the Fibres of the Roots so as to make them branch out again, and loosen the Earth about the Roots, and throwing the Earth on the Stems, so as to make fresh Roots break out.

The saving superfluous Seeds and sowing the Ground more equally.

The giving a free Passage to the Air.

It is not yet determined how far the Rows should be from one another, nor how thick the Plants should be sown; it will require that they should be sown thinner to produce a great Crop
of

of Seeds; or Roots, than a great Quantity of Herbs.

Quere, Is there any Difference in the Direction of the Rows ?

Enriching Crops are such as supply the Soil with Matters capable of being converted into Mucilage, they do this

First, By Exfudation from the Roots,

Secondly, By leaving the Roots, which will putrify.

Thirdly, If ploughed in, the whole Plant will putrify; and it is to be observed in this Case, that the Plants would always be cut down when in full Vigour, and while the Exfudation is still taking Place strongly.

If the Juices exfuded are very astringent, they counteract the good Effects of this Method of Culture by preventing the Putrefaction.

A List of M A N U R E S.

First, Those furnishing Mucilage or Substances convertible into it.

As, 1, Glue,

2, Skins,

3, Hair,

4, Horns,

5, Bones,

Rags,

6, Rags, &c. &c.

7, Dung of Animals,

8, Insects,

9, Vegetable putrified Substances; these go through the Sacharine, Vinous, and Acetous Fermentations first; so that a Dunghill is not sufficiently putrified, until the Heat is over; but it is better to putrify too little, than too much, as in the first Case, the Putrefaction may be continued in the Soil; in the second, the Mucilage is converted into Salts, and cannot be restored.

Putrescible Vegetable Substances: It is to be observed that Vegetable Substances that are of too solid a Texture, as Wood, putrify with great Difficulty into a Mucilage, and also those that have astringent Juices, and such as have lain in the Earth a considerable Time, and Sugar,

Enriching Crops.

Secondly, Manures converting putrescible Substances into Mucilage.

1, Calcareous Earth, as

2, Marle,

3, Chalk,

4, Effete Lime:

5, Earthy Salts, in

a The Dung of Fowls, Rabbits, &c.

Too

b Too putrid Dunghills,
c Sea Water in small Quantity,
 Thirdly, Forcing Manures, as,
 Quick Lime,
 Fixt Alkalis in Vegetable Ashes,
 Neutral Salts which do not assist Pu-
 trefaction,
 Earthy Salts as above.

Of I N S E C T S.

There are some Insects which infest Vegetables when healthy, as the Insect occasioning the Smutt, or Blackness, in Grain: this Insect is not destroyed by drying, but revives upon being moistened, and if sown with the Seeds, will be propagated over the whole Field.

Q. Is this to be destroyed by steeping the Seeds in Solutions of Neutral Salts in Water?

Most Insects attack Plants, in consequence of a Weakness of the Plants themselves; the Juices in that Case being converted into Sugar, become proper Nourishment for, and attract them, but when this happens, they afterwards hurt the Plant greatly.

Each Plant is infested by its particular Insects.

P A R T V.

SUBSTANCES necessary for the
Examination and Analysis of SOILS,
are,

FIRST, Vitriolic Acid,
Secondly, Muriatic Acid,
Thirdly, Solution of fixt Vegetable Alkali in
Water.

Fourthly, Common Caustic, or Caustic fixt
Vegetable Alkali.

Fifthly, Caustic Volatile Alkali, or Spirit of
Sal Ammoniac with Quick Lime; it is known
to be Caustic by not effervescing with an Acid.

Sixthly, Sal Ammoniac.

Seventhly, Galls.

Eighthly, Pure Water, if the Water contain
any Metallic or Earthy Salt it is improper; to
try this, pour into a Glass of it a few Drops of
Solution

Solution of fixt Vegetable Alkali in Water; if it be impure, the Alkali will precipitate the Metal or Earth; such Water is to be purified by Distillation or Boiling.

PROCESSES for ascertaining the Substances contained.

Process First, To ascertain the Quantity of Water.

Take one hundred Grains of the Earth, spread it on a Stone Plate very thin before the Fire, or in the Sun-shine in a warm day, let it lie till it be thoroughly dry, the Water will evaporate, and therefore its Proportion will be known by the Weight lost.

Secondly, To know if there be any Metallic or Earthy Salt.

Take about a Pound of Soil, pour upon it about a Pint of boiling distilled Water, stir them thoroughly together, and let them stand for ten Minutes, filter off the Water through filtrating Paper, pour into what comes through a little of the Solution of the fixt Vegetable Alkali in Water, if there be any Earthy or Metallic Salt, a Precipitation will take Place.

Thirdly, To know if the Salt contained has Calcareous Earth for one of its Elements.

Take the filtrated Solution, pour into it half an Ounce of Caustic Volatile Alkali, or continue

to

to drop in this Alkali till no further Precipitation takes Place, afterwards filtrate it, and pour to what filtrates through, a little Solution of fixt Vegetable Alkali; if there be any further Precipitation, it shows that there is an Earthy Salt consisting of Calcareous Earth for one of its Elements; if a Precipitation took Place upon the Application of the Caustic Volatile Alkali, it shows that there are either other Earthy or Metallic Salts.

Fourthly, To know if the Salt contained be Metallic or Aluminous.

Add to the filtrated Solution an Infusion of Galls, if there be any Metallic or Aluminous Salt, a Precipitation will take Place, if Iron a purplish Black, if Copper, or Allum, a Grey.

Copper may also be distinguished from Iron by falling in a blue Precipitate upon the Application of an Alkali, while Iron forms a Greenish, and Allum a White one.

Fifthly, To know if Magnesia be an Element of the Salt found.

Take the filtrated Solution, apply to it a Solution of Galls; if no Precipitation take Place, apply Caustic Volatile Alkali, which will precipitate the Magnesia if it be an Element of the Salt contained.

G

Sixthly,

Sixthly, To know if a Neutral Salt be contained.

Evaporate the filtrated Solution with a boiling Heat, till the whole Water is nearly gone off, and let it stand to cool. If there be any Neutral Salt, it will crystallize.

