

The student's chemical pocket companion / by W.S. Jacobs, M.D.

Contributors

Jacobs, William Stephen, 1770-1843.
National Library of Medicine (U.S.)

Publication/Creation

Philadelphia : Printed for the author, by S.W. Conrad, Pewter-Platter Alley, 1802.

Persistent URL

<https://wellcomecollection.org/works/guc57nxv>

License and attribution

This material has been provided by This material has been provided by the National Library of Medicine (U.S.), through the Medical Heritage Library. The original may be consulted at the National Library of Medicine (U.S.) where the originals may be consulted.

This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

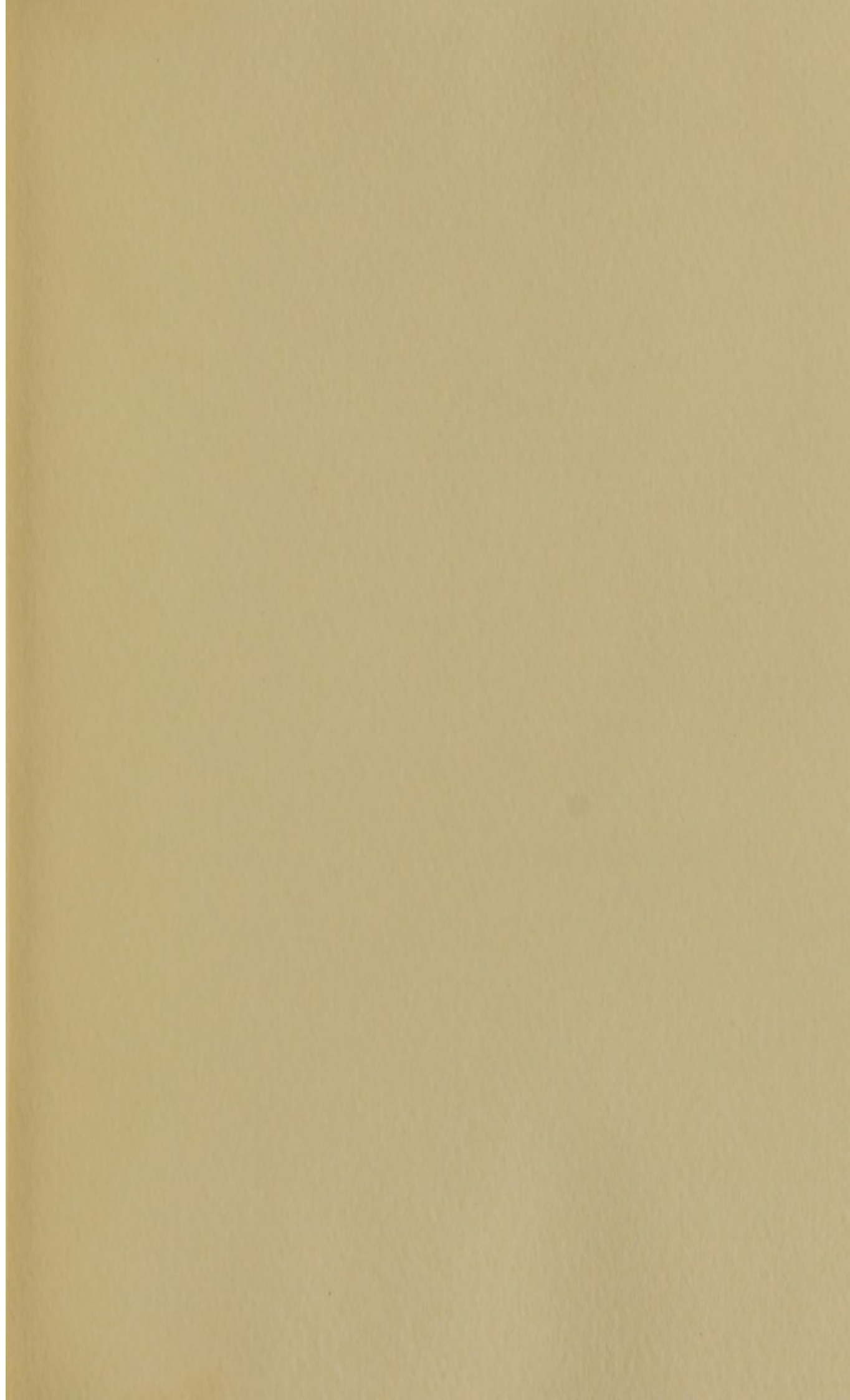
You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.

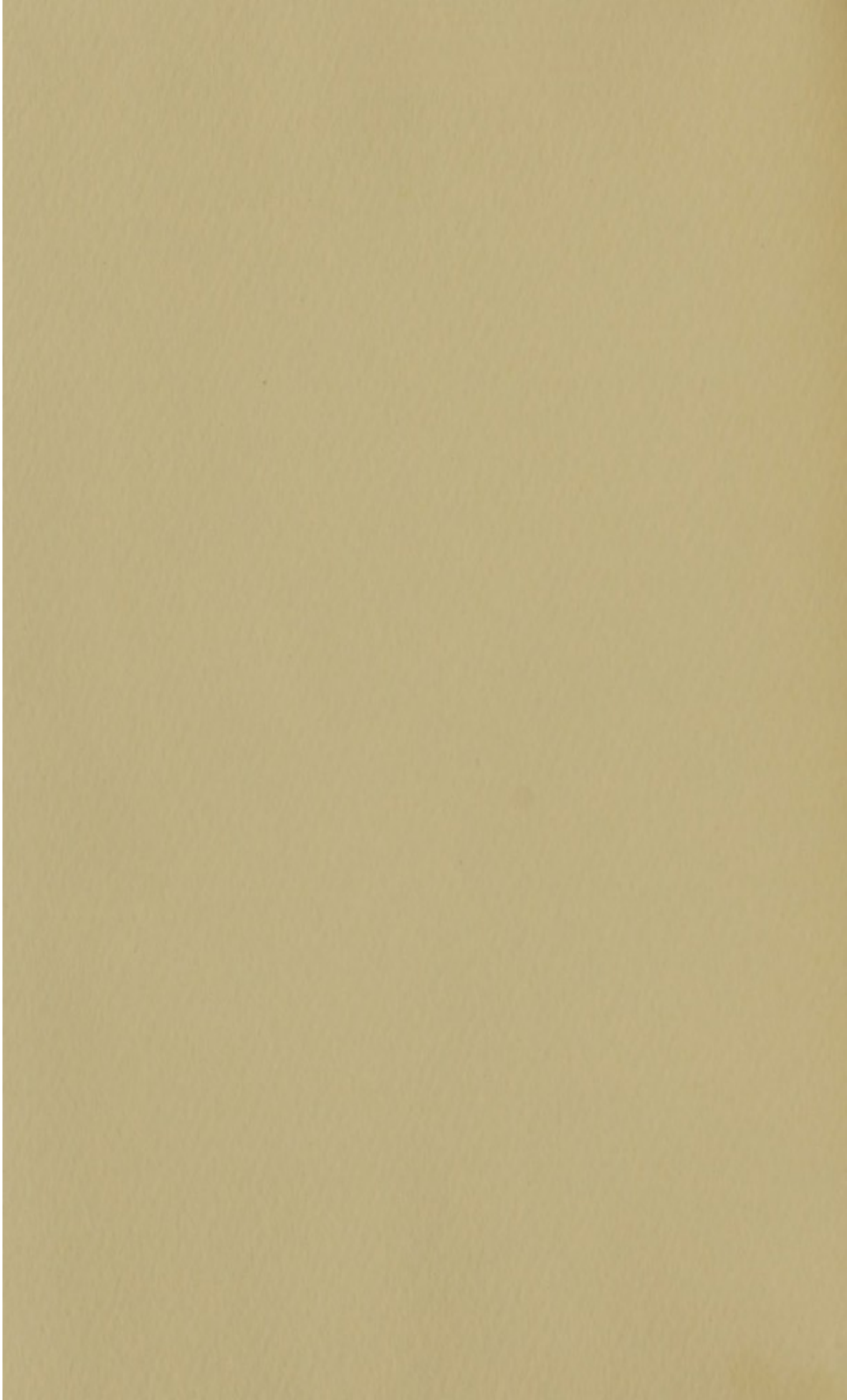


Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
<https://wellcomecollection.org>



NATIONAL LIBRARY OF MEDICINE
Washington





cop. 2



540.4

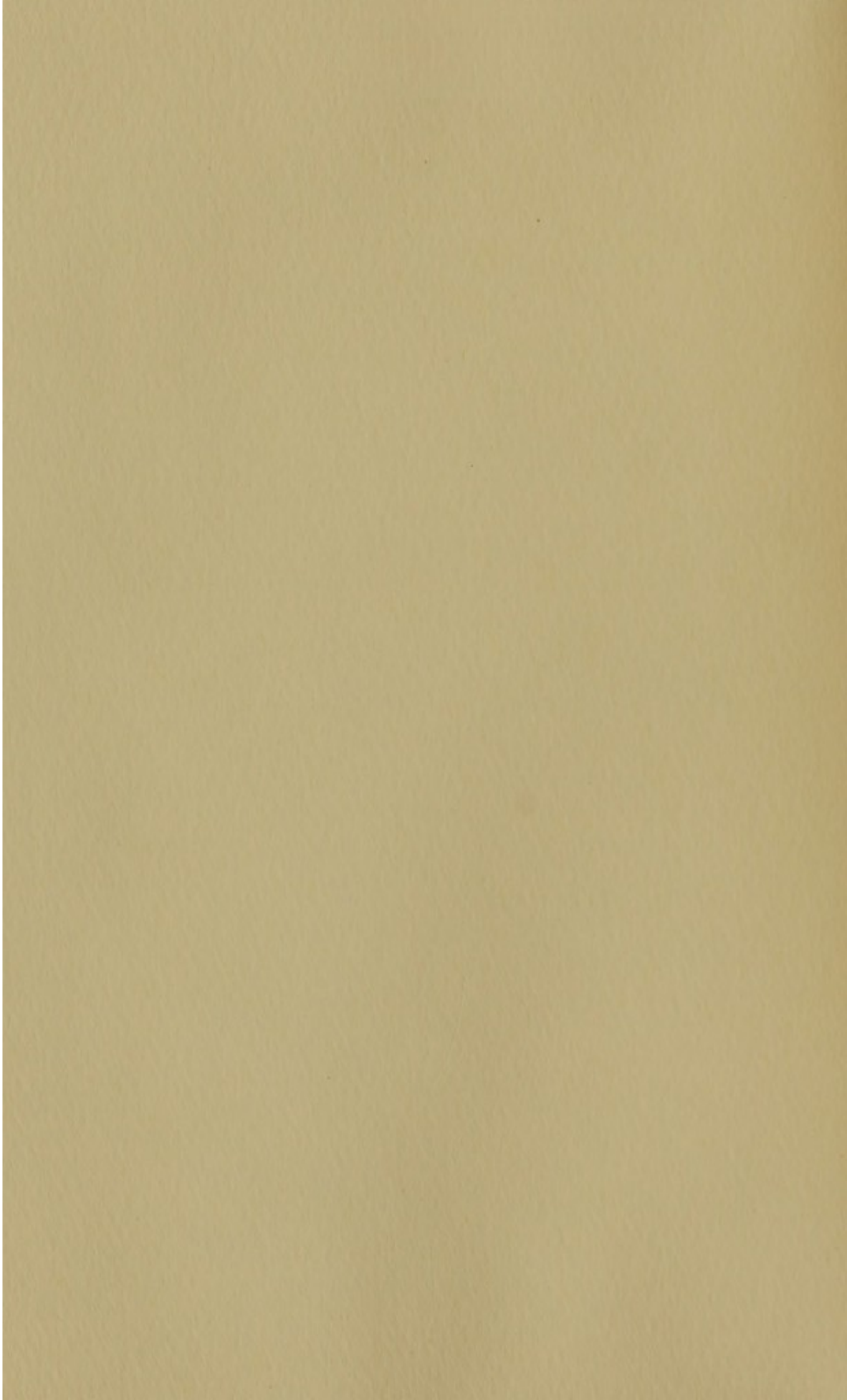
J 15

GIFT OF

Withdrawn from Smith Memorial Collection

Dr. F. Sessing

**THE WALTER HATFIELD '72 COLLEGE
MEMORIAL LIBRARY OF CHEMISTRY**



*Ferdinand Lessing no.
class '69*

THE
STUDENT'S
CHEMICAL
POCKET COMPANION.

BY
W. S. JACOBS, M. D.

Trahit quodcunque potest atque addit acervo.

HOR.

PHILADELPHIA:
PRINTED FOR THE AUTHOR, BY S. W. CONRAD,
PEWTER-PLATTER ALLEY.

.....
1802.

THE LIBRARY OF
COPYRIGHT SECURED.
THE UNIVERSITY OF
PENNSYLVANIA

THE UNIVERSITY OF
THE STATE OF NEW YORK
THE UNIVERSITY OF THE STATE OF NEW YORK

WORMSER JULY 14, 1958

TO THE GENTLEMEN
ATTENDING THE
MEDICAL LECTURES
IN THE
UNIVERSITY OF PENNSYLVANIA,
THE
FOLLOWING SHEETS
INTENDED TO FACILITATE
THEIR PROGRESS IN
THE SCIENCE OF CHEMISTRY,
ARE INSCRIBED,
BY
THEIR FRIEND,
AND WELL WISHER,
W. S. JACOBS.

40.14
512-ep2

188186

30E

THE UNITED STATES

OF AMERICA

DEPARTMENT OF THE INTERIOR

LAND OFFICE

WATER RIGHTS

IN THE

STATE OF CALIFORNIA

IN THE

COUNTY OF SAN JOAQUIN

THE

LAND OFFICE

BY

JOHN W. BACON

AND WILLIAM

W. BACON

PREFACE.

THE utility and necessity of a compendium, to facilitate the study of Chemistry, of a size and compass as the one I now present to the public, has long been acknowledged. To comprise the essential information in a size convenient for the pocket, is attended with more difficulty than many will allow. The following sheets may probably merit the attention of the students in this university, as they contain a detail of many original and useful experiments, as performed by the professor of Chemistry, Dr Woodhouse.

I have not aimed at any thing elaborate: intending it principally for the Tyro in Chemistry, I have selected, and thrown together in as compendious a manner as possible, what is essentially, indeed indispensibly requisite, to be known by him.

The various and interesting subjects of this science require, in a minute investigation, the aid of volumes ; but the Student, too frequently damped in the commencement of his career, by the prospect of labour before him, turns from the volumes with disgust, and relinquishes the pursuit, before he can become interested in the subject, or capable of appreciating its advantages. A volume of this size is calculated to allure him into the path of science, by diverting the mind, and exciting in it the spirit of enquiry.

This performance, as being executed in those hours, which could be spared from a laborious employment, will, I hope meet the indulgence of the candid reader.

CHEMISTRY.

CHEMISTRY has for its object, the investigation of the constituent principles of bodies.

This knowledge is obtained by analysis or decomposition, and synthesis, or composition.

ATTRACTION, is that power, by which the particles of bodies are approximated.

There are four kinds of attraction, 1st, the attraction of gravitation; 2d, of cohesion; 3d, of magnetism; and 4th, chemical attraction.