Seventhly, To know if there be any Mucilage, and what Quantity.

Take thirty or forty Pounds of the Soil, boil it in ten Gallons of Water for an Hour, let the Earth subside, pour off the clear Solution, afterwards add four or five Gallons of Water to the Earth, stir them thoroughly, let them stand to subside, pour off the Water clear, mix it with the former, and evaporate the whole to dryness, putting it into a Water Bath towards the End of the Evaporation; what remains is the Mucilage, making Allowance for that part of the Decoction which was not washed out from the Earth, and deducting the Saline Substances which will crystallize if there be a considerable Quantity, but will be destroyed in the Operation if in small Proportion, as they generally are.

Eighthly, To know if there be any Calcareous Earth in the Soil, and what Quantity.

Take one thousand Grains of the dry Soil, apply to it half an Ounce of Muriatic Acid and four Ounces of Water in a Glass, Stone Ware,

or Porcelain Vessel, sufficiently large; let them stand together till no more Effervescence takes place and if it was very considerable, pour in half an Ounce more of the Acid, let this stand also till the Effervescence ceases, if any arose upon pouring it in, continue to add more Acid in the same Manner, until what was poured in last, produces little Effervescence, which is often at the first, and generally at the second or third half Ounce.

After the Effervescence has ceased, put the whole in a Filter, let the Solution filtrate through; pour half a Pint of Water upon what remains in the Filter, let that filtrate also in the same Vessel; add to the Solution thus filtrated an Ounce and an Half of Caustic Volatile Alkali for every Ounce of Acid used; if any Precipitation take Place, there is Magnesia, Earth of Allum, or the Calx of a Metal (generally Iron or Copper) contained in the Soil; after adding the Volatile Alkali the whole is to be thrown into a Filter again; after the Filtration has taken Place, pour into the Liquor a Solution of mild fixt Vegetable Alkali in Water; if there be any Calcareous Earth in the Soil, a Precipitation will take Place; continue to add the Solution of the Alkali till no fresh Precipitation ensues, throw the whole into a Filter, let the Liquor filtrate off, pour on by De-

grees a Pint of Water, let that filtrate off also, dry what remains in the Filter, it is the Calcareous Earth.

Ninthly, To know the Proportion of Sand and Clay.

Take what remains in the Filter after the first Solution in the foregoing Operation, and by Elutriation separate the Sand from the Clay, dry and weigh them: If there be any Pyrites it will appear in the Sand.

In the above Processes the principal Things to be attended to, are,

Whether there be any Metallic, or Alluminous Salts, as these are absolute Poisons, and therefore are to be decomposed by Quick Lime.

Whether there be such a Proportion of Neutral or Earthy Salts as to be hurtful, in which Case, the Solution in *Process* (Second,) will taste Salt, a Soil containing them in so large a Proportion, will hardly ever admit of Culture for Grain.

Whether there be Calcareous Earth, and in what Proportion, as that ascertains the Propriety of applying any Manure containing it, and the Quantity of that Manure.

What

• What the Proportion of Sand and Clay is which ascertains the Propriety of adding Sand or Clay.

• Whether there be Pyrites as that shows why, and when a Soil will be long of being brought into Cultivation.

PYRITES are best destroyed by Fallowing, and afterwards applying Lime,

EXPLA-

EXPLANATION of the PLATES.

FIG. I.

FROM Experiment it is found, that Bodies upon cooling contract and retain their Shape; therefore that they contract in every Direction.

Suppose A A A B B B to represent the Section of a Sphere, the Diameters A B upon the Sphere's being cooled, become equally shorter in all their Parts; but if the Particles lying in the Direction of these Diameters touched, they could not come nearer, and the Diameters could not contract, it is evident that the Particles do not touch.

FIG. II.

The Particles O O of the Oil, attracting one another stronger than they do the Particles W W, &c. of the Water, form a Globule G G, surrounded by the Particles W W, &c. of the Water.

FIG. III.

The Particles S of the Serum, attracting the Particles W of the Water, as strongly as they do one another, they intermix together equally.

F I G. IV.

Suppose N a Sphere of Iron immersed in Water, it would be surrounded by the Particles of Water W W, &c. in order to sink through the Water it must separate the Particles D D from one another, and therefore must overcome their Attraction, and it must slide along the Particles C B and therefore that Friction must also be overcome. If therefore the Difference of specific Gravity should not be sufficient to overcome these Resistances, the Sphere would swim. But the resistance of the Attraction of the Particles D D will be the same nearly in a large and a small Sphere, and the total Difference of the Gravity of a small Sphere and an equal Bulk of the Fluid, will be less than the total Difference of the Gravity of a large Sphere and an equal Bulk of the Fluid; if therefore you could diminish the Sphere until that Difference is less than the Attraction of the Particles D D it would swim.

F I G. V.

As the Particles of Bodies do not touch but adhere by Attractions, and Repulsions, they may be considered as acting at the Sphere, where their Attractions are in Equilibrio. If there be four Particles P P P P, they may be considered as producing their Effects at the Spheres A A A A.

F I G. VI.

When two Particles P P are chemically combined, they may be considered as united at the chemical Sphere of Action C, and now to have acquired one common Sphere of Mechanical Action M, their former Spheres of Mechanical Action being lost during their chemical Combination.

F I G. VII.

Thus a Particle of Volatile Alkali, may unite chemically with a Particle of an Acid, forming Sal Ammoniac, in which they have one common Sphere of Chemical Attraction, at which they may unite with Copper, and when so combined, the three Particles acquire one Sphere of Mechanical Action.

F I G. VIII.

Substances evaporate more or less readily according to the Pressure on their Surface; suppose therefore, that a Fluid consists of Rows of Particles A B C, the upper Row A has only the Pressure of the Atmosphere, but the next Row B, has both the Pressure of the Atmosphere, and the Pressure of the upper Row, therefore the upper Row A will evaporate most readily, and as boiling Fluids are heated equally, and it will require a greater Heat to evaporate the Row B than the Row A, the whole Evaporation will take place from the Surface.

APPENDIX

A P P E N D I X

FOR THE USE OF

PRACTICAL FARMERS.

THERE are Five Earths, *viz.* 1st, Sandy. Earths,
—2d, Clay.—3d, Magnesia.—4th, Earth
of Allum.—5th. Calcareous Earth.—The Three
last are called Absorbent Earths.—The Magnesia
and Earth of Allum are seldom found in Soils
uncombined with an Acid Substance.

The Calcareous Earths are *Marle*, of all Sorts,
Limestone, *Chalk*, Marble, and the Earth formed
of the Bodies of all Animals, sometimes called
Animal Earth : Most Calcareous Earths are sup-
posed to be formed originally from Shells.

Sand, Clay and Water, form within a mere
Trifle of what we call Earth or Soil ; for any
other Ingredient that may be therein are in a mighty
small Proportion to the Sand, Clay and Water.—
These are the great compotent Parts, whatever
Colour or Texture the Soil may happen to have.

Mucilage is a Substance which is converted into Mucilage.
the Nourishment of all Plants whatsoever ; it is
formed from the Putrefaction of Animals or Ve-
getable Substances ; it is formed also from Dung
from Dew—or Rain-water putrified.—Plants,

H

while

while their Leaves flourish, discharge Juices from their Roots capable of being converted into a Mucilage.—The Succulent Plants, such as, Pease, Beans, Turnip, Cabbage, &c. yield much Matter for Mucilage to the Ground.—Quick-Lime, and rolling the Ground with a heavy Roller, destroy numberless Insects, which afterwards putrify, and yield Matter for Mucilage.

Mucilaginous Juices--are of two Kinds,--*One*, when dissolved in Water forms a Sort of Jelly, and is an immediate Manure.—Most Animal Substances are of this Sort.—The *Other* Kind dissolved in Water makes a Gummy Liquid as Sugar does.—This Kind must putrify before it becomes a Manure.—Most Vegetable Substances are of this latter Kind.

Putrefaction has two Stages.—The First converts Animal or Vegetable Substances into a Mucilage.—The Second converts that Mucilage into one, or, more Species of Salt.

How
Marle or
Lime be-
nefit or
exhaust
Land.

Marle, Lime, or any other Calcareous Earth applied to Land, acts in this Manner.—They hasten the Putrefaction of all Putrescible Substances in a Soil,—consequently, if there be not added at least a proportionable Quantity of Dung, well mixed, containing Mucilage, they must infallibly exhaust Land ;—for they convert all the putrescible Matter therein to Mucilage, much sooner than it would be otherwise converted :—This will at first make the Land produce much greater

greater Crops than usual, there being so much additional Food prepared for the Plants; but after one, two, or three Years at most, those heavy Crops will have consumed most Part, if not all the Mucilage; and the little that may remain is converted into Salts, by the second Stage of Putrefaction as above-mentioned, which Salts in a little Time are rendered of no Effect, or if they have any Effects, they are hurtful to Vegetation, if without Mucilage, and by this Means, the Soil becomes quite exhausted, and a mere Caput Mortuum.—Another Benefit Lime, &c. yield to Land is, That if there be an Iron, Copper, or Sulphur (which are poisonous to Plants) dissolved in the Acid Juices of the Soils, Lime, Marle, &c. will attract that Acid, and let go the Iron, &c. which, when become solid in a Heap, can do no Harm to Land.

Plough the Land as deep as possible, so as to bring up a new Body of Mould before Winter; then *Fallow* it well the ensuing Summer and Autumn, that every Part of it may be exposed to the Winter and Summer Air; dung it strongly, then sow a Crop of these Plants that yield most Mucilaginous Matter (as above-mentioned) and before their Leaves have done flourishing, plough in that Crop.—If this be done exactly as here described, the Land will acquire a new Stock of Nourishment, and come into good Heart again:

The Remedy for Land exhausted by Lime, &c.

Properties
of Muci-
lage.

Diffolved in Water, and applied to Plants, it makes them grow Luxuriant.—In a moist Soil, it jellies the Water, and prevents it from soaking through the Sides of the Roots of Plants.—In a dry Soil it prevents the Water from being exhaled; it gives Tenacity to a Sandy Soil, and Friability to a Clay Soil: It is converted into the Juices of Plants, and nourisheth them.

Proporti-
onal Parts
of a good
Soil.

It is presumed they may be as follows.—Either One-fourth Sand, and Three-fourths Clay:—Or Three-fourths Clay, and One Sand: this is including Water, Calcareous Earth, Mucilage, Salts, &c. in the Mass of Earth you examine:—For Instance,

In 400 Grains of Good Soil, there may be,
Sand,——Clay,——Water,——Calc. Earth,——Mucila.——Total.
72 } 219 }
or } or } —100 — 7 — 1 — 400
219 } 72 }

N. B. The Quantity of Mucilage to do real good to a Soil, must bear a certain Proportion to the Quantity of Water, as in the above Instance, there is *one* Grain of Mucilage to 100 Grains of Water.—Hence observe, the Necessity of thoroughly draining Land; for if there be the greatest Quantity possible of Mucilage in your Soil, yet, if the Water should exceed its due Proportion, all the Mucilage is lost, and of no Effect, by the Mucilage not having the
Power

Power to give the necessary Degree of Tenacity and Consistence to the Water.

Manures are of two kinds. *One* adds Nourishment to the Soil, as all Animal and Vegetable putrescible Substances from whence Mucilage can be found.—The *Other* gives no Nourishment to the Soil but forces it, by preparing the Nourishment already there.

Manures
are of two
Kinds.

Forcing Manures are of two Kinds.—One resists Putrefaction, the other forwards it:—That which resists, is several Sorts of Salt in the Ashes of burnt Vegetables, in Soot, Dung of Fowls, some in Horse Dung, if it be not too putrid, and in Sea-Water, &c.—Also Quick-Lime is a Resister of Putrefaction;—the Way in which these act, is to kill the weak Fibres of Plants, and thereby force them to shoot out stronger Ones; they also facilitate the Digestion of Plants; they dissolve in Water, and prevent it from evaporating too easily; they destroy Insects.