The laws of chemical attraction or affinity are of two kinds, viz. the affinity of aggregation, and the affinity of composition.

The attraction of aggregation exists between particles of bodies similar in their nature; while the attraction of composition, exists between particles which are dissimilar.

OF CALORIC.

HEAT tends to separate the particles of bodies, and antagonises all kinds of attraction.

When the attraction of cohesion, is in an over-proportion, bodies are solid. When caloric predominates in a small proportion, they assume a liquid form; but when in a greater degree, the body is converted into gas.

HEAT always tends to an equilibrium.

Bodies are called good or bad conductors, according to the quick or slow passage of this fluid through them.

When a body passes from a solid to a fluid state, a quantity of heat is absorbed, this heat is then in a state of combination, and is called latent heat. Bodies passing from a fluid to a gaseous state, heat is also absorbed by which they are kept in that state. When on the contrary, a body passes from a fluid to a solid state, heat is given out, which becomes sensible heat.



LIGHT.

The solar light is divisible, by the prism, into seven primitive colours, viz. red, orange, yellow, green, blue, indigo and violet.

LIGHT passing from one medium into another of different density, suffers refraction. It is also ponderous.*

* See Newton.

VEGETABLES when deprived of light, exhibit a pale colour, are inodorous, insipid, and deprived of active qualities.

Light has great effects on chemical operations, by disengaging oxygen from various combinations.

SULPHUR

Is a simple substance of an orange yellow colour, burning with a blue flame, and exhaling a strong penetrating odour; by friction, it becomes electric.

It is found native, or combined with earths and metals; it is also obtained from certain vegetables.

FLOWERS OF SULPHUR, are obtained from crude sulphur by subliming it in close vessels.

Sulphur burnt with substances, containing oxygen, forms the sulphuric acid.

Sulphur combined with different substances, forms sulphurets; but these combinations will be mentioned in their respective places.

CARBON.

From many experiments, it appears that the diamond, is crytalyzed carbon, or carbon in a state of purity.

PLUMBAGO is the next degree of purity, and is an oxyde of carbon.

CHARCOAL possesses the third degree of purity ; and carbonic acid the last, being completely faturated with oxygen.

Plumbago is found in different parts of the world, but the best is found in England. It it a mixture of carbon and iron.

Charcoal is obtained from animal and vegetable substances by combustion. In close vessels, it resists the greatest heat ; by this means it is obtained in a state of purity. It readily absorbs moisture from the atmosphere. Fourcroy considers charcoal, as an hydrogenous oxyde of carbon.

PHOSPHORUS

Is a substance of the consistence of wax, of a flesh colour, and when pure transparent, it is luminous in the dark and soluble in alkohol and the essential oils.

This substance was first obtained from urine, but is procured with greater facility from bones, as they contain the phosphate

of lime. These must be calcined to whiteness, then pulverized, and diluted sulphuric acid thrown on them; the sulphuric acid unites to the lime, and forms the sulphate of lime, while the phosphoric acid is set at liberty, and remains in the fluid: this is decanted, and evaporated to the consistence of an extract, it then must be put in a crucible, and exposed to heat, till converted into glass. This must be powdered and mixed with pulverized charcoal; it is then to be put in an earthen retort well coated with dung and clay, and exposed to the heat of an air furnace. In this operation the oxygen of the phosphoric acid, unites with the coal, and forms the carbonic acid, while the phosphorus comes over in tears and phosphorated hydrogen gas.

PHOSPHORUS takes fire at about 100 ° of Fahrenheit, it then combines with the oxygen of the atmosphere, and forms phosphoric acid.

OF THE GASES.

HYDROGEN GAS is a combination of hydrogen and caloric, so called because it is one of the constituent parts of water. It is obtained from several substances, but

with great facility by the decomposition of water.

If to a piece of zinc, be added a quantity of diluted sulphuric acid, the acid decomposes the water; the oxygen of the water oxydes the zinc, which is dissolved by the acid, forming a sulphate of zinc, and the hydrogen is disengaged. It is also obtained, in large quantities, by passing steam through an ignited iron tube.

If 15 parts of hydrogen, and 85 of oxygen be burnt in a close vessel, water is formed proportionally to the weight of the gases employed.

When this gas is obtained over mercury, it is inodorous; but when obtained over water, it contracts a disagreeable smell from the water it holds in solution.

It is improper for respiration and combustion, unless in contact with atmospheric air. When taken into the lungs, it suffers no decomposition.

It is the lightest of all the gases, a cubic foot weighing only 72 grains.

Hydrogen gas has the property of dissolving certain substances. When combined with sulphur, it is called sulphurated hydrogen, or hepatic gas, which has a disagreeable smell, renders white metals black, and is unfit for animal life. It may be formed by adding water to *hepar sulphuris*: In this experiment, the water is de-

composed, the oxygen unites to part of the sulphur, and forms the sulphuric acid, this combines with the potash of the hepar, and forms vitriolated tartar, while the hydrogen of the water dissolves the other part of the sulphur, forming sulphurated hydrogen gas.

With carbon, it forms carbonated hydrogen gas; this is the most fatal of all the gases.

It may be obtained by extinguishing ignited coals under water, and receiving the gas as it is formed.

It is also procured from cast iron, and the sulphuric acid, or from finery cinder and charcoal by distillation: hydro carbonate generally contains a small quantity of carbonic acid, it is freed from this by washing it in lime-water.

With phosphorus, it forms phosphorated hydrogen gas: this is often seen in the neighbourhood of burial grounds, as the ignes fatui, &c. It is this gas that burns on the surface of certain springs.

OF OXYGEN.

OXYGEN, the acidifying and putrifying principle, is found only in combination.

OXYGEN GAS, is composed of oxygen and caloric. It forms a constituent part of our atmosphere, in the proportion of 28 to 100. It is the only gas proper for combustion and animal life: in both cases, the oxygen is decomposed, and sensible heat generated: it is also one of the component parts of water.

It is emitted by exposing vegetables to the light of the sun, under water.

It may be obtained, by decomposing acids, of which it is the base.

One pound of nitre yields 1200 cubic inches of this gas, by distillation. In this case, the nitric acid of the nitre is decomposed. It is obtained also in great quantities, from the black oxyde of manganese, by the sulphuric acid and heat, or by exposing the oxyde, in an earthen retort, to a red heat.

MERCURIAL OXYDES yield large quantities of this gas, by heat only, holding a small portion of mercury in solution.

Its specific gravity exceeds that of atmospheric air—a cubic foot weighing 760 grains.

NITROGEN,

Or AZOTE, is the radical of the nitric acid: it is always found in combination.

NITROGEN GAS is a combination of nitrogen with caloric. The best method of obtaining it, is by exposing a quantity of atmospheric air, in a vessel inverted over a liver of sulphur or of lime: the oxygen will be absorbed, and the nitrogen left behind; which must be washed in lime-water, to absorb a small quantity of carbonic acid, which generally exists in atmospheric air.

It may also be obtained by treating the muscular parts of animals, with the nitric acid. Also by inverting a vessel over a combustible body, the oxygen will be absorbed during combustion, and the azote left behind.

This gas is improper for respiration and combustion; it is lighter than atmospheric air, of which it forms 72 parts in the hundred.

ATMOSPHERIC AIR

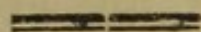
Is a mixture of 72 parts of nitrogen, and 28 of oxygen; a small proportion of carbonic acid exists, but not as a constituent part.

These gases are not in a state of combination, but in a state of mixture.

The gravity of the atmosphere differs at different times, which is evinced by the barometer.

It is invifible, infipid, and inodorous : a cubic foot weighs 720 grains.

This gas is decomposed, during refpiration, part of its oxygen is abforbed in its paffage through the lungs : this unites to the phofphorus of the blood, and produces the phofphoric acid, while heat is fet at liberty ; this phofphoric acid unites to the iron of the red globules, and produces the red colour—Another part of the oxygen combines with the carbon of the blood, and forms the carbonic acid, which is difcharged from the lungs with a portion of atmofpheric air, not decomposed in the procefs.



WATER

Is a transparent fluid, compofed of hydrogen and oxygen, in the proportion of 15 parts of the former, and 85 of the latter.

It exifts in moft bodies, of the animal, vegetable, and mineral kingdoms. At 32° of Farenheit's Thermometer, water freezes ; above this temperature it affumes a liquid form, and at 212° it is converted into vapour.

WATER, when raised in the atmosphere, constitutes clouds, fogs, mists, rain, &c. by simple refrigeration.

ICE is the natural state of water; the conversion of water into ice, is attended with a disengagement of heat.

Water, in a solid state, occupies more space than in a liquid form.

Water is generally presented to us by nature in a fluid state; river, or rain-water, is never found pure, but contains salts, acids, &c. these are rendered pure by distillation. If water be passed through an ignited iron tube, it will be decomposed, the oxygen unites to the iron, and the hydrogen escapes; the metal will be found to have encreased in weight, which if added to the hydrogen will be equal to the weight of the water employed. This experiment is one of the pillars of the new doctrine.

ALKALIES.

ALKALIES have an acrid urinous taste, turn blue vegetable colours, green (indigo and litmus excepted) effervesce with some

acids, and form neutral salts with all. They likewise render oils miscible with water, forming soap.

ALKALIES are divided into fixed and volatile.

OF FIXED ALKALIES.

POTASH or the vegetable alkali, is composed of nitrogen, and a base, which is supposed to be lime. It is obtained from the ashes of vegetables, and from the lees of wine; this salt attracts the moisture of the atmosphere, and is then called oil of tartar, per deliquium.

Pure potash is also obtained by fusing nitre upon charcoal, the acid and water are dissipated, while the alkali remains alone; this is called extemporaneous alkali.

SALT OF TARTAR is formed by calcining the tartar of wine, dissolving the residue in water, and crystalizing it; or by burning nitre and tartar; the residue after lixiviation, is a beautiful salt of tartar.

MINERAL ALKALI.

Natron or soda, is found in a native state, in Egypt, but is generally obtained from the ashes of marine plants. It is supposed to consist of nitrogen and magnesia, it effloresces in the air; when pure it is less caustic than potash, and better for the purpose of making glass, contains in 100 parts, 16 acid, 20 alkali, and 64 of water.

Alkalies combine easily with sulphur: If pure liquid alkali be digested upon sulphur, the mixture becomes reddish, and is then called liver of sulphur; a fetid gas, called hepatic gas, is disengaged. This hepatic sulphur, or liver of sulphur, dissolves metals, even gold itself.

Vegetable and mineral alkalies have the property of forming glass with silica, and not being volatilized by heat.

AMMONIAC,

Or the volatile alkali, is composed of hydrogen and nitrogen, in the proportion of 193 of the former, and 807 of the latter, in the 1000: volatile alkali, is usually obtained by distilling animal substances, as hoofs, horns, bones &c, this product is contami-

nated with Dippel's animal oil; it is also obtained from certain vegetables. Very pure ammoniac may be obtained by mixing equal parts of sal ammoniac, and quicklime in powder; this is put into a flask, to which a syphon is adapted; being exposed to heat, the volatile alkali comes over, and is received in vessels containing water, until fully saturated; the muriatic acid of the sal ammoniac unites to the lime, and forms muriate of lime, while the ammoniac is disengaged in the form of alkaline gas, which is absorbed by the water, forming the caustic ammoniac.

ALKALINE gas, is a combination of ammoniac and caloric; it is improper for respiration and combustion, and is lighter than atmospheric air.

By mixing this gas with the oxygenated muriatic acid; water is produced. This is effected by the union of the oxygen of the acid, with the hydrogen of the alkali, while the azote is set at liberty, and the oxygenated acid is reduced to the state of common muriatic acid.

OF ACIDS.

ACIDS are formed by the combination of oxygen with certain bases.

Acids have a four stiptic taste ; effervesce with alkalies, and change blue vegetable colours, red, indigo excepted.

THE SULPHURIC ACID, is obtained by burning sulphur with a substance containing oxygen ; nitre is generally used for this purpose—100 parts of this acid contain about 70 sulphur and 30 oxygen. When this acid is mixed with water, it produces heat sufficient to make water boil. It attracts water from the atmosphere, and congeals by intense cold—If any combustible body is immersed in the acid, this last is changed into the sulphureous by parting with its oxygen. If more oxygen is abstracted, it will be converted into sulphureous gas.

SULPHURIC ETHER is made by distilling together equal parts of strong sulphuric acid, and alkohol. The first product is spirit of wine, the second ether, the third is a substance called sweet oil of wine ; and a black matter resembling tar, is left in the retort.

HOFMAN'S ANODYNE DROPS, is a mixture of ether, alkohol, and a small quantity of the sweet oil of wine.

If the sulphuric and muriatic ethers be mixed together, the evaporation is so rapid that mercury has been frozen by the degree of cold thus produced.

SULPHURIC ACID, united to certain bases, forms salts, called sulphates.

SULPHATE OF SODA, or Glauber's salt is obtained in different ways; but a very economical process of forming Glauber's salt, is by adding the sulphate of ammoniac, in solution, to the muriate of soda; here a double elective attraction takes place, the sulphuric acid unites to the soda, forming sulphate of soda, while the muriatic acid unites to the ammoniac, forming muriate of ammoniac; these salts are then crystallized, and exposed to heat in a close vessel; the muriate of ammoniac sublimes, and the Glauber's salt is left pure: this is to be dissolved and crystallized.

The sulphate of ammoniac, for this experiment, is obtained by decomposing the sulphate of lime, by means of the carbonate of ammoniac, obtained by the distillation of bones.

Glauber's salt contains 27 of acid, 15 of alkali, and 58 of water, in 100 parts, it effloresces in the air, has a bitter urinous taste, and is soluble in its own weight of boiling water.

SULPHATE OF POTASH or vitriolated tartar: 100 parts contain 30.21 of acid, 64.61 of alkali, and 5.18 of water. It has a penetrating taste, becomes red-hot before it fuses, and is volatilized without decomposition. These salts supersaturated with the

acid, are called acidulous fulphates of potash or of soda.

SULPHATE OF AMMONIAC has a bitter taste: barytes and lime decompose it: it contains 42 of acid, 40 alkali, and 18 of water, in the 100.

SULPHATES, with earthy bases—

SULPHATE OF LIME, gypsum, or plaster of Paris—100 parts contain 32 of lime, 46 of acid, and 22 of water.

SULPHATE OF MAGNESIA, or epsom salt, it contains 24 of acid, 19 of magnesia, and 57 of water: it is found in mineral waters; from which magnesia is obtained, by adding fixed alkali to its solution: the earth is precipitated, in the state of a carbonate.

SULPHATE OF ALUMINE, or alum: 100 parts contain 38 of acid, 18 of earth, and 44 of water. If alum be exposed to heat, and the water of crystallization be driven off, it becomes caustic, and is then called burnt alum. The alum of commerce contains a small portion of potash.

PYROPHORUS is made by taking three parts of burnt alum and one of sugar, or

honey; this is to be exposed to heat in a crucible, until it becomes black; it is then to be put in a phial, coated with a mixture of horse-dung and clay; then placed in a crucible, surrounded with powdered charcoal, and again exposed to heat, till a blue flame appears.—A pyrophorus may be made by rubbing together 54 grains of sulphur 36 of willow charcoal, and 3 of phosphorus.