The other Sort of Forcing Manures which forward Putrefaction, are certain Salts formed from Calcareous Earth, and Spirit of Sea Salt, or Oil of Vitriol.—All Marle, or Lime-stone, six or eight Months after being burnt, forward Putrefaction, and turn all putrescible Matter in a Soil into a Mucilage; likewise Dung over-putrid is a forcing Manure, that forwards Putrefaction from the Salt in it.

N. B. Lime when burnt discharges all its fixed Air, but after five or six Months it imbibes again

again the fixed Air, and reverts to its former State of unburnt Lime.

From what has been said with Respect to the Action of Marle, and all Calcareous Earths, it will plainly appear, that if there be little, or no putrescible Matter in a Soil to convert into Mucilage, it can have no effect at all (except to prevent the poisonous Effects of Metal) on the Land.

Fermen-
tations in
a Dung-
hill,

Salts are not converted into the Nourishments of Plants as Mucilage is; the richer the Soil the more Effects it will have.—As to all Acid and Metallick Salts, and Salt of the Earth of Allum, they are poisonous to Plants. Fermentations in a Dunghill are Five.—The *First* makes the Juices sweet;—the *Second* makes them Spirituous like Wine;—the 3d, Sour like Vinegar;—the 4th and 5th, are of the putrefactive kind above-mentioned.—During the three first, the Dunghill heats, but when the 4th, or Mucilaginous Putrefaction begins, the Mucilage forms, and the Dunghill grows cold (that is the proper Moment for laying the Dung upon the Land, though it is better to lay it on too soon than too late) after this, the last Fermentation begins, in which the Mucilage is converted into Salts.—Great Care should be taken, by frequently mixing the whole Mass of Dung well together, that every Part of it may as far as possible, be in the same Stage of Fermentation, lest some should arrive

arrive at the last Stage, *viz.* the Salts, before the other Parts are become Mucilaginous.—This happens very frequently, where Dung and Lime are laid in Strata in a Dunghill, and not well mixed throughout the Mass, much of the Benefit of it is thereby lost.

Most Plants used in Agriculture, that do not Plants. branch out at the Side above Ground, generally do it below Ground, as all Corns and Grasses do.—Feeding Corn, or bruising the Tops of it with a Roller, makes it branch out below Ground.

All Perennial Grasses continue such, by branching out anew every Year, for the old Root always dies.

Whenever a Plant becomes weak, its Juices are converted into Sugar, which allures Insects to come, and lay their Eggs there; hence Blights, &c.

Plants absorb Nourishment by their Leaves, as well as by their Roots; and whilst their Leaves are flourishing, they discharge into the Ground a Part of their Juices; and until they begin to flower, they discharge a greater Quantity than they receive from the Earth, consequently till then they enrich the Ground.—Plants that have lateral Flowers, such as Pease, Lupins, &c. continue to flourish during all the Time of Flowering, which is till the Seed is ripe.—Plants that have terminal Flowers, as Corn and Grasses, have their Leaves wither by Degrees in a few
2 Days,

Days, as the Flowering advances, and from that Period they absorb all their Nourishment from the Ground to perfect their Seed, and yield no Nourishment to the Ground.—Seeds taken from Plants in a rich Soil, branch out more than those taken from Plants in a poorer Soil—No Plant robs another of the Food it takes in by the Root; but, on the contrary, gives it more Food; for the Ground is kept the moister, the more Plants there are; but Plants by being too close rob one another of what they receive from above, *viz.* Air, Sun, Dews, Rain, &c.

There is always the greatest Crop of Hay if cut when the Flowering begins to open, for then there is a greater Quantity of Nourishment in the Plants, than either before, or after that Period.

Plough-
ing.

Amongst the numberless Advantages that attend a thorough Ploughing, &c. pulverizing of the Soil, there are two most certain; one is, that if there be any poisonous Qualities in the Soil, arising from Metals or Sulphur, you infallibly destroy them, by turning them up to the Air.

The Second is, that you open the Way for the Fibres of Plants to go in Quest of their Food, and thereby render them strong and vigorous.

F I N I S.