Pyrophorus inflames when in contact with atmospheric air.

SULPHATE OF STRONTITES is insipid, and scarcely soluble in water.

SULPHATE OF BARYTES, or ponderous spar: 100 parts contain 30 of acid, 67 of barytes, and 3 of water; when heated, it becomes luminous, and is called Bolognian phosphorus.

NITRIC ACID is composed of about 80 of oxygen, and 20 of azote or nitrogen; it always exists in a state of combination: it is usually obtained by distilling nitre with a quantity of powdered flints; some of the other earths have also the property of decomposing this salt. It may be obtained by distilling nitre with the sulphuric acid; or a mixture of nitre and sulphate of iron.—The sulphuric acid unites to the potash,

and forms vitriolated tartar; while the nitric acid is disengaged in yellow fumes.—The nitric acid thus obtained, contains a small quantity of fulphuric or muriatic acid; it is cleared from the fulphuric by re-distilling it from fresh nitre; and from the muriatic, by the addition of the nitrate of silver—the muriatic acid unites with the silver, and luna cornea, is precipitated.

Nitric acid, acts on many of the metals, producing nitrous gas—When mixed with oils it inflames, or renders them black. If nitric acid be poured on finely powdered charcoal, or lampblack, the mixture will take fire; carbonic acid, and nitrous gas, being produced.—For this experiment the acid should be concentrated.

NITROUS ETHER, is made by distilling equal parts of nitric acid, and alcohol.

SPIRITUS NITRI DULCIS, is formed by distilling three parts of alcohol, and one of nitrous acid.

NITROUS ACID, is supposed to exist in three states: the bright yellow, containing 2.344 of oxygen; the orange coloured 2.292, and the dark green 2.230, to 1 of nitrogen.

NITROUS GAS, is composed of 56 parts of oxygen, and 44 of nitrogen, in 100—it is

invisible, and lighter than atmospheric air ; improper for respiration and combustion, and is neither acid, nor alkaline : but when it combines with the oxygen of the atmosphere, it forms the nitric acid ; from this property it has been used to ascertain the purity of the atmosphere, by means of the eudiometer ; this process however, is fallacious.

Nitrous gas may be procured by decomposing the nitric acid, with combustible substances. The best method of obtaining this gas, is by exposing copper in a phial, adding a solution of nitre ; and then pouring on the sulphuric acid—In this experiment, the sulphuric acid unites to the potash of the nitre, and forms vitriolated tartar ; the nitric acid being disengaged, attacks the copper, and is in part decomposed, a portion of its oxygen, oxyding the copper, while another unites to the nitrogen forming nitrous gas, which is given over.

NITROUS OXYDE—The gaseous oxyde of azote, of Dr. Mitchill, or the dephlogisticated nitrous air of Dr. Priestly, is a lower degree of oxydation, than nitrous gas, it consists of 37 of oxygen, and 63 of azote. The oxygen appears to exist in a much weaker state of combination, in this than in the nitrous gas. Inhaled, when mixed with

atmospheric air, it induces hilarity, &c. It differs from nitrous air, in being absorbed by water, and in supporting combustion; a taper burning nearly as vividly in this, as in oxygen gas, and in contact with oxygen, it does not form the nitric acid. It is obtained from tin, and the nitric acid: (*see tin*) but the best method is by means of the nitrate of ammoniac; this nitrate is formed by adding the nitrate of potash to a solution of the sulphate of ammoniac; here a double elective attraction takes place, the sulphuric acid of the sulphate of ammoniac, unites to the potash and forms the sulphate of potash, or vitriolated tartar, while the nitric acid of the nitre unites to the ammoniac, and forms the nitrate of ammoniac, which remains in the supernatant liquor, after the vitriolated tartar is crystalized; and by evaporation the nitrate of ammoniac is obtained in crystals; this nitrate is then exposed to heat in a retort, and nitrous oxyde is given out in large quantities.

Dr. Mitchill, employs the terms septic acid, for nitric acid; septous acid, for nitrous acid; septic gas, for nitrous gas; septous gas, for nitrogen gas; and septon, for nitrogen.

He supposes that septon, chemically united to oxygen, before it has taken on the form of a gas, to constitute the matter of pestilence.

NITRATES, are neutral salts, composed of nitric acid, and certain bases.

NITRATE OF POTASH, is formed by a direct combination of the nitric acid, and potash. This salt leaves a sense of coldness in the mouth; if thrown on ignited coals, its acid is decomposed, the oxygen unites to the coal, and forms the carbonic acid: its nitrogen and water being dissipated, and pure potash remains behind. It exists ready formed in the earth, as in burial grounds, &c.—It is also obtained from the plaster of old houses. In some places it effloresces on the surface of the earth, exists in some vegetables, and is produced in the process of putrefaction—the nitrogen of the animal substance, unites to the oxygen of the atmosphere, and forms the nitric acid; this unites with an alkaline base, produced by vegetable decomposition, and forms nitre—100 parts contain 30 acid, 63 alkali, and 7 water.

CRYSTAL MINERAL, or sal prunel, is formed by fusing nitre, and driving off its water of crystallization.

SAL POLYCREST, is produced by mixing equal parts of nitre, and sulphur, in a red-hot crucible.

Gun Powder

23

GUN POWDER, consists of 75 parts of nitre, 16 of charcoal, and 9 of sulphur.

FULMINATING POWDER is formed by triturating, 3 parts of nitre, 2 of salt of tartar, and 1 of sulphur. This put on a shovel and heated, detonates with violence; previous to the explosion, the sulphur unites to the potash, forming hepar sulphuris, which gives out sulphurated hydrogen gas; this unites to the oxygen of the nitre, and is set on fire by the heat applied.

NITRATE OF SODA or cubic nitre, is a salt formed by the nitric acid and soda; it is never found in a native state, it has a cool and bitter taste; this salt contains the strongest nitric acid, according to Kirwan. It consists of 28.80 of acid 50.09 of alkali, and 21,11 of water.

NITRATE OF AMMONIAC is formed by adding nitre to a saturated solution of sulphate of ammoniac; this must be twice evaporated, at the temperature of 250° — it deposits the sulphate of potash, leaving nitrate of ammoniac in solution, which at 212° crystalizes in needles. It is also produced by uniting volatile alkali, with nitrous acid vapours.

7/100 / 6 1/4
96

NITRATES with earthy bases.

NITRATE OF LIME is sometimes found adhering to lime stone, also in spring water or in the lixivium of old plaster, it is a very deliquescent salt—100 parts contain, 43 acid, 22 lime, and 35 water—When exposed to heat, it parts with its acid, in the form of nitrogen and oxygen gases: The residue is Baldwin's phosphorus. A solution of this salt in alcohol, burns with a red flame.

NITRATE OF BARYTES is the production of art, alkalies do not decompose it, it is an excellent test for the sulphuric acid; sulphate of barytes being precipitated; by exposing this salt to a violent heat, pure or highly caustic barytes remains; a solution of this salt in alcohol, burns with a pale yellow flame.

NITRATE OF MAGNESIA is found in the walls of old buildings, &c. it is acrid, bitter and deliquescent. It is decomposed by lime, the alkalies &c. 100 parts contain 36 of acid, 27 of magnesia, and 37 of water.

NITRATE OF ALUMINE is astringent to the taste, and deliquescent: alkalis, magnesia and lime decompose it.

NITRATE OF STRONTITES forms octahedral crystals, and gives a carmine red flame to alcohol.

NITRITES are neutral salts, formed by nitrous acid, and certain bases: to which very little attention has been paid.

MURIATIC ACID, has been supposed by some gentlemen, to be composed of hydrogen and oxygen—and Mr. Lamb thought that sulphurated hydrogen, was the base of this acid!!!

It is obtained by distilling common salt, and the sulphuric acid—the sulphuric acid combines with the soda, and forms Glauber's salt, while the muriatic acid is given over.—It has a strong saffron-like smell, and is lighter than the sulphuric and nitric acids.—It emits white vapours, which are rendered more visible, if in contact with volatile alkali, sal ammoniac being formed.

MURIATES are neutral salts, formed by the muriatic acid, and certain bases.

MURIATE OF POTASH, or febrifuge salt of Sylvius—is found in sea water, and in animal and vegetable fluids. It has a strong

D

bitter taste, it contains 29.68 of acid, 63.47 of alkali, and 6.85 of water.

MURIATE OF SODA, or common salt, is found in mines, in several parts of the world, by the drying up of salt lakes, &c. it is also obtained from sea-water, by evaporation, &c. It decrepitates in the fire, is volatilized without decomposition; and assists the fusion of glass. It contains 43 acid, 46 alkali, and 11 of water in 100.

SODA is obtained from common salt, by the addition of the acetate of lead, the muriatic acid of the salt unites with the lead, forming a muriate of lead; while the soda combines with the vegetable acid, from which it must be separated by evaporation and calcination: it is also decomposed by potash and barytes.

It is said that common salt contains a small quantity of mercury, in the state of corrosive sublimate.

MURIATE OF AMMONIAC, or sal ammoniac, is found native in many places, but particularly in the neighbourhood of volcanos: It is generally brought to us from Egypt, where it is obtained by distillation from the foot of the dung of animals, feeding on saline vegetables. It sometimes exhales from the human body in malignant fevers. It contains 52 parts of acid, 40

ammoniac, and 8 of water, in 100: it is ductile under the hammer, and does not change when exposed to the air. It is decomposed by lime and the fixed alkalies: in this process the ammoniac is disengaged, leaving an alkaline muriate, or muriate of lime. If the lime, or alkali, be pure, caustic ammoniac is produced; but if carbonates are employed, the carbonate of ammoniac is the result.

MURIATE OF LIME is found in mineral waters, particularly in sea-water; it is very deliquescent, and of difficult crystallization: 100 parts of lime take up 86 of acid—It may be formed by saturating marine acid with lime: When fused, it is called Homberg's phosphorus. Muriate of lime is also formed, by mixing lime and the muriate of ammoniac in solution; the sal ammoniac is decomposed, the muriatic acid unites to the lime, and forms muriate of lime, while the ammoniac is set at liberty: the liquor is to be evaporated and crystallized. If a strong solution of this muriate be mixed with the concentrated sulphuric acid, the mixture will put on a solid form.

If the crystallized muriate of lime be mixed with snow, the cold it produces is so intense, as to freeze mercury.

MURIATE OF MAGNESIA exists in seawater, and in the mother waters of salt-works; it is an acrid, bitter, and deliquescent salt: 100 parts contain 34 acid, 41 magnesia, and 25 of water.

MURIATE OF BARYTES has never been found native: pure alkalies and earths have no effect on this salt (to obtain it, *see barytes*.) It is an excellent test for the sulphuric acid.

OXYGENATED MURIATIC ACID is formed by distilling the muriatic acid with the metallic oxydes—For this purpose, the black oxyde of manganese may be used.

If a quantity of common salt and manganese are put in a retort, and sulphuric acid added; a portion of the acid decomposes the salt, and forms Glauber's salt, and the muriatic acid is set at liberty; while the other portion of the sulphuric acid, acting on the manganese, drives over the superabundant oxygen, to which the muriatic acid unites, and passes over in the state of oxygenated muriatic acid—It may also be formed by adding simply the muriatic acid to an oxyde.

It has a strong penetrating smell, and acts positively on the trachea. It has the property of destroying colours in most substances, and when exposed to light, loses its

oxygen; in both of which processes it is converted into the common muriatic acid.

From the property of destroying colours, it is used in bleaching of linnen, cotton, silk, wax, &c. for these purposes it is mixed with alcohol: When mixed with minium, or red lead, it is used to destroy the colour of common ink, but does not act on printer's ink.

This acid, in a state of gas, inflames many combustible substances, in a state of division; as gold, antimony, bismuth, zinc, cinnabar, charcoal, sulphur, phosphorus, &c. The oxygen of the gas unites to the combustible substance, and heat and light is given out.

OXYGENATED MURIATIC ACID GAS may be obtained in large quantities, by adding the muriatic acid to the black oxyde of manganese, and applying heat.

Seeds have been made to vegetate, by putting them in a paste made with the black oxyde of manganese, and the oxygenated muriatic acid.

OXYMURIATES are salts, formed by the combination of the oxygenated muriatic acid and certain bases.

OXYMURIATE OF POTASH is obtained by saturating a solution of caustic alkali, with this acid; by evaporation, crystals of an argentine brilliancy are deposited; with this oxymuriate, two other salts are also formed—the hyperoxygenated muriate, and the common muriate of potash, differing in the form of their crystals. The hyperoxygenated muriate of potash contains the greatest quantity of oxygen, of any known substance, and from it the purest oxygen is obtained; 100 grains yielding 75 cubic inches.

If a very small quantity of this salt be triturated with sulphur, it explodes loudly. If, instead of nitre, this salt be used in the formation of gun-powder, its effects will be much augmented.

OXYMURIATE OF SODA is obtained in the same way as the above salt; and has nearly the same properties.

Of the other oxymuriates little has been ascertained.

NITRO MURIATIC ACID, or aqua regia, is formed by distilling two parts of nitric acid, and one of muriatic together: it is also formed by dissolving four ounces of sal ammoniac in a pound of nitric acid. It is said that the nitric acid, in this experiment, attacks the sal ammoniac, and displaces the

muriatic, which combines with a portion of the oxygen and nitrous gas of the nitric acid. It is also formed by mixing the two acids together.

The nitro muriatic acid dissolves metals, and is the true solvent of gold: its specific gravity is less than that of the two acids made use of.

CARBONIC ACID, or fixed air, is found in three different states; viz. in a state of gas, as in wells, tombs, cellars, &c.—in a state of mixture, as in mineral waters—and thirdly, in a state of combination, as in limestone, &c. It is procured in its gaseous form, by adding the sulphuric acid to limestone, or chalk: The sulphuric acid unites with the lime and forms gypsum, while the carbonic is disengaged.

This gas is also formed in the processes of combustion, respiration, and vinous fermentation. It appears to consist of 28 parts of carbon, and 72 of oxygen, with a portion of caloric.—The properties of this gas, are—it is heavier than atmospheric air, consequently occupies the lowest situations, and may be poured from one vessel into another—It turns blue vegetables red, forms neutral salts with the alkalies, is absorbed by water, is unfit for respiration or combustion, and precipitates lime-water, &c.

CARBONATES are neutral salts, formed by the carbonic acid, and certain bases.

CARBONATE OF POTASH, or cretaceous tartar, is formed by saturating a solution of potash, with the carbonic acid, and crystallizing it: This salt effloresces; by heat it is converted into pure alkali, and is then deliquescent.—Lime and all the acids decompose it: 100 parts contain 20 acid, 48 alkali, and 32 of water.

If to a solution of carbonate of potash, lime be added, the carbonic acid of the potash unites with the lime, forming a carbonate of lime, and the alkali will be rendered caustic: the clear liquor must then be decanted, and kept in close bottles; if evaporated, fused, and cast into moulds, the lapis causticus is obtained.

CARBONATE OF SODA, or cretaceous soda, effloresces in the air; 100 parts contain 16 acid, 20 alkali, and 64 of water; it is decomposed by heat, lime, phosphorus and the acids—It has greater affinity with silica than the former; in consequence of which it is better calculated for vitrification.