Fig. 1st

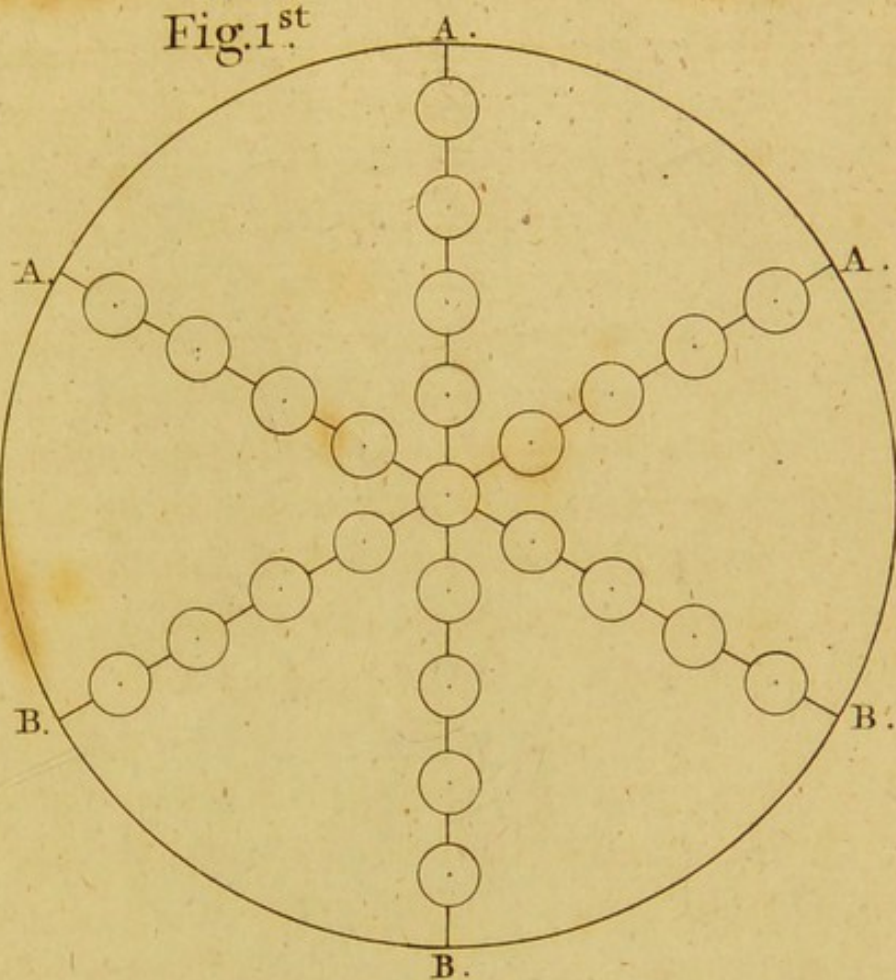
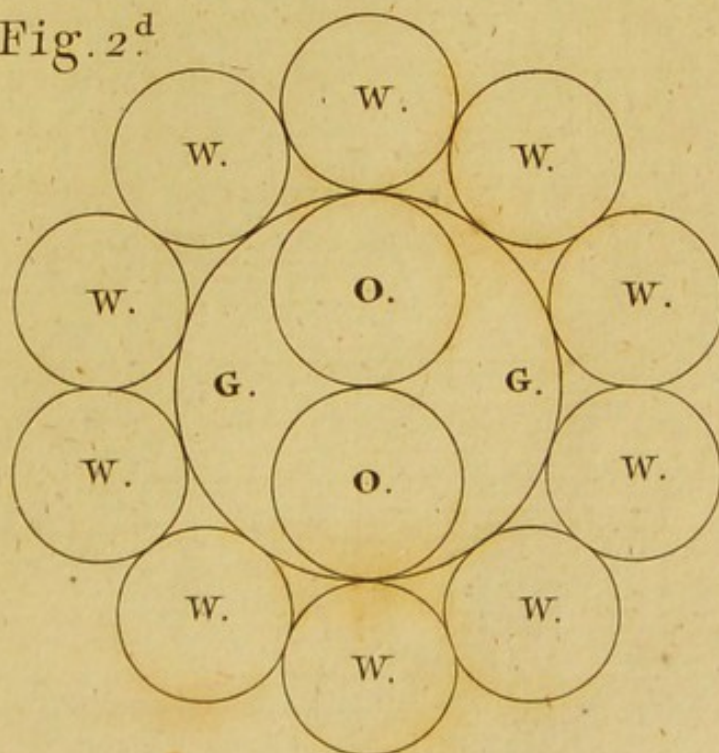