CARBONATE OF AMMONIAC, or concrete volatile alkali—is formed by passing carbonic acid through a saturated solution of ammoniac: or by exposing ammoniac to an

atmosphere of carbonic acid—It is also obtained from animal substances by distillation ; but the best method for obtaining it, is by decomposing the muriate of ammoniac ; for this purpose, pulverized sal ammoniac and chalk, are to be mixed together, put in a retort, and exposed to a low degree of heat : a double elective attraction takes place, the muriatic acid of the sal ammoniac unites to the lime, forming the muriate of lime ; while the carbonic acid of the lime, unites to the ammoniac, forming carbonate of ammoniac, which is sublimed and crystalized, on the sides of the receiver—In passing over, the ammoniac dissolves a portion of the chalk—100 parts contain, 45 acid, 43 alkali, and the remainder chalk and water.

CARBONATE OF LIME, is found crystalized by nature ; but has never been obtained in crystals by art.—It effervesces with acids, forming calcareous salts ; and the carbonic acid is discharged—100 parts contain 55 lime, 34 acid, and 11 water.

CARBONATE OF BARYTES, is an insipid substance, scarcely soluble in water—It is decomposed by heat, and the alkalies ; It contains 80 barytes, and 20 acid in 100 parts.

CARBONATE OF MAGNESIA is obtained from epsom salt, by adding a carbonate of alkali; cold water dissolves more than hot—when crystalized, 100 parts contain 25 magnesia, 50 acid, and 25 water.

FLUORIC ACID is obtained by distilling fluor spar, and the vitriolic acid, in a leaden retort: The sulphuric acid unites with the lime of the spar, and forms sulphate of lime, while the fluoric acid passes over in the state of gas, and is absorbed by water.

This acid has the property of corroding and dissolving glass (Dr. Priestly says it will corrode a glass retort in the space of ten minutes) and has been used for the purpose of engraving on this substance, in the same manner as the nitric acid is used on copper.

From the great affinity between this acid and lime, it may be used as a test to ascertain the presence of it.

FLUATES are formed by this acid and various bases.

FLUATE OF LIME, or fluor spar; this in a moderate heat becomes phosphorescent; it contains 16 acid, 57 lime, and 27 water.

BORACIC ACID, or acid of borax—If borax be sublimed with half its weight of sulphuric acid, a beautiful white powder is obtained, which constitutes the boracic acid. Or by adding the sulphuric acid to a solution of borax in hot water, the acid will be deposited, in small scaly crystals, on the sides of the vessel.

BORATES are formed of this acid, with certain bases.

BORATE OF SODA, or borax—The purest comes from China; it is white and transparent, is an excellent flux, and used in the fusion of glass and the soldering of metals.

BORATE OF POTASH—This is effected by the direct combination of this acid with potash: It crystallizes in parallelopipedons.

BORATE OF AMMONIAC—This is formed by dissolving boracic acid in ammoniac, and evaporating until it crystallizes.

LITHOLOGY:

OR THE

DOCTRINE

OF

EARTHS AND STONES.

PRIMITIVE EARTHS.

EARTH is an insipid, inodorous, brittle substance; white when pure; soluble in some of the acids, but scarcely soluble in water. Earths are simple substances, and appear to be nine in number; viz. lime, magnesia, alumine, flint, barytes, strontites, jargon of Ceylon, Glucine, and Augustine.

LIME.

LIME-STONE, when exposed to a strong heat, becomes white and brittle; is deprived of its carbonic acid, and is called quick-lime.

To obtain lime in a state of purity, chalk is to be washed in boiling distilled water ; then dissolved in distilled vinegar, and precipitated by the carbonate of ammoniac ; the precipitate must be calcined, and it is then pure lime. It has a penetrating burning taste, seizes water in large quantities, increases in bulk, falls in powder, and emits heat, and light in the dark. It is soluble in some acids.

Strong nitric acid poured upon lime, has no action on it.

It is soluble in 680 times its weight of water : This is called lime-water : It is a good test for detecting the carbonic acid, forming the carbonate of lime. If exposed to the atmosphere, it will, in a short time, exhibit a pellicle on its surface, known by the name of cream of lime : it is regenerated lime-stone.

Pure lime, if exposed to the atmosphere, absorbs the carbonic acid, and re-assumes its primitive state of mildness.

BARYTES,

Or ponderous earth, is never found pure, but combined with the sulphuric or carbonic acids, forming the sulphate or carbonate

E

of barytes. Pure barytes is obtained in the following manner:—The sulphate of barytes, or ponderous spar, is to be pulverized and mixed with a small quantity of charcoal, and exposed to a red heat for about an hour; the calcined powder must be then thrown in water, to which it communicates a yellow colour; and hepatic gas is disengaged from it: the liquor is then filtered, and a quantity of muriatic acid added, by which a precipitate is produced: this must again be filtered, and the liquor holds in solution the muriate of barytes. If a solution of the mild vegetable alkali be now added, the carbonate of barytes is thrown down, and the carbonic acid must be driven off by calcination.

Pure barytes is white; the prussiate of potash precipitates it from its combinations with the nitric and muriatic acids; this distinguishes it from other earths. It precipitates alkalies from their combinations with acids.

MAGNESIA

Is a light, spongy, white, insipid, and fusible earth: It is soluble in water, when combined with the carbonic acid; and cold water dissolves more than hot: It has never

been found pure. To obtain it in a state of purity, take a quantity of the sulphate of magnesia, or epfom salt, and dissolve it in distilled water; to which add the carbonate of potash; the sulphuric acid of the sulphate of magnesia combines with the potash, and the sulphate of potash is held in solution, while the carbonic acid of the potash unites with the magnesia, and the carbonate of magnesia is precipitated, from which precipitate the carbonic acid must be driven off by heat, the remainder is called calcined magnesia.

ALUMINE,

Or pure clay, is found in combination with the sulphuric acid, and known by the name of alum.—To obtain the alumine pure, dissolve a quantity of alum in water, to which add a solution of potash: the sulphuric acid of the alum, unites with the potash, and the pure clay is precipitated in the form of a white powder.—Pure clay seizes water with avidity, forming a paste; it contracts by heat; on this property Wedgwood's thermometer, for ascertaining the higher degrees of heat, is constructed: when baked, this earth strikes fire with the steel, and is infusible by itself.

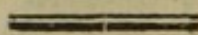
Alumine is capable of an imperfect fusion, by a current of oxygen gas. Chalk assists this process : it is fusible in a crucible of chalk, but not in a common crucible.



SILEX,

Is found nearly pure in rock crystal ; to obtain it perfectly so, fuse one part of rock crystal with four of alkali ; this must be dissolved in water, and precipitated by an acid. Silica is soluble in the fluoric acid, but the fixed alkalies are its true solvents, forming thereby glass.

This earth is rough, and insoluble in water ; it is likewise infusible when unmixed.



STRONTITES,

Has been found in the states of a carbonate, and sulphate. This earth decomposes all the sulphates, owing to its stronger affinity for the sulphuric acid.



JARGON OF CEYLON,

Possesses some properties in common with lime and silica, it unites with the carbonic,

nitric, and sulphuric acids, but is precipitated from the last by the alkalies.

GLUCINE,

Is a new earth discovered by Vauquelin; it exists in the emerald of Peru, and is found in the beryl, or aqua marina.

It is soluble in the sulphuric acid, and its salts have a sweetish taste.

AGUSTINE,

Is an earth which has received a name, from its salts being tasteless. It is insoluble in water; and the alkalies have no effect on it.

ADAMANTINE SPAR has been supposed to contain a new earth; but from the experiments of Mr. Klaproth, it is found to consist of alumine, from 84 to 89 parts, silica from 5.5 to 6.5, oxide of iron, from 1.2 to 7.5. It has lately been discovered in the United States.

FIRST CLASS.

SALINE STONES, or the combination of earths with acids, comprehending several genera.

GENUS I.

Earthy Salts, with a basis of Lime.

SPECIES I.

Carbonate of lime, including different kinds of lime-stone, of which there are several varieties.

VARIETY I.

Calcareous spar, presents a diversity, in point of figure; the rhomboidal is the most common; some are pyramidal, as in the hog and dog tooth spar. They contain from 34 to 36 of acid, from 53 to 55 of earth, and the remainder water. These stones sometimes contain a small quantity of iron, giving a variety in colour.

VARIETY II.

Calcareous stones not crystalized—Of this we will make two divisions; such as admit of a polish, and such as do not.

Of the former, are the different kinds of marbles and alabasters: white marble is the purest; as the ancient Parian marble—Black marble is coloured by iron, bitumen, schorl, &c. Some are composed of the shells of animals, united by a calcareous cement; that of Carinthia, forms one of the most beautiful.

Alabasters are calcareous stones, having some degree of transparency, causing a double refraction.

Such as do not admit of a polish, are found in masses; as stones for building, or in a pulverulent form, as chalk. These are taken up by waters, and deposited on different substances, forming petrifications, or stalactites.

If the carbonate of lime be exposed to a violent heat, it is converted into quick lime; in this case, the stone is deprived of its water and acid, and a portion of caloric perhaps enters in combination: in this state, the lime is caustic; but if exposed to the air, it again absorbs what it had lost, and becomes mild or regenerated lime-stone, as we observe in mortar, used as a cement for building, &c.

SPECIES II.

Sulphate of lime, gypsum, selenite, plaster of Paris, or plaster stone, is found in solid masses, crytallized, stalactites, or in the form of gypseous earth, fossil flower, &c. having a degree of transparency which is lost by calcination; by this process it becomes pulverulent, absorbs large quantities of water, and again resumes its hardness, but not its transparency. It is found of different colours: the white is most esteemed: 100 parts contain 30 of acid, 32 of lime, and 38 of water.

SPECIES III.

Fluate of lime, or fluor spar—It becomes blue, when heated, and, like common salt, decipitates: it is found of different colours, from which it receives the name of false emerald, amethyst, and topaz.

SPECIES IV.

Nitrate of lime exists only in waters, owing to its great solubility and deliquescence.

This salt calcined, emits light in the dark, and constitutes Baldwin's phosphorus.

SPECIES V.

Muriate of lime, exists in sea waters, which is supposed to give the bitter taste to them. It is deliquescent, and when calcined, like the former, becomes phosphorescent, and is called Homberg's phosphorus.

SPECIES VI.

Phosphate of lime is a whitish stone of some degree of hardness—in the fire it emits a beautiful green light—It constitutes the base of animal bones.

GENUS II.

Earthy salts with the base of barytes.

SPECIES I.

Sulphate of barytes, or ponderous spar, is the heaviest of all stones; it is found in plates, applied upon one another, and easily separated: when heated it exhibits a blueish light in the dark.

SPECIES II.

Carbonate of barytes, this combination is extremely rare—100 parts contain 7 acid, 65 barytes, and 28 water.

SPECIES III.

Nitrate of barytes is not found native. The nitric having less affinity for this earth than the sulphuric and fluoric acids.

SPECIES IV.

Muriate of barytes appears lanced, and is an excellent test for the smallest portion of sulphuric acid—It is a production of art.

GENUS III.

Earthy salts with a base of magnesia.

SPECIES I.

Sulphate of magnesia or epfom salt is found in mineral waters, it crystallizes in fine white needles—100 parts contain 24 acid, 19 magnesia, and 57 water.

SPECIES II.

Nitrate of magnesia: this salt decomposes the muriates, and is decomposed by lime and the alkalies.

SPECIES III.

Muriate of magnesia, exists in the mother waters of salt works; it is very bitter.

SPECIES IV.

Carbonate of magnesia is obtained by precipitating epsom salt, by an alkaline carbonate.

GENUS IV.

Earthy salts with the base of alumine.

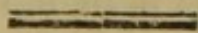
SPECIES I.

Sulphate of alumine, or alum, may be formed by digesting the sulphuric acid upon clay—It is also found native.

SPECIES II.

Carbonate of alumine, is formed by adding, a solution of an alkaline carbonate, to a solution of alum: the carbonic acid unites to the alum, while the sulphuric acid unites to the alkali.

The combinations of the other earths are but little known.



SECOND CLASS.

Concerning the mixture of earths.

Earths are found mixed with each other, in large masses, having the characters of

the earth which predominates—which we will consider as specific.

GENUS I.

Calcareous mixtures.

SPECIES I.

Lime-stone and magnesia, this combination exists in common lime-stone.

SPECIES II.

Lime-stone and barytes, is found in Derbyshire.

SPECIES III.

Lime-stone and alumine, as the different kinds of marle.

SPECIES IV.

Lime-stone and silex, constitutes the stalated spar, or stern schorl: It contains 66 lime, 30 silex, and 4 of iron.

SPECIES V.

Lime-stone and bitumen, is known by the name of fwine-stone; it emits a fœtid smell by friction.

SPECIES VI.

Lime-stone and iron; sometimes iron exists in such large quantities in lime-stone as in hematites &c. as to constitute iron ore.

GENUS II.

Barytes with other substances.

SPECIES I.

Sulphate of barytes, petroleum, gypsum, alum, and silex, constitute liver-stone, or lapis hepaticus.—100 parts contain 33 barytes, 5 petroleum, 7 gypsum: 17 alum, and 38 silex.

SPECIES II.

Carbonate of barytes, iron and silex, resemble the sulphate of barytes.

GENUS III.

Magnesian mixtures.

All the stones of this genus are soft, or greasy to the touch, and take a tolerable good polish.

SPECIES I.

Carbonate of magnesia with silex and alumine—this mixture forms steatites, talcs, pot-stones, or lapides ollares. It is white and soft, 100 parts contain, 80 silex, 17 carbonate of magnesia, 2 alumine, and 1 iron.

Serpentine, contains the same ingredients but differing in the proportions.

It is harder than the former, takes a better polish, is of different colours, and sometimes transparent.

SPECIES II.

Carbonate of magnesia, silex, lime, alumine, and iron: these constitute asbestos, and mountain cork: asbestos is brittle and rough to the touch, and of a grey colour. Mountain cork, is so called from a resemblance to this substance.

SPECIES III.

Carbonate of magnesia, lime, sulphate of barytes, alumine and iron: this combination forms amianthus, it is composed of flexible threads: this was manufactured into cloth, by the ancients.

GENUS IV.

Mixtures of alumine.

SPECIES I.

Alumine, silex, carbonate of lime, and iron, comprehend all the varieties of clay. They adhere to the tongue, and are used for pottery &c.

SPECIES II.

Alumine, pure magnesia, silex, and iron, this combination forms mica; it is lamel-
lated, shining, and of various colours.

SPECIES III.

Alumine, magnesia, silex, lime, and iron, these form horn blende. It has a close grain, and a greyish black colour.

SPECIES IV.

Alumine, silex, carbonate of magnesia, lime and iron—To this species belong most of the varieties of schistus or slate, as the purple, blue, black &c.

SPECIES V.

Alumine, silex, barytes, carbonate of lime, and magnesia, form another kind of schif-

tus called pyritous schistus, when bitumen is present in the composition, it is called bituminous schistus.—When bitumen abounds, it forms the different kinds of pitcoal.

SPECIES VI.

Alumine, silex, lime and water: these form what is called zeolyte, it is white and se-mi transparent.

GENUS V.

Siliceous mixtures.

All the stones of this genus, give fire with the steel.