Fig. 2^d



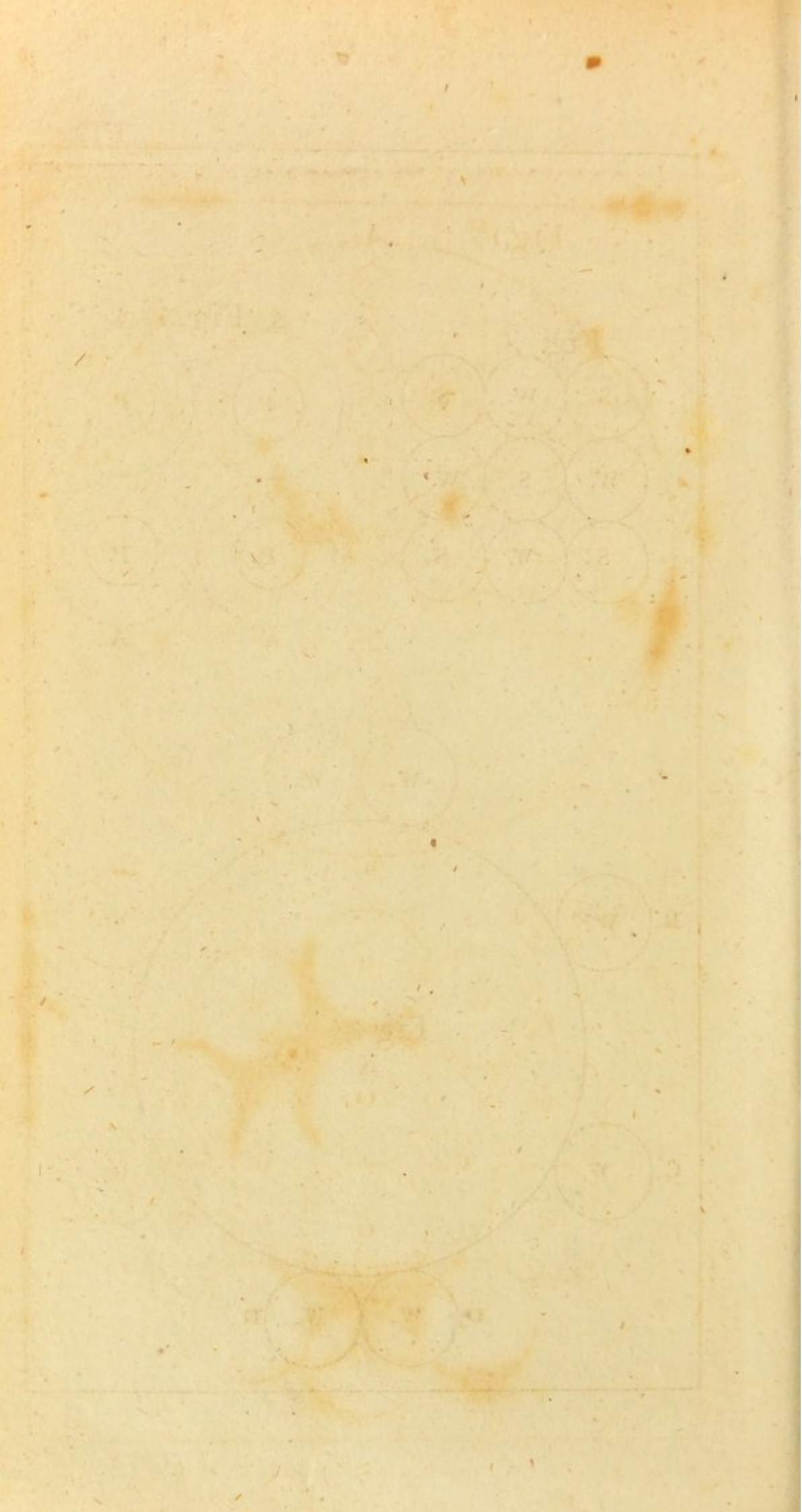
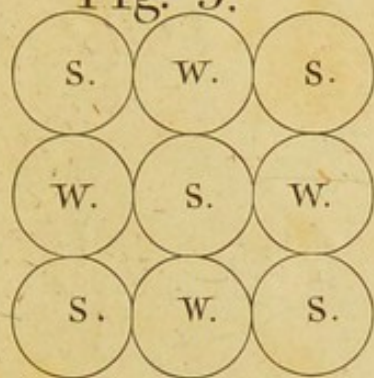
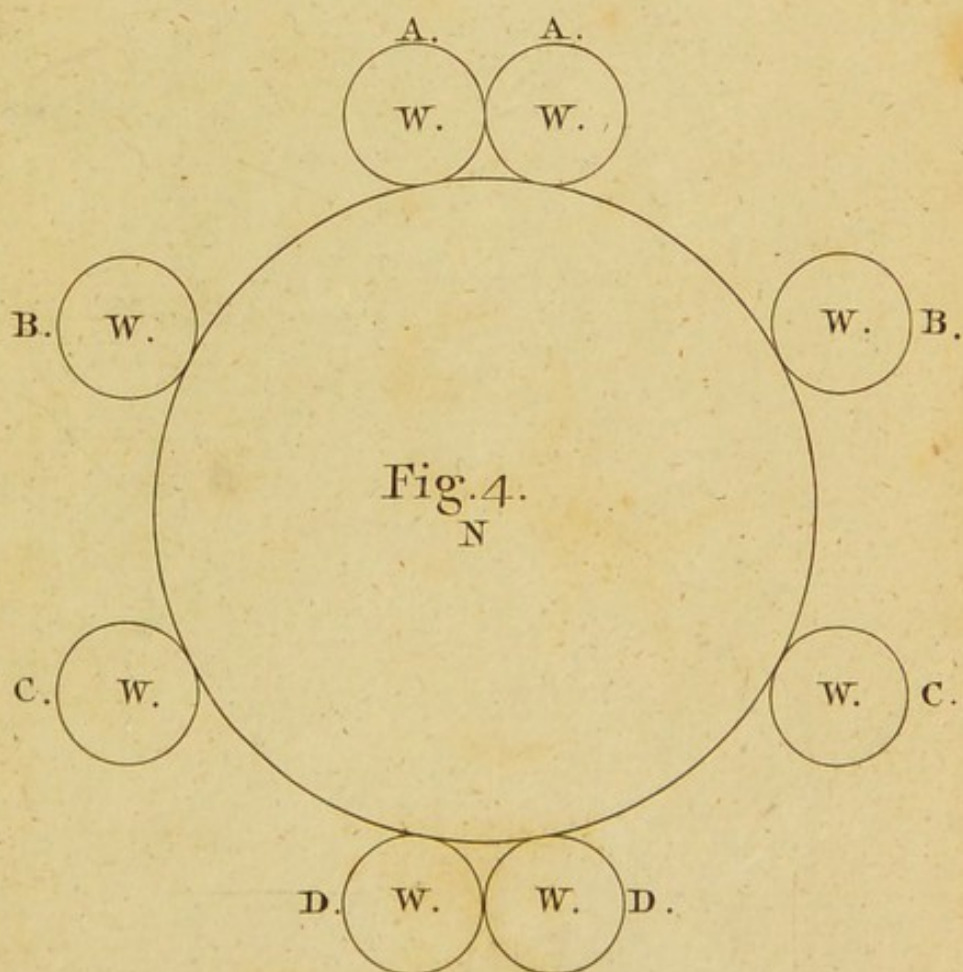
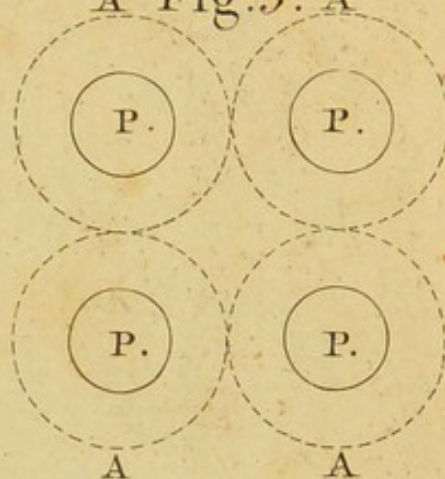


Fig. 3.