SPECIES I.

Silex, alumine, lime, and iron, intimately combined form all the varieties of precious stones or gems.

1. *Red gems, as ruby, garnet, &c.*
2. *Yellow do. as topaz, hyacinth, &c.*
3. *Green do. as emerald, chrysotite, beryl.*
4. *Blue do. as sapphire.*

SPECIES II.

Silex, with a small quantity of *alumine, lime, and iron*, form quartz and rock crystal: in this last, silex is in an almost pure

state: It is often tinged with iron, and receives different names, from its colour.

When *Red, false Ruby,*
Yellow, Bohemian Topaz,
Brown, smoky Topaz,
Green, false Emerald,
Blue, water Sapphire,
Violet, Amethyst.

SPECIES III.

Silex, lime, alumine, and iron, intimately mixed, form coarse and fine flints; as gun-flints, petro-filex, agate, calcedony, carnelian, &c.

SPECIES IV.

Silex, alumine, and iron, form jasper; this is one of the hardest stones, and receives a beautiful polish.

SPECIES V.

Silex, alumine, lime, and a small quantity of magnesia, and iron, form schorls and volcanic productions. Schorl is found differing in colour, as black, green, violet, &c. The tourmaline seems to be a variety of it.

Lava is the principal of volcanic productions; *basalties* is crystalized *lava*. *Puzzolano* is the same stone attenuated.

SPECIES IV.

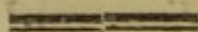
Silex, *lime*, *magnesia*, *iron*, *copper*, and *the fluoric acid*, forms the *chrysoprase*; it is of a greenish colour, and extremely hard.

SPECIES VII.

Silex, *blue fluuate of lime*, *sulphate of lime*, and *iron*, constitute *lapis lazuli*, or *azure stone*. This stone, in powder, forms a valuable blue, known by the name of *ultramarine*.

SPECIES VIII.

Silex, *magnesia*, *barytes*, and *alumine*, form *feld-spar*; it is white and lamellated, and is one of the constituent parts of *granite*.



METALLIC SUBSTANCES.

METALS are simple bodies, distinguished by their gravity, opacity, and brilliancy. They are found in the bowels of the earth, in a metallic state, called *native* or *virgin* metals; in a state of oxydation, or in com-

bination, as pyrites, &c. All the metals are soluble in acids, forming metallic salts. We are acquainted with the following—Gold, platina, silver, mercury, copper, iron, lead, tin, zinc, antimony, bismuth, cobalt, nickel, manganese, uranite, sylvanite, titanite, chrome, arsenic, molybdenite, and tungstinite.

Gold, silver, and platina, are considered as perfect metals, being more difficultly oxydized than the other metals, which are called imperfect.

OF GOLD.

This metal is of a yellow colour, ductile and tenacious, and generally found pure; it melts at 32° of Wedgwood's thermometer; by a continued heat it is volatilized in its metallic state: the sulphuric acid has no action on it, but the nitric muriatic and oxygenated muriatic acids dissolve it. If this solution be precipitated by ammoniac, fulminating gold is obtained, in the form of an oxide; this, when gently heated, detonates violently; the oxygen of the gold and the hydrogen of the alkali take fire, and the metal is revived.

Tin also precipitates gold from its solution; this powder is used for painting on

porcelain : and is the purple powder of Cassius. Gold is also soluble in the alkaline sulphurets ; it unites with most of the metals.



PLATINA

Is of a greyish white colour, the most ponderous of all bodies ; it is found in South America, in small grains, resists the heat of a common furnace, and is scarcely altered by a flame of oxygen gas. It is soluble in the nitro and oxygenated muriatic acids, from which it is precipitated by the muriate of ammoniac, potash, and soda. It unites with most of the metals. If platina be once fused, with the burning lens, or oxygen gas, it becomes as malleable as gold.



SILVER

Is a white shining metal, possessing in an eminent degree, malleability and ductility. It is not oxyded by exposure to the atmosphere. By violent heat it is converted into a green glass. It is found frequently pure, being called virgin silver : It is also

found combined with other metals, and frequently mineralized by sulphur, &c. Nitric acid dissolves half its weight of silver, this solution deposits crystals, which when fused and cast into moulds, constitutes the *lapis infernalis*, or lunar caustic. Copper precipitates silver from all its solutions; in a metallic state, presenting an appearance of vegetation.

If mercury be used for this purpose; the precipitate is called *Arbor Dianæ*. The nitrates of silver and mercury, are good tests for detecting, the presence of the muriatic acid. If to the nitric solution of silver, muriatic acid be added, a precipitate is obtained; the muriatic acid unites to the silver, forming a muriate of silver, or lunar cornea. Lime-water and the alkalies, also precipitates silver from its solutions. If lime-water be added to the nitrate of silver, the silver is precipitated in the state of an oxyde. If this oxyde be dried in the air, and mixed with the volatile alkali, it assumes a black colour; the fluid must then be decanted and the powder dried; this constitutes fulminating silver, the most dangerous of all fulminating substances; when once made, it cannot be touched without danger of an explosion. Only a very small quantity can be made at a time. In this case, the oxygen of the silver, unites to the hydrogen of the ammoniac, and pro-

duces water in a state of vapour : the expansive power of this vapour, with the nitrogen of the ammoniac, are the causes of the explosion ; the silver being revived.

MERCURY

Is fluid at the common temperature of the atmosphere ; at 39° below 0 of Fahrenheit's thermometer, it is congealed, and then in common with other metals, possesses malleability &c. It boils at the temperature of 600° . It is of the colour of bright silver, and has been found in large quantities in South America, in its virgin state, also combined with sulphur, forming cinabar or ethiops ; when bright red, it is called vermilion.

If mercury be exposed to the air, it is converted into a black powder, called black oxyde of mercury : this is an imperfect oxyde.

If a quantity of mercury be exposed to the air, in a low degree of heat, for several months, it is converted into a powder, called red oxyde of mercury, or precipitate per se. This gives out its oxygen by heat and the mercury is revived.

Mercury evaporates like other substances, persons being salivated by breathing

the air of an apartment, in which mercury was exposed.

If water be boiled upon mercury, a minute portion is taken up—It may be detected by exposing a piece of gold in it—This mercurial water, has the property of destroying worms.

The sulphuric acid acts on mercury only when assisted by heat; sulphureous gas, being disengaged, and a white powder deposited: this powder is heavier than the mercury made use of; if thereon boiling water be poured, it assumes a bright yellow colour, called turbith mineral. The French chemists are of opinion, that this is an oxyde; Dr. Woodhouse, on the contrary, supposes it to be a sulphate: It however gives out its oxygen by heat.

The nitric acid acts on mercury, without the application of heat, nitrous gas being disengaged; one part of the acid oxyding the metal, while the other dissolves it.

RED PRECIPITATE is formed by heating the nitrate of mercury in a crucible, or by distilling it three or four times with fresh nitric acid. Mercurial water is formed by dissolving the nitrate of mercury in water. It detects sulphuric and muriatic salts—some of the acids, alkalies, earths and metals, precipitate mercury from its solution, in the state of an oxyde.

MERCURIUS CINEREUS, or ash-coloured calx of mercury, is formed by precipitating the nitric solution by caustic ammoniac.

MERCURIUS FUSCUS, or yellow precipitate, is obtained by adding a solution of mild potash, to the nitric solution of mercury.

MERCURIUS PRECIPITATUS ALBUS, or white precipitate, is formed by precipitating the nitrate of mercury, by the carbonate of ammoniac : It is a carbonate of mercury. The nitric acid, in this experiment seizes the ammoniac, while the carbonic acid combines with the mercury.

The carbonate of ammoniac employed in this experiment, must be made says professor Woodhouse, by adding to a solution of the muriate of ammoniac, the carbonate of potash ; unless this is attended to, the precipitate instead of being white, will be of a black colour.

FULMINATING MERCURY : If mercury be boiled with nitric acid, in the proportion of 100 grains, to 12 drachms of acid ; and if to this nitrate, 2 ounces of alcohol be added to each 100 grains, and applying a low degree of heat, a powder is deposited, which when dried, constitutes the fulminating mercury : This powder inflames and detonates in vacuo ; it explodes by fricti-

on, by the blow of a hammer; by electricity, and by the addition of the sulphuric acid: In those experiments, the mercury is revived; and the heat produced, is not sufficient to explode gun-powder.

Muriatic acid, digested for sometime on mercury, oxydes and dissolves it.

MERCURIUS DULCIS, calomel, or the mild muriate of mercury, may be formed in the dry or humid way. Scheele's method is by adding a solution of common salt, to a solution of nitrate of silver—the muriatic acid of the salt unites to the mercury, and forms the muriate of mercury, while the nitric acid unites to the soda.

It is also made by adding the muriatic acid to a nitric solution of mercury.

If formed in the dry way, four parts of corrosive sublimate, and three of quick silver, are triturated together, and sublimed in a glass vessel.

Calomel often contains a small proportion of corrosive sublimate; to free it from this, nothing more is required, than the addition of hot water; the sublimate being dissolved, may be poured off with the water, and the calomel, being insoluble, remains.

CORROSIVE SUBLIMATE, or the oxygenated muriate of mercury is formed by the

oxymuriatic acid and mercury. This salt is also formed in the dry and humid way. If equal parts of dried nitrate of mercury, decripitated muriate of soda, and sulphate of iron, be rubbed together, and sublimed, a fine corrosive sublimate is formed. Equal parts of common salt and sulphure of mercury, being sublimed, also afford it.

Mercury dissolved in the oxygenated muriatic acid, and evaporated, forms a beautiful corrosive sublimate. It is also obtained by mixing common salt, mercury, and the black oxyde of manganese, and then adding sulphuric acid. The only difference between this salt and calomel is, that it contains a greater portion of oxygen.

Corrosive muriate of mercury is decomposed by the fixed and volatile alkalies, lime, barytes, and magnesia.

If corrosive sublimate be added to lime-water, a yellow precipitate is produced, which is again dissolved: this liquor is called aqua phagedenica.

The acetic acid dissolves the oxyde of mercury, forming an acetate of mercury: This is the base of Keyser's pills.

The boracic acid unites to mercury—If a solution of borax be added to mercurial water, a yellow precipitate is formed, and part remains in solution, which may be obtained by evaporation.

ETHIOPS MINERAL, or the black oxyde of mercury, is formed by triturating 4 parts of mercury and 12 of sulphur. If ethiops be sublimed, a sulphurated oxyde of mercury or cinnabar is formed; which is called vermilion by the painters.

Mercury combines with most of the metals, forming amalgams: on this is founded the art of gilding, the working of mines, &c.

Mercury is also used in thermometers, barometers, and various chemical experiments.

COPPER

Is a red, elastic, and sonorous metal, nauseous to the taste, often found native, but generally mineralized by sulphur, as in copper pyrites; by the decomposition of these, the sulphate of copper is formed, which is soluble in water, and may be detected in some mineral waters, by immersing a piece of polished iron, on which the copper is deposited in a metallic form.

Sulphuric acid, concentrated, acts on copper, with the assistance of heat; sulphureous gas being disengaged, and the sulphate of copper is formed: to which if ammoniac be added, the copper is precipitated

and immediately redissolved, a beautiful blue colour being produced. This liquor is called aqua cœlestis, which by evaporation leaves cuprum ammoniacum.

Nitric acid acts violently on copper, nitrous gas and dephlogisticated nitrous air being emitted.

Muriatic acid does not act on copper, without the assistance of heat.

Acetous acid corrodes copper, forming acetate of copper, or verdigris.

ENS VENERIS is made by subliming copper and sal ammoniac.

AQUA SAPPHARINA, may be made by digesting sal ammoniac and lime-water in a copper vessel, or by adding verdigris and sal ammoniac to lime-water.

Copper combines with several of the metals. With arsenic it forms tombac, with bismuth, a reddish white alloy; with antimony, a violet alloy; with zinc, it forms Manheim gold; with lapis calaminaris, brass; with tin, bronze; it also unites with gold, silver, &c.



IRON

Is of a greyish colour: It is the only metal that strikes fire with quartz, or that

is obedient to the magnet. This metal, when exposed to heat, becomes oxyded, separates in scales, and is called finery cinder, which is still attracted by the magnet: when the oxyde is of a black colour, it is called Ethiops martial, or the black oxyde of iron: If this black oxyde be urged by heat, the crocus martis, or saffron of Mars, is formed.

Iron burns vividly in oxygenous gas. It contains carbon and oxygen.

STEEL is formed by depriving iron of its oxygen, and combining a greater proportion of carbon, by means of heat.

Cast or pig iron contains more carbon than steel.

Iron and steel are fusible, being then called cast iron or steel.

To convert iron into cast steel, nothing more is necessary than to fuse it with a substance containing carbon; as charcoal, pit-coal, plumbago, carbonate of lime, &c. about 1 part of carbon to 90 of iron, is sufficient to make the best cast steel. It was formerly made by fusing steel of cementation, but it is now proved that malleable iron, and even iron ore, answers the same purpose.

Sir Thomas Frankland asserts, that cast steel and common steel, or iron, will unite; the former in a white, the latter in a wel-

ding heat: But the fact is, that if a white heat be given to cast steel, it is converted into iron. From the information of persons of veracity, I am induced to believe, that if the two unite, it must be by giving a cherry red to the cast steel, and a welding heat to the iron; then gently hammering them together; after which they are again to be heated cherry red, and hammered until they become black.

Iron combines with sulphur, forming martial pyrites, or sulphurets of iron: in this manner pyrites are formed in the bowels of the earth. It is by the decomposition of these, that the formation of sulphate of iron must be accounted for.

COLCOTHAR OF VITRIOL is formed by calcining the sulphate of iron, thereby driving off the water and acid.

INK is made by mixing the sulphate of iron and powdered galls in water, the iron is precipitated by the gallic acid.

The common sulphate of iron consists of two salts, the green and red sulphate: the former is soluble in alcohol, but the latter is not.

If diluted sulphuric acid be added to iron, the water is decomposed; its oxygen oxydes the metal, while its hydrogen is disengaged;

and the acid dissolves the oxyde—forming sulphate of iron by crystallization.

The nitric acid acts on iron—If more iron be added to a solution already saturated, the acid throws down the oxyde, and attacks the iron.

The muriatic acid acts on iron, when diluted, with violence; producing hydrogenous gas.

PRUSSIAN BLUE is formed by dissolving iron in the prussic acid.

ZWELFER'S SAFFRON OF MARS, is formed by detonating equal parts of steel filings and nitre in a crucible.

ENS MARTIS, flores martiales, or martial flowers, is formed by subliming one pound of muriate of ammoniac, and one ounce of steel filings.

Iron dissolved in the acidulous tartrate of potash, forms the soluble martial tartar, or aperitive extract of Mars.

The carbonic, phosphoric, fluoric, acetic, and prussic acids, all unite to iron, forming different combinations.

Iron is found in plants, and in animal fluids.

LEAD

Is the softest, least sonorous, least tenacious, least elastic, and one of the heaviest and most fusible of the metals. It is of a blueish white colour.

Lead is generally found mineralized with sulphur, and is then called galena: if this metal be kept in fusion, for sometime, its surface is converted into a grey oxyde: this oxyde when exposed to a greater heat, becomes yellow, and is called massicot: If the heat be continued, it is changed into a red oxyde or minium. This oxyde is 10 per cent heavier than the metal used.