A Fig. 5. A



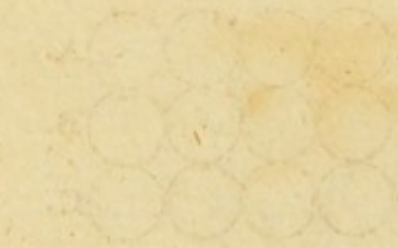
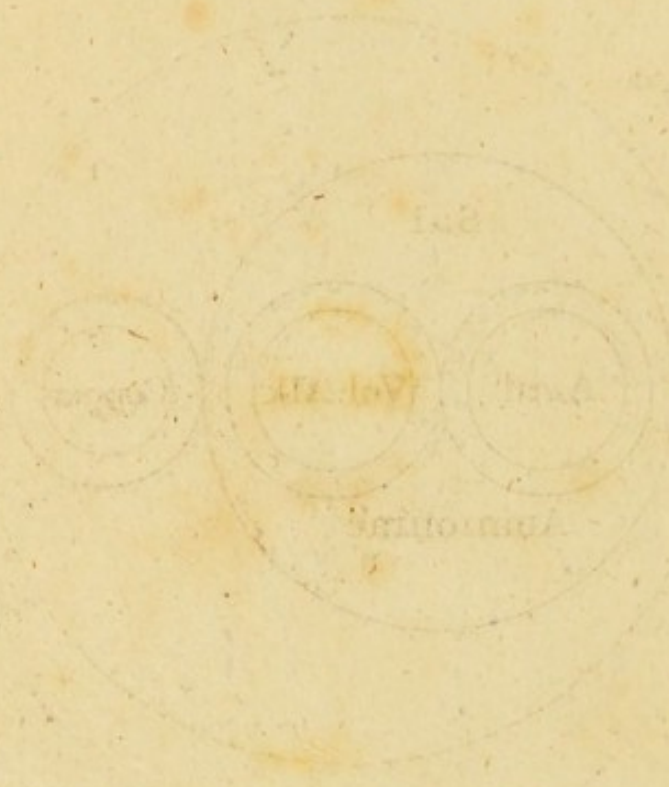
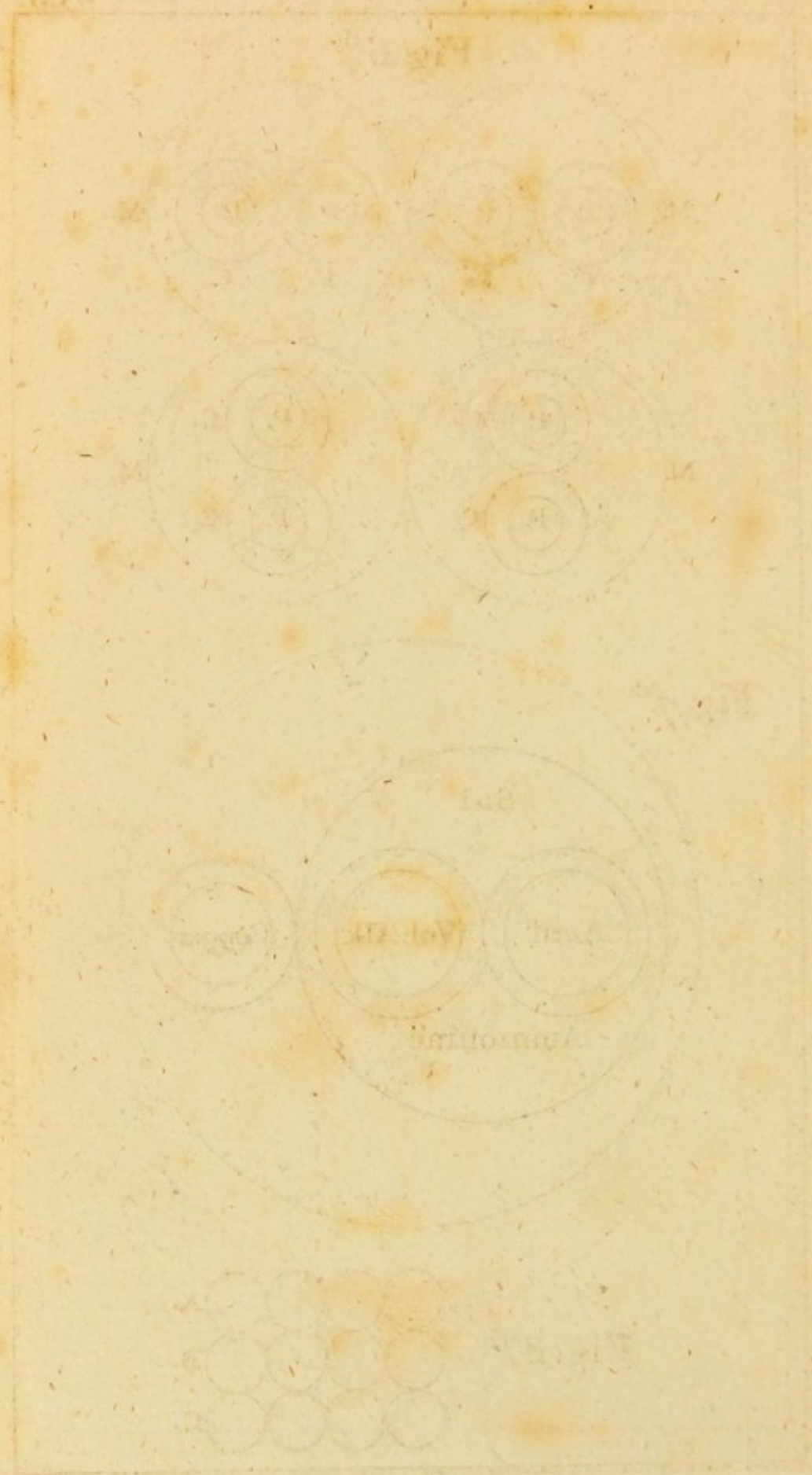
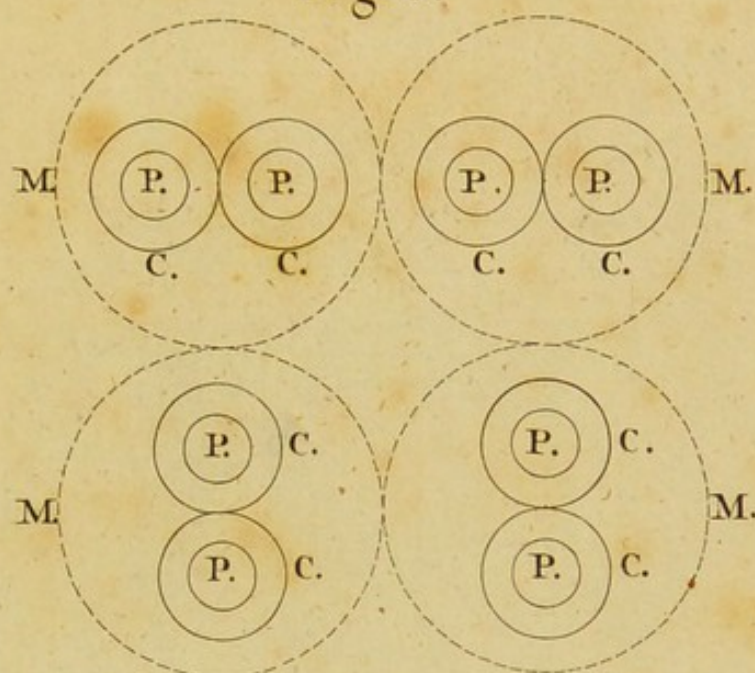
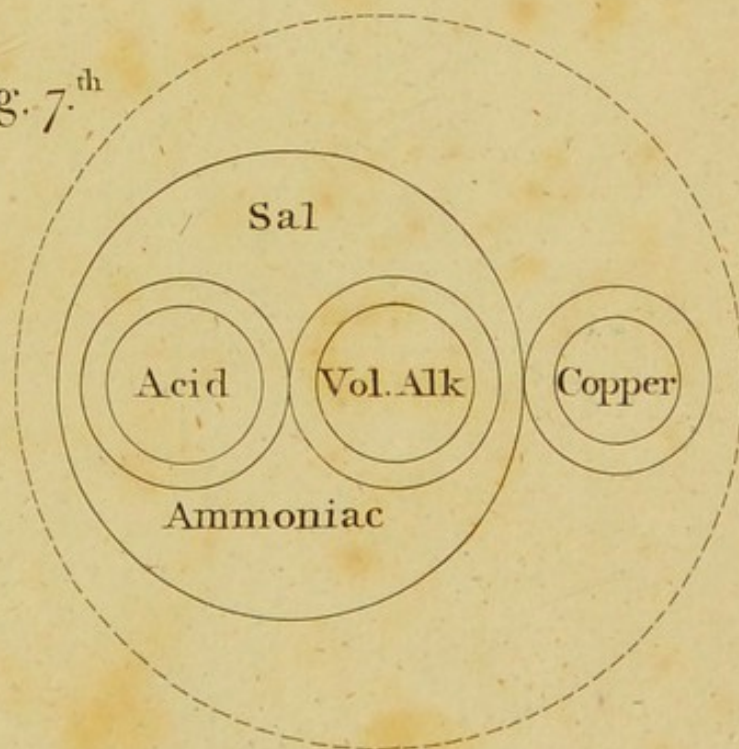