If a stream of fresh air be directed over lead in fusion, a scaly oxyde is obtained called litharge.

The oxydes of lead afford oxygenous gas by distillation.

The muriatic acid dissolves lead; this muriate of lead, by calcination, affords a powder of a yellow colour, called patent yellow. This is also made by fusing in a strong heat, an oxyde of lead, and common salt.

The acetic acid, corrodes lead and affords a white oxyde, known by the name of white lead. Ceruse is a mixture of white lead and chalk.

SUGAR OF LEAD, is formed by dissolving white lead in vinegar, the solution being concentrated, forms efflorescent crystals.

If a piece of zinc be suspended in a solution of sugar of lead, the lead is revived, and adheres to the surface of the zinc, forming the leaden tree.

GOULARD'S EXTRACT, is a solution of sugar of lead in vinegar.

The oxydes of lead, are used to render oils drying; this is effected by giving out their oxygen to the oils.

If paper be written on with a solution of sugar of lead, it will be invisible, but if exposed to sulphurated hydrogen gas, it becomes black.

TIN

Is the lightest and most fusible of all the metals; it is soft and of a silver white colour; emits a crackling noise when bent, which is called the cry of tin: This has been attributed to arsenic; but some late experiments on Malacca, and Banca tin have proved the contrary.

If tin be kept in fusion, and the surface exposed to the air; it is converted into a

grey oxyde, which by more heat, becomes a white and perfect oxyde, called putty.

If melted tin, be triturated in a mortar till it cools, it is called pulvis stanni.

The muriatic acid, dissolves tin.

THE FUMING LIQUOR OF LIBAVIUS, is made by distilling an amalgam of tin and mercury, and the same quantity of corrosive sublimate; an insipid liquor accompanied with white vapours comes over: It is an oxygenated muriate of tin.

Highly concentrated nitric acid, has no action on tin, but if diluted, the water is immediately decomposed, its oxygen converts the metal into an oxyde: part of the acid seizes this oxyde, and forms with it a nitrate of tin; while the hydrogen of the water unites to a part of the azote of the acid, and forms ammoniac; this is seized by another portion of the nitric acid, and is converted into the nitrate of ammoniac; the last portion of the nitrogen and oxygen of the nitric acid, unite, and form the nitrous gas, and the nitrous oxyde, which are given over during the process.

Tin dissolved in the diluted nitric acid, is used for the composition of scarlet dye from cochineal.

AURUM MUSIVUM, or Mosaic gold, is a sulphure of tin, it is formed by amalgama-

ting 8 ounces of tin, and mercury; this is put in a matrafs with 6 ounces of fulphur, and 4 of fal ammoniac, which must be exposed to heat: If the heat is such as to inflame the mixture, it is sublimed of a dazzling colour. In this process the tin is oxyded by the muriatic acid of the fal ammoniac: The hydrogen of the water of the fal ammoniac, unites with the sulphur, forming sulphurated hydrogen gas. The muriated oxyde of tin, and mercury, united with sulphur, forming cinnabar, also rises; the remaining oxyde of tin and sulphur, forming the aurum musivum.

An amalgam of tin and mercury is used in making looking-glasses.

A mixture of 3 parts of tin, 5 of bismuth, and 2 of lead, form an alloy, fusible at the temperature of boiling water.

An excellent amalgam, for exciting the electrical machine, is made by melting together 1 part of zinc, 1 of tin and 2 of mercury.

PEWTER is a mixture, of tin, lead, and antimony.

Tin is used for tinning copper vessels. It is used also in enamelling, in the composition of bronze, &c.

ZINC

Is of a whitish blue colour; when heated to redness, it sublimes in the form of a white powder called flowers of zinc, pompholix, &c. It is an oxyde, and is acted on by all the acids. If diluted sulphuric acid be used, the water is decomposed, its oxygen oxydes the metal, while the acid dissolves it, forming white vitriol; and the hydrogen escapes.

The nitric and muriatic acids act on zinc, forming the nitrate or muriate.

Zinc combines with most of the metals, with copper it forms tombac, prince's, and Pinchbeck's metal, similar, &c.

LAPIS CALIMINARIS, is an oxyde of zinc.

 ANTIMONY

Is a white semi-metal of a brilliant colour, difficult of fusion; when melted, it sublimes in the form of a white powder, called flowers of antimony.

Antimony is usually found combined with sulphur: The sulphur driven off by heat, leaves the metal after fusion in the state of a regulus. By calcination the reg-

ulus is converted into a grey oxyde, which being urged by heat, is changed into a reddish semi-transparent glass, called glass of antimony. This mixed with wax, constitutes the cerated glass of antimony.

KERMES MINERAL, or the sulphurated oxyde of antimony, is obtained by boiling the ore of antimony in a pure alkaline solution; after which the fluid is filtered, and the kermes is precipitated by cooling. It is also made by digesting pulverized antimony in lime-water. The golden sulphure of antimony only differs from it in colour.

If the sulphuric acid be poured on antimony, sulphureous gas is obtained, and the sulphur sublimes, leaving a metallic oxyde with a sulphate of antimony.

The nitric acid acts on this metal; the oxyde thus prepared, is a true bezoar mineral.

Muriatic acid long digested on antimony, acts partially on it.

If 2 parts of corrosive sublimate, and 1 of antimony, be distilled together, the butter or sublimed oxymuriate of antimony is obtained, which easily crystallizes: it is a violent caustic. If water be added to this oxymuriate, a powder is precipitated, called the powder of algaroth, or mercurius vitæ.

Water acts on this metal, contracting a purgative quality.

ANTIMONIAL WINE, is prepared by digesting the glass of antimony, or crocus metallorum in wine. It is dissolved in proportion to the acidity of the wine.

THE PERPETUAL PILL is antimony cast in that shape; the gastric juice acts on it.

TARTAR EMETIC or the antimoniated tartrate of potash, is formed by the glass of antimony, or the crocus metallorum, and the acidulous tartrate of potash, boiled in equal quantities with water; by filtration and evaporation, over a gentle heat, crystals are obtained.

DIAPHORETIC ANTIMONY is formed by detonating equal parts of nitre, and the regulus of antimony.

CROCUS METALLORUM is prepared by deflagrating the sulphure of antimony and nitre in an ignited crucible. This sulphurated oxyde of antimony must be pulverized and washed.

JAMES'S POWDER, is a composition of antimony and the phosphate of lime.

Antimony unites with several of the metals; with iron, it is called *regulus martialis*; with copper, *regulus veneris*, &c.

BISMUTH,

Or tin glass, is of a white, yellowish colour, brittle, and the most fusible of all the semi-metals.

When fused, it sublimes in the form of a yellow powder, called flowers of bismuth; which acquire 12 per cent in weight.

Bismuth is soluble in all the mineral acids, from which by the addition of water, a white powder falls down called the magistery of bismuth, pearl white, face white, &c. it is used by the ladies as a pigment for the face, but like all metallic pigments, is a bad one, being turned black, by sulphurated hydrogen gas.

The various solutions of bismuth in acids, constitute sympathetic ink.

This semi-metal unites with all the metals, but difficultly with the other semi-metals.

It amalgamates with mercury forming a fluid alloy.

They are frequently mixed by the druggists: but the fraud may be detected by dis-

solving the mixture in the nitric acid; the magistery of bismuth will be produced.

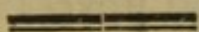
COBALT

Is a semi-metal, of a grey or whitish blue colour; it is generally found combined with arsenic; when cleared from this, it is known by the name of zaffer; this oxyde fused with 3 parts of sand, and 1 of potash, forms a blue glass, which, when pounded and ground in a mill, is called smalt, the finest particles washed off by water, are named azure; it is used in the preparation of clothes, and laundresses use it as they do Prussian blue. It is used in painting on porcelain, pottery, &c. This semi-metal is soluble in the acids. With muriatic, and nitro-muriatic acids it forms a very singular sympathetic ink.

NICKEL

Is of a greyish colour, difficult of fusion, soluble in the mineral acids, and generally found combined with arsenic and iron. The arsenic is separated by repeated calcination.

The sulphuric acid distilled on nickel affords sulphureous acid; the residue communicates a green colour to water. It does not amalgamate with mercury.



MANGANESE

Is of a blackish colour, and always found in the state of an oxyde, more or less perfect, from which the metal has been obtained by Mr. Ghan. This oxyde affords large quantities of oxygenous gas by heat only. If 1 part of the oxyde of manganese and 3 of nitre, be put in a crucible and exposed to heat, camelson mineral will be formed. Scheele has proved that the ashes of vegetables contain manganese: to this the blue colour of calcined potash has been attributed.

This semi-metal is more fusible than iron.

The oxyde of manganese distilled with charcoal affords the carbonic acid, and unites easily by fusion, with all the metals, except mercury. The sulphuric acid attacks manganese, and produces hydrogen gas.

The nitric acid dissolves manganese with effervescence.

The muriatic acts on the metal, but when digested on the oxyde, it seizes the

oxygen, and is converted into the oxygenated muriatic acid.

The oxyde of manganese is used to deprive glafs of its green colour; hence the term glafs makers soap. It gives a violet colour to glafs and porcelain.

ARSENIC

Is generally found in the state of an oxyde, it is brittle, white, and soluble in water; exhaling an odour of garlic, when exposed on hot coals.

By fusion it unites with metals, rendering them brittle.

The oxyde of arsenic united with sulphur forms orpiment or realgar: the only difference is in the colour, which only depends on the degree of heat used: They are found native in different parts of the world.

If equal parts of orpiment and corrosive sublimate, be distilled together, a black liquor comes over, called the sublimed muriate, or butter of arsenic.

The arsenical acid is obtained by distilling 6 parts of nitric acid, and 1 of the oxyde of arsenic. This acid is obtained in a concrete state, but attracts the humidity of the atmosphere.

Arsenic is used as a flux in glass-houses, and is also used by dyers. Orpiment and realgar are much used by painters.

MOLYBDENA

Has long been taken for black-lead ore ; but is a semi-metal of some degree of brilliancy : It is composed of scaly particles, slightly adhering to each other.

It is oxydated in a strong heat ; the concentrated sulphuric acid dissolves a great quantity of it. The molybdic acid is obtained in the same way as the arsenical.

Wolfram, tungstinite, titanite, sylvanite, or telurite and uranite, are semi-metals, of which we know but little more than the names,

VEGETABLE KINGDOM.

VEGETABLES are organized living beings, endowed with irritability, and probably with the power of sensation. To these may be added, digestive and secreting organs, with the apparent faculty of locomotion.

The difference between the vegetable and mineral departments, has been satisfactorily established, by philosophers : but the limits between the animal and vegetable creation, will, perhaps, never be determined.

Vegetables may be considered as the lowest order of animated beings : like animals, they digest their food, and propagate their species. They will grow and vegetate in air, in which animals have perished : This fact evinces that pure air is not necessary to their existence. Light is essentially necessary to them ; and they possess a temperature of their own, at times exceeding that of the atmosphere.

The constituent principles of vegetables are more numerous and complicated than those of minerals. It is therefore evident,

that chemists must have made less progress in the former, than in the latter.

Plants are defended with a general covering, analogous to the skin of animals; which is divided into three different parts, viz. The external, or cuticle; the cellular or true bark, and the cortical, or liber.

The first, or *cuticle*, if detached from the bark is again reproduced, adhering more closely to the bark; forming a cicatrix, similar to what takes place when the epidermis of animals has been destroyed: it also serves to defend the plant from external injuries.

The second, or *true bark*, is chiefly composed of glands and vessels; and might be considered as the lymphatic system: By this, all the secretions are performed.

And lastly, the *cortical*; which appears to be a perfect tissue of vessels, analogous in its functions to the system of blood vessels in animals; and from which the wood is formed.

The bark is the most essential part of the vegetable: Some plants consist merely of bark, as the gramina, or grasses.

Trees have frequently been decayed internally, and kept alive by the bark alone.

THE WOOD is formed of concentric layers; the innermost are the hardest: the external, which are always whiter, are called sap.

THE PITH is found in the centre of young branches, and disappears as they grow larger. Vegetables are furnished with glands, for the purposes of secretion.

THE LEAVES perform an important office in the economy of vegetables; they have been compared to the lungs in animals.

The food of plants appears to be various; as water, carbonic acid, &c. From these different substances, the sap, or blood of the plant, is produced, from which the secretions, as gums, resins, mucilages, &c. are formed.

MUCILAGE is that viscid substance, which exists in seeds; as in linseed, &c. It is in greater quantities in young vegetables; is insipid, inodorous, soluble in water, but not in alcohol, and is one of the nutritious parts of vegetables. Mucilage is absolutely required for the acetous fermentation. If this substance be treated with the nitric acid, the oxalic will be formed; and if with the muriatic, the citric acid will be produced.

GUMS are inspissated mucus; as the cherry gum: that exuding from other trees, as gum Arabic, gum adragant, &c. They appear to consist of oxygen, hydrogen, carbon, nitrogen, lime, and the phosphoric acid.

OIL is a combustible fluid, and insoluble in water. There are two kinds of oil, the fixed and the volatile: the former is combined with mucilage, and the latter with aroma.

FIXED OILS are obtained by expression, from seeds, &c. they combine with alkalis, forming soap. Fine white soap is made from tallow and soda; and the soft soap from whale-oil and potash.

Fixed oils are insoluble in alkohol: They afford, by distillation, phlegm, acid, a light oil, hydrogen gas, and carbonic acid. By the combustion of oils, lampblack, or the charcoal of oils, is produced.

VOLATILE OILS are obtained by distillation and expression; they are slightly soluble in water, and entirely so in alkohol and acids: they have a greater affinity with oxygen, than fixed oils—forming resins.

Some of the essential oils inflame, by the addition of the nitric acid. Dr. Mitchill has taken notice of this in an elegant manner, in the following verses:

You saw, that time, terrific anger boil,
When aqua fortis met with heated oil;
Both vanquish'd, falling underneath the shock,
Expir'd in blaze and suffocating smoke!!!

STARKEY'S SOAP is made by triturating 10 parts of caustic alkali, with 8 of the oil of turpentine, together, in a hot mortar.

RESINS are oils rendered concrete, by the absorption of oxygen: They are inflammable, insoluble in water, and soluble in alcohol. The purest are, the balm of Mecca, or Judea, tacamahaca, elimi, sanguis draconis, &c.

VARNISH is made by dissolving resin in different substances. There are three kinds of varnish; the fat oil, essential oil, and spirit varnish. The fat oil varnish is resin, dissolved in drying oil; essential oil varnish is a solution of resin in oil of turpentine, &c. spirit varnish is made by dissolving resin in alcohol. Oil of turpentine is generally added to fat oil varnish, to promote its drying; and to spirit varnish, to prevent its cracking.

The beautiful black varnish of the Chinese is obtained from a tree, by incisions.

GUM RESINS seem to consist of an extractive matter and resin: they are partly soluble in water, and in alcohol; as the frankincense, scammony, gum gutta, assa fœtida, &c.

BALSAMS are resins combined with aroma; they contain a principle, which by

combining with oxygen, forms an acid: under this head are placed, benzoin, balsam of Tolu, storax, &c.

GUM ELASTIC is obtained from a tree of South America, called caoutchouc, by incisions being made in it. It is applied on moulds of clay when soft, and afterwards dried. It is insoluble in water or alkohol; and is only dissolved in the nitric ether.

CAMPHOR is a gum resin, obtained from a species of laurel—the *laurus camphora*. It grows in China and Japan. Camphor may be obtained, in small quantities, from thyme, sage, rosemary, saffra, &c. The roots are generally used, from which the camphor is obtained by distillation. This is called crude camphor; which must be purified by sublimation.

The resin possesses the greatest virtue, and is taken up by alkohol.

FECULA of vegetables appears to be mucilage somewhat changed; it is insoluble in cold water, but when dissolved by hot water, it resembles mucilage: Leguminous vegetables contain the most of it. It is obtained by bruising the plant in water: by this process, the fecula will be deposited.

In this manner is prepared starch, cassava, falep, indigo, fago, &c.

VEGETABLE GLUTEN, or the materia vegeto-animalis, having some of the properties of animal substances, is obtained from wheat, barley, &c. by making a paste with the powder, and washing the fecula from it. This substance exists also in opium: it is insoluble in water: in the fire it burns like an animal substance, and seems to consist of carbon, hydrogen, nitrogen, oxygen, and phosphorus.

FARINA, or flour, is composed of three principles: of fecula, or starch; materia vegeto-animalis, or gluten; and sugar--each of which is capable of a peculiar fermentation: The fecula undergoes the acetous; gluten, the putrefactive; and the saccharine, a vinous fermentation. In the rising of bread, these three processes are combined.

SUGAR is a salt, extracted from numerous vegetables by a complicated process. The maple (*acer saccharinum*) beets, parsnips, carrots, &c. afford it; but it is obtained in general, and in the greatest quantity, from the *arundo saccharifera*, or sugar-cane. When purified, it is white, and then called loaf-sugar; and sugar-candy, when crystal-

ized. It appears to consist of oxygen, carbon, and hydrogen. An acid is extracted from it. (*See oxalic acid.*)

MANNA is a sugar, secreted, by several vegetables; as the maple, juniper, fig, &c. That of Calabria is the most esteemed.

ALBUMEN exists in vegetables, and is obtained from cabbages, &c. It resembles the serum of the blood; coagulating by heat, acids, and alcohol, and being soluble in cold water.

VEGETABLE ACIDS

Are all composed of carbon, hydrogen, and oxygen; they differ from mineral acids, in being more volatile; and after combustion leaving a coaly residue.

CITRIC ACID, or acid of lemons, is obtained by saturating the juice of lemons with chalk, which forms a citrate of lime; this must be washed in warm water, to which sulphuric acid is to be added, sufficient to saturate the chalk; after which, being boiled and filtered, the sulphate of lime remains on the filter; the liquor is then evaporated, and the acid is obtained in crystals.

It may also be obtained highly concentrated, by exposing lemons to the frost ; the aqueous parts congeal, while the acid remains fluid.

It is one of the strongest of the vegetable acids, and acts on many of the metals.

MALIC ACID, is obtained from the juice of unripe apples ; by saturating it with chalk, and adding a solution of acetite of lead ; the acetic acid combines with the lime, and the lead with the malic acid, which is precipitated ; this is to be washed in water, and sulphuric acid added ; sulphate of lead is formed, and the malic acid left pure : It unites with the earths and metals, forming malates.

BENZOIC ACID is formed by boiling together 1 part of lime, 4 of benzoin, and 4 of water, over a gentle fire ; the acid unites with the lime, forming a benzoate of lime, this is to be filtered, and muriatic acid added as long as a precipitate continues to be formed ; this precipitate is the benzoic acid. If distilled with the sulphuric acid, and the oxyde of manganese, it is converted into the acetic acid. Like the former, it unites with earths, alkalies, and metals.

TARTAROUS ACID, or acid of tartar, is obtained from tartar, by dissolving it in water, and saturating it with chalk; a tartrate of lime is precipitated; to this the sulphuric acid must be added, and the tartarous is set at liberty and is obtained by evaporation and crystallization. If this acid be boiled with the sulphuric, it is converted into the acetic acid; the taste of this acid is very sharp. By the addition of soda, sal rochelle or feignette is formed.

OXALIC ACID, or acid of sugar; is generally obtained from the salt of sorrel, which is the juice of the *oxalis acetosella*.

It may be obtained by treating 1 ounce of loaf-sugar, with 4 ounces of nitric acid; a low degree of heat is then to be applied, until nitrous gas ceases to come over, the heat is then to be increased and the liquor evaporated and crystallized. It is an excellent test for detecting the presence of lime.

CAMPHORIC ACID, is obtained in the same manner as the oxalic; it acts on copper, iron, zinc, arsenic, &c.

GALLIC ACID, is obtained from bark, roots, &c. or by infusing nut galls in water, and filtering it; after standing, a pre-

cipitate is deposited, which, being dissolved in boiling water, and evaporated by a gentle heat, deposits fine sandy crystals, which constitutes the gallic acid: It is acid and astringent to the taste. It effervesces with alkalies, and reddens litmus. It precipitates several of the metals: Iron of a black; lead, of a white; copper, of a brown; silver, of a grey; and mercury of an orange yellow colour.

TANNIN is that principle which combines with the gelatinous parts of animals, in the process of tanning: It is found in the bark and ligneous part of vegetables, generally accompanying the gallic acid.

SUBIREC ACID, or acid of cork, is bitter and pungent, and if exposed to the air, assumes a brownish colour: It unites with lime, potash, magnesia, alumine, &c.

EMPYREUMATIC ACIDS.

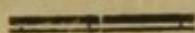
These acids are three in number.

PYRO-TARTAROUS ACID, is obtained, by distilling dry tartar. Its combinations are called pyro-tartrites.

PYRO-MUCUS ACID, is obtained by distilling saccharine, gummy, or farinaceous

mucilages : It communicates a reddish colour to the skin, dissolves iron, tin, and copper ; corrodes lead, &c.

PYRO-LIGNOUS ACID, is obtained by distilling wood : hard wood, as beech, &c. affords the largest quantities : It reddens the blue vegetable colours, does not precipitate iron ; unites with alkalies and earths : Its action on metals is similar to the acetous acid.



VEGETABLE FERMENTATION

Never takes place, without the presence of oxygen ; It is afforded by the atmosphere, or the decomposition of water. In this process heat is generated.

Fermentation is of three kinds, the acetous, the vinous, and the putrefactive. If mucilage is abundant, the acetous takes place—if sugar abounds, it is termed vinous ; and if gluten predominates, the putrefactive fermentation results.

ACETOUS FERMENTATION : for this process, it is necessary that oxygen, a certain degree of heat, and mucilage be present. When fermentation commences, the mass or liquid, becomes warm, and turbid at-

mospheric air is absorbed, and a sediment falls to the bottom: the liquor then becomes clear, emits a lively smell, and is acid to the taste.

If wine, beer, or cider, are suffered to ferment too long; or too much heat be applied, it passes from the vinous, to the acetous fermentation, forming vinegar. Spirit of wine, mucilage, and air, are required in the formation of vinegar.

Vinegar thus obtained, is concentrated by distillation, and is then called acetous acid.

The combination of this acid with potash, forms the acetite of potash, or *terra foliata tartari*; with soda, an acetite of soda; with ammoniac, *spiritus mindereri*.

The oxygenated acetous acid, radical vinegar, or acetic acid, is formed by combining a large dose of oxygen with the acetous. For this purpose, it is distilled with the metallic oxydes, or by the sulphuric acid, and the acetite of soda.

This acid forms salts denominated acetates; differing from those made by the acetous acid.

The acetic acid, is acrid and volatile, forming ether with alcohol.

It may be procured as strong as the sulphuric acid.

Combined, with the sulphate of potash it forms the salt of vinegar.

VINOUS FERMENTATION, is that by which wine, beer, cider, &c. are obtained; no substances but those containing a saccharine matter, are capable of this fermentation.

By mixing water and sugar, a rum, or taffia is obtained.

In making wine, the ripe grapes are pressed, and the juice received in proper vessels, in which the fermentation is suffered to advance—after a few hours, a motion is perceived in the liquor, which gradually increases; heat is developed, and the volume of the fluid is augmented, becoming oily and turbid, attended with the disengagement of carbonic acid: after some days, the motion subsides; the bulk decreases, the liquor becomes clearer, has an agreeable odour, is less saccharine, and has acquired a reddish colour, if made of the red grape. This is owing to the spirit dissolving the colouring matter of the pellicle. The liquor is now decanted and put into casks, where it undergoes a second fermentation: if this be prevented, the wine will be brisk, as the brisk champagne, &c. during the process, a substance is deposited, on the sides of the vessel, called crude tartar. It is purified by washing, and boiling it with clay; which when evaporated, and crystalized, is called cream of tartar, or the acidulous tartrate of potash: some wines afford more than others, and the tartar of

red wines possesses the colour of them. Its taste is acid and vinous.

CIDER, by a similar process, is obtained from the juice of apples; this liquor affords by distillation, the same product as wine, namely, brandy: Brandy, when obtained in this way, has, a disagreeable taste and smell, owing to the cider containing a great quantity of mucilage, which is altered by heat in this process.

PERRY is obtained from pears.

Cherries afford a tolerable good wine.

BEER is made from certain grains; as wheat, barley, oats, &c. These are moistened, and suffered to germinate to a certain degree, which is stopped by torrefying them: the germination and drying of the grains, destroy the gluten, it is then ground into a coarse meal, and is called malt; on this, warm water is poured, which dissolves the sugar and mucilage: In this state, it is called wort. It is then boiled with a quantity of hops, for the purpose of obtaining the bitter principle of that vegetable. It is now suffered to cool, and a quantity of recent yeast added: this soon excites the vinous fermentation, which is prevented from going too far, by putting it in casks, where it throws off a frothy scum. The

colour of the beer is owing to the degree of heat applied in drying the malt; when gently heated, pale beer is obtained.

BRANDY is usually procured from wine, by distillation.

RUM, from sugar, or the juice of the sugar-cane.

WHISKEY, or malt spirit, from the different grains.

KOUMISS of the Tartars, is obtained from milk, which has first gone through the acetous, and afterwards the vinous fermentation.

In the vinous fermentation, at the commencement of the intestine motion, atmospheric air is absorbed; this air, as well as the water of the mass is decomposed; a portion of the oxygen unites with the carbon of the saccharine principle, and flies off in the form of carbonic acid: while the hydrogen of the water unites with the remainder of the carbon, and forms alcohol.

ALCOHOL is an inflammable and volatile fluid, composed of hydrogen and carbon. It is purified by the addition of caustic potash; which combines with the water of the alcohol: a small quantity of the potash is

dissolved; this is proved by distilling it: Ammoniac will be produced in consequence of the hydrogen of the alkohol uniting with the nitrogen of the alkali. By burning 1 pound of alkohol, Mr. Lavoisier obtained 18 ounces of water.

Alkohol is the true solvent of resins, essential oils, soap, &c.

OFFA ALBA HELMONTII is formed by mixing equal parts of alkohol and carbonate of ammoniac; the two instantaneously unite, in a solid form. To succeed in this experiment, the vessel should be colder than the surrounding air: By rubbing the vessel with the hand, it becomes again fluid—This is called *the liquefaction of the blood of St. Januarius!* This pretended miracle is annually exhibited in Naples; cochineal is there added to give it a red colour.

ETHER is oxygenated alkohol; if the oxygenated muriatic acid be passed through alkohol, it will be converted into ether, and the acid changed into the common muriatic.

It is commonly obtained by distilling equal parts of alkohol and sulphuric or nitric acids: the carbon of the alkohol unites with the oxygen of the acid, and comes over in the form of ether. If sulphuric acid be digested upon ether, it is, after

some time, converted into an ethereal oil, or sweet oil of wine. Muriatic ether is made by distilling a mixture of alkohol, muriatic acid, and the black oxyde of manganese together.

Ether is the lightest and most volatile of all fluids ; insoluble in water ; burns with a white flame ; has a strong, agreeable, and penetrating odour.

VEGETABLE PUTREFACTION takes place whenever vegetables, impregnated with their juices, are heaped together, and exposed to the air : the mass soon swells ; becomes heated ; and hydrogen, azote, carbonic acid, with ammoniacal, fulphurated, and phosphorated hydrogen gases are given out. After this, the mass diminishes, and is reduced or resolved into a brown mold, forming an excellent manure.

It appears that a gas may be formed by vegetable putrefaction, deleterious to animals, by producing malignant fevers.

ART OF DYING

Consists in fixing the colouring principle of one body upon another. No process requires more chemical knowledge than

this. We must in the first place consider the manner in which colours are formed; the combination of colours, and the best means of extracting and obtaining them; and lastly, the method of applying and rendering them permanent. All bodies in nature possess the property of absorbing or reflecting the rays of light, thereby forming the various shades.

The art of dying, therefore, consists in changing the surface of one body by means of another; so that they will both reflect the rays of light alike.

The colouring principle in vegetables exists in four different states: with gum, extract, resin, or with fecula—from which it is extracted by chemical processes. When combined with gum and extract, water is sufficient to extract it: Spirit of wine dissolves it, when combined with resin: when it exists with fecula, an alkaline solution, or solution of lime, dissolves it: from which combinations they are precipitated by the addition of an acid, on those substances which are to be dyed. When the colour is of the nature of a gum, and soluble in water, it is necessary, in order to fix them upon stuffs, that they be immersed in a liquor, called a mordant. These are various; as, the acidulous tartrate of potash, sulphate of alumine, of iron, of copper, of zinc, &c. the nitro and oxygenated muriatic acids,

tin, &c. These are calculated to prevent the colours from being washed out. It is requisite that the mordant have a certain relation with the stuff and the colour. Tin is the mordant for scarlet, but will not give that colour to silk; and gives no colour at all to cotton.

Indigo, turnsole, rocou, &c. are soluble in alkalies and lime.

Indigo is sometimes dissolved in the vitriolic acid.

Stuffs to be coloured, are previously impregnated with a solution of alum, and then dipped in the colouring matter, which renders the blue colour permanent.

Before the application of the colouring principle, it is requisite to prepare the stuffs, by washing and boiling them in an alkaline solution. The oxygenated muriatic acid is also used for this purpose.

TURNSOLE is made from a kind of moss, by putrefaction.

INDIGO is obtained from a plant, by bruising it in water; by fermentation the colouring principle, or fecula, is deposited on the bottom.

WOAD is obtained in a similar way.
Sap colours, are extracts of plants.

ALKALIES exist in vegetables, they are obtained, by lixiviation, from the ashes.

Plants near the sea-shore, afford soda; others potash; and some, ammoniac; as the horse-radish, mustard, &c.

POLLEN, or prolific powder of vegetables, is of the nature of a resin: it is inflammable, soluble in alkohol, and has a peculiar smell.

WAX is a solid oil. It appears that wax and the fecundating powder are nearly alike.

HONEY, or nectar, is obtained from certain flowers, by bees; it often retains a noxious property, if obtained from poisonous vegetables. It appears to be a solution of sugar in mucilage.

AROMA, or the fragrant principle of vegetables, exists only in those containing an essential or volatile oil.