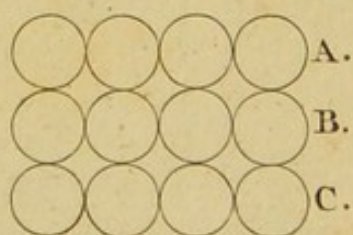
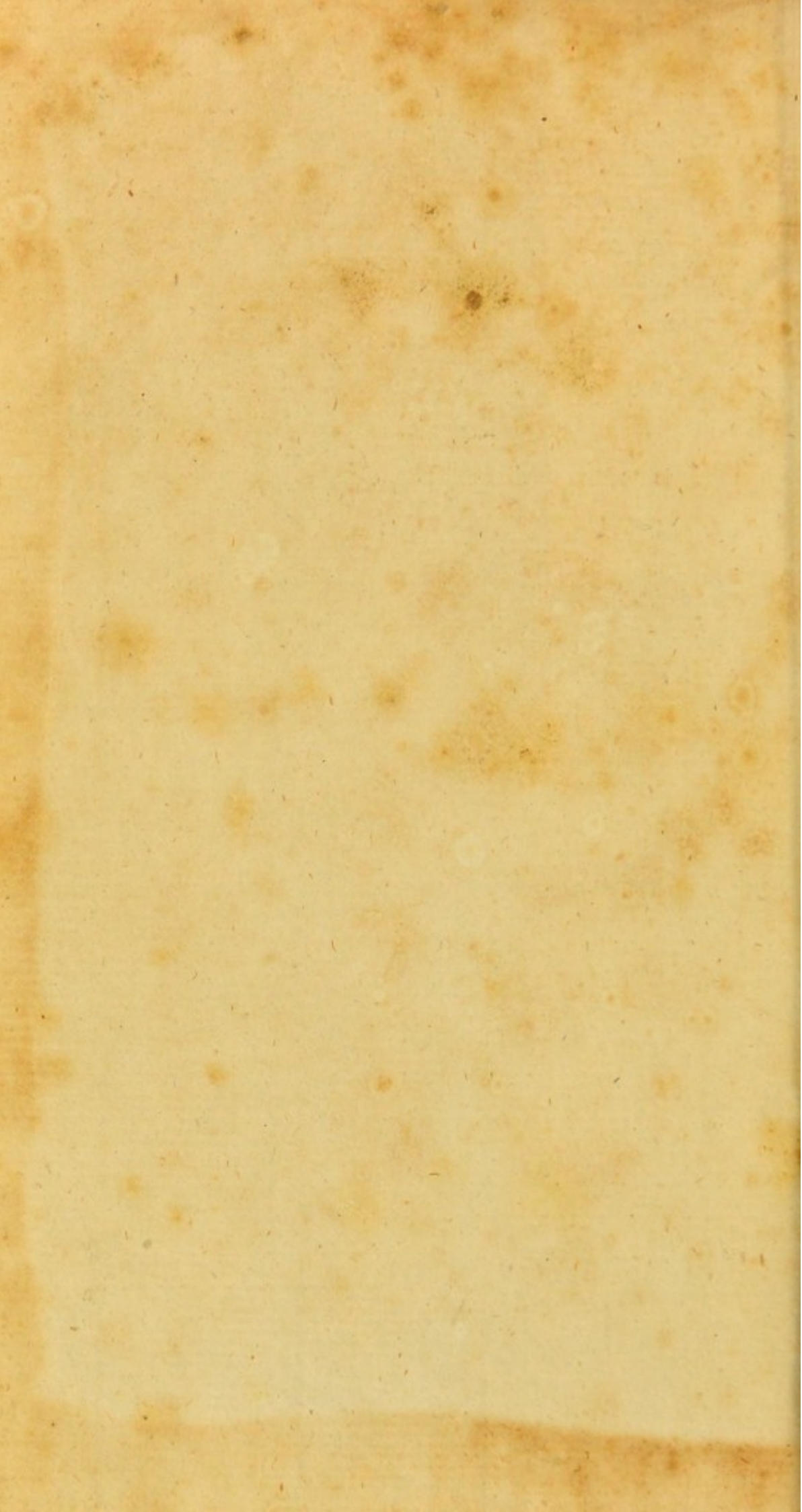


Fig. 6.thFig. 7.thFig. 8.th







Sum 7/83

$\frac{20}{7} \text{ D}$
 $\frac{79}{79}$
 $3/54 \text{ D}$

$\frac{1}{1}$