CHARCOAL, or the oxyde of carbon, is obtained from vegetables, by the process of charring or burning wood, without the free access of air. It is a black, sonorous, and brittle substance, insoluble in water, &c.

Sulphur, iron, gold, manganese, lime, alumine, and silex, are all contained in vegetables.

OPIUM is obtained from a species of poppy (the *papaver somniferum*;) it grows in Persia and Asia minor: it is extracted from the heads of the plants, by incisions made into them: the first fluid is collected, and affords the purest opium; but this is never exported from the country: that which we get, is procured by expression; it is then inspissated, and wrapped up in its own leaves. From some late experiments it appears to consist of a gum, a resin, a fecula, and a materia vegeto-animalis, or gluten farinæ.

ANIMAL KINGDOM.

The constituent radical principles of animals, are but few; as, carbon, hydrogen, nitrogen, oxygen, lime, and phosphorus.

BLOOD, when first drawn, is an homogeneous fluid; but soon separates into two distinct parts:—serum, and crassamentum. The serum swims on the top, and the crassamentum is composed of coagulable lymph and red globules.

SERUM is slightly saline; it coagulates at a moderate degree of heat; also, by alcohol and the acids. It yields, by distillation, phlegm, carbonate of ammoniac, and a fetid blackish oil; the ashes of the residue afford muriate and carbonate of soda, with the phosphate of lime.

THE COAGULABLE LYMPH of the blood may be obtained by putting a rough piece of wood in blood, when warm, and stirring it round; on which the coagulable lymph is collected: It is then to be washed in water,

and it presents a fibrous texture, has no smell, is insipid, and easily putrefies.

RED GLOBULES contain a large quantity of iron: If dried blood be burned, an oxyde of iron is obtained, obedient to the magnet.

GASTRIC JUICE is secreted from the stomach: by this the food is dissolved. It yields in distillation, phosphates, water, and gelatin.

PANGREATIC JUICE, and SALIVA, appear to be nearly the same.

MILK is secreted by that order of animals called mamalia: It is a white, sweet, and oily fluid; when exposed to the air, cream is observed on its surface: In a short time it becomes sour and separates into two distinct parts—coagulum and whey.

SERUM LACTIS or whey, may, by several processes, be made to pass into the vinous fermentation, and affords alkohol, vinegar, &c.

COAGULUM contains two substances—cheese and butter; cheese is obtained by suffering it to undergo the putrefactive fermentation. It is then dried, and acquires a proper consistence.

Butter is produced from the cream, by agitating it: The remainder is called butter-milk. Butter, by distillation, yields water, the sebatic acid, and a coloured oil.

LACTIC ACID or acid of milk; by evaporating four milk, then adding lime water to the residue, a precipitate is obtained; and the lime combines with the acid: The oxalic acid, is then added, which combines with the lime, forming an oxalate of lime, which is insoluble; and the acid remains in the fluid; this is evaporated to the consistence of an extract, to which alcohol must be added; this combines with the acid; it is then filtered, and the lactic acid is obtained by distillation.—This acid, unites with earths, alkalies, and metals.

SUGAR OF MILK is obtained by evaporating whey to the consistence of honey. It is then dried in the sun, afterwards washed and dissolved in water, and suffered to crystallize.—It has all the appearances of sugar: by the nitric acid, it is converted into the oxalic.

SACCHOLACTIC ACID, is obtained in the process of making oxalic acid, from sugar of milk; it is soluble in spirit, but not in water; is combustible, but leaves no residue, sour to the taste, and reddens litmus.

FAT is a condensed oil, consisting of carbon, hydrogen, and the sebacic acid. It is generally white, or yellowish; and is obtained pure, by boiling it in water. It has more consistence in some animals than others. It has all the characters of oil, being inflammable, forming soap, &c.

SEBACIC ACID, or acid of fat is obtained by distilling fat, on the water bath, or with a low degree of heat. It is also obtained by distillation from spermaceti.

It appears to exist ready formed in fat, and unites with metals earths, &c.

BILE is a fluid secreted by the liver, it is of the consistence of an oil, of a greenish colour, intensely bitter, and forms a froth by agitation, like a solution of soap. It has been supposed to be saponaceous, but this is denied by my ingenious friend Dr. Roebuck, in his inaugural dissertation printed at Philadelphia in 1801. By distillation it affords a water or phlegm, impregnated with a spiritus rector or aroma, and a quantity of fixed oil. The residue contains the phosphates and muriates of lime and soda. Iron has been supposed to exist in the bile, but some late experiments render this doubtful.

GELATIN, or jelly, is obtained, by boiling animal substances, such as bones, cartilages, tendons, skin, &c. It is insipid, inodorous, soluble in water, but not in alkohol: It soon putrefies, giving out hydrogen, azote, and carbonic acid: It is also soluble in acids, and alkalies; with nitric acid, it affords nitrogen gas: This substance made into cakes and dried, forms the portable soup: In a similar manner glue is obtained. The strongest glue is obtained from the skins of old animals.

Gelatin by distillation, affords a phlegm, with additional heat, it becomes black, swells up and emits a strong smell; an alkaline phlegm, empyreumatic oil, and carbonate of ammoniac, then come over: The residue affords muriate of soda, and phosphate of lime.

THE MUSCULAR PARTS of animals yield by distillation an alkaline phlegm, which soon putrefies, empyreumatic oil and carbonate of ammoniac. From the residue, fixed alkali, and muriate of potash are obtained. By the addition of the nitric acid, much nitrogen comes over. It also affords oxalic and malic acids, when treated with the nitric.

The muscular parts of animals when buried for a certain time under ground; afford a substance, similar to spermaceti.

URINE, is a fluid secreted from the blood by the kidneys: It is saline to the taste, of a pale yellow colour, and has a peculiar smell when fresh; which however is soon lost, and the smell of ammoniac is then perceptible: This ammoniacal odour is succeeded by one of a very fœtid and offensive nature.

Urine when recent, contains phosphoric acid in excess, holding a quantity of lime in solution. The urine of animals feeding on vegetables, does not contain this acid. Fresh urine, contains no less than 11 ingredients viz. uree, the radical or specific matter of urine; sulphate of lime, of magnesia, of soda, and of ammoniac; muriate of soda, and of ammoniac; albumen, gelatin; lithic and benzoic acids.

If urine be suffered to undergo the putrefactive fermentation, some of these principles are changed, and new ones formed: the crystals of the muriate of ammoniac, and soda are altered, and the following substances are generated: Phosphate, urate, and carbonate of ammoniac; ammoniaco-magnesian, phosphate, and ammoniac, united with the acetous and benzoic acids.

CALCULUS OF URINE, is a concrete salt, soluble in boiling water; which deposits crystals, by cooling; these crystals consti-

tute the lithic acid. This acid is also obtained by dry distillation, being called the sublimate of Scheele. It may also be procured by adding the nitric and muriatic acids to fresh-made urine; reddish small crystals, are precipitated: This acid is insipid and inodorous, changes blue vegetable colours, and is soluble in caustic alkali.

The sulphuric and nitric acids, act on calculus, but the muriatic acid does not.

It is always dissolved by the caustic alkalis, and precipitated by the acids.

A small quantity of lime, ammoniac, and animal matter is found in its composition.

PRUSSIC ACID, is that substance which gives the colour to prussian blue.

To obtain prussian blue, animal substances, as horns, hoofs, dried blood, &c. are exposed to a red heat, with a quantity of alkali: In this process, the alkali unites with the prussic acid, of the animal substance, forming prussian alkali. This alkali has the property of precipitating all the metals, from their solutions—the alkali unites with the acid, which holds the metal in solution, while the prussic acid unites to the oxyde, giving it a peculiar colour: Iron, blue; constituting prussian blue, or prussiate of iron: Gold, yellow: Lead, white: Copper, brown, &c.

Prussiate of lime or of potash, are made by digesting prussian blue with lime, or potash : these are good tests for detecting the presence of iron.

MUCUS of the nose, is a peculiar mucilage, containing muriate of soda, phosphate of lime, and soda, in a pure state.

SALIVA, is a fluid secreted by glands, situated in or about the mouth. It is more fluid than mucus, and contains the same saline principles.

The phosphate of lime from the saliva, is frequently deposited upon the teeth, and is then called tartar : Similar concretions have been noticed, in the ducts of the salivary glands.

TEARS are secreted by the lachrymal glands. The constituent principles are the same as saliva.

SYNOVIA is a glutinous substance, found in moveable articulations : It consists of water, carbonate, and muriate of soda, with the phosphate of lime.

SEMEN, consists of the following principles, water, mucilage, phosphate, and muriate of soda and of lime, and caustic soda.

SWEAT is generally of an acid nature, and probably contains the phosphoric.

LIQUOR AMNII, is composed of albumen, muriate of soda, pure soda, phosphate of lime, and water.

PUS, is a substance secreted by the arteries, when fresh it does not appear to differ much from mucus; but undergoes the acid fermentation, while mucus becomes putrid. Some persons have pretended that they have discovered a peculiar acid in pus.

BONES are composed of jelly, oil, lime, and phosphorus. By distillation, volatile alkali, Dippel's empyreumatic oil, hydrogen, and carbonic acid are obtained. The residue is called ivory black, by the painters.

ENAMEL OF THE TEETH is the hardest part of the animal. It is soluble in the nitric acid: this liquor saturated with the carbonate of ammoniac, affords a precipitate, which is the phosphate of lime. The phosphoric acid, after being disengaged by the nitric, existed in the liquor and seized the lime, while the carbonic acid was dissipated. It is also soluble in the muriatic acid, without the application of heat.

ZOONIC ACID is lately found to exist in and is to be obtained from animal substances by distillation.

FORMIC ACID or acid of ants, is procured in large quantity, by distilling the animals. It is soluble in alkohol, and unites with most of the metals.

ANIMAL PUTREFACTION, for this process air, heat, and water, are required; the animal substance, first acquires a faint and disagreeable smell, its texture becomes relaxed; its colour, changes to a blue, then green, and becomes softer, more fœtid, and assumes a brown colour; next a putrid odour manifests itself, mixed with that of ammoniac: It loses its consistence; the carbonated phosphorated hydrogen, together with carbonic acid are separated: It is now changed into a black fœtid mass, which forms a good manure, when mixed with mould.

In the process of animal decomposition, the nitric acid is generated by the union of the oxygen of the atmosphere, with a part of the nitrogen, of the animal substance; while the hydrogen of the animal fluid, combining with another portion of the nitrogen, forms ammoniac; a portion of the oxygen, unites with the carbon of the flesh, and forms the carbonic acid, which with a part of the hydrogen, holding phosphorus in solution, are disengaged.

MINERAL WATERS.

They are so termed from their containing mineral substances in solution. They may be divided into four classes—*acidulous*, *saline*, *sulphureous*, and *metallic*.

ACIDULOUS WATERS, have a sharp penetrating taste, boil with facility; emit bubbles by agitation, precipitate lime-water, and change blue vegetable colours red. Carbonic acid is generally contained in these waters—The fulphuric acid sometimes exists in them.

SALINE WATERS are characterized by a saline taste; they hold in solution fulphate and muriate of soda, muriate, carbonate, and nitrate of potash; but most commonly fulphate, muriate and carbonate of lime; fulphate, and muriate of magnesia, and of alumine.

SULPHUREOUS WATERS have in general a disagreeable smell, resembling that of rotten eggs; owing to a quantity of hepatic gas held in solution, and which is easily disengaged: but the hepar sulphuris is contained in water, as well as the sulphurated hydrogen, or hepatic gas.

METALLIC WATERS, are the most general, they commonly contain iron, and are then astringent to the taste. The fulphates of copper, iron, and zinc are occasionally detected, and sometimes arsenic.

For detecting the ingredients of these waters, three processes have been instituted, viz. Evaporation, distillation, and the action of chemical reagents. By evaporation alone, the proportions of the ingredients are ascertained. The elastic fluids, by distillation, and by reagents, acids, earths &c.

In Acidulous Waters,

The carbonic acid is detected by lime-water; a white precipitate is formed which is the carbonate of lime. The caustic volatile alkali, is deposited in the state of a carbonate of ammoniac.

Sulphuric acid is detected by the muriate of barytes.

In Saline waters,

Muriate of soda, is detected by the nitrate of mercury.

When the nitrate of silver is used, the muriate of silver, or luna cornea, is precipitated. By the oxalic acid, calcareous salts are detected; an insoluble oxalate being formed.

Corrosive sublimate precipitates pure lime in the form of a yellow powder: caustic potash detects magnesia, with which it forms a white fleaky precipitate. The salts with a base of alumine are detected by the alkalies.

Sulphureous Waters.

Waters which contain sulphurated hydrogen, have their courses marked, by the deposition of sulphur. This is owing to the

hydrogen, which holds the sulphur in solution, forming water on coming in contact with the oxygenous portion of the atmosphere ; and the sulphur is precipitated.

The sulphur of hepatic gas, may be precipitated by very strong nitric acid. Arsenic also detects the sulphur, and the acetate of lead forms a brownish precipitate.

In Metallic Waters,

The gallic acid strikes a black colour with the iron in the water ; the prussiate of potash and lime produces a blue one. When the carbonic acid holds iron in solution in mineral waters ; it may be driven off, by boiling, and the iron falls to the bottom, in the state of an oxyde.

Sulphate of copper is detected by the volatile alkali, forming the cuprum ammoniacum. By immersing a piece of polished iron in it, the acid unites to the iron and the copper is precipitated on it.

Arsenic is detected by adding the cuprum ammoniacum, forming a greenish yellow precipitate, or by evaporating the water, and exposing the residue on burning coals, the smell of garlic will be evident.

The residuum of evaporation, may also be placed between two pieces of copper, and exposed to heat : the surface of the copper will become white.

FINIS.

TABLE OF CONTENTS.

Gun powder 23

Caloric	1	Carbonic	31
Light	2	Fluoric	34
Sulphur	3	Boracic	35
Phosphorus	4		
Carbon	ib.	Vegetable acids	87
Water	10	Citric	88
		Malic	ib.
Gases	5	Benzoic	ib.
Hydrogen	ib.	Tartarous	89
Oxygen	7	Oxalic	ib.
Nitrogen	8	Camphoric	ib.
Atmospheric air	9	Gallic	ib.
Nitrous —	19	Suberic	90
Nitrous oxyde	20	Acetic	92
Alkalies	11	Empyreumatic —	90
Vegetable	12	Pyro tartarous	ib.
Mineral	13	— Mucous	91
Volatile	ib.	— Lignous	ib.
Mineral acids	14	Animal acids	
Sulphuric	15	Lactic	104
Nitric	18	Saccho-lactic	ib.
Muriatic	25	Sebacic	105
Oxy muriatic	28	Lithic	107
Nitro muriatic	30	Prussic	108

THE LIBRARY OF
THE UNIVERSITY OF
PENNSYLVANIA

CONTENTS.

Neutral Salts.		Metals	
Sulphates	16	Gold	55
Nitrates	22	Platina	56
Muriates	25	Silver	ib.
Oxymuriates	29	Mercury	58
Carbonates	32	Copper	63
Fluates	34	Iron	64
Borates	35	Lead	68
		Tin	69
		Zinc	72
Earths	36	Antimony	ib.
Lime	ib.	Bismuth	75
Barytes	37	Cobalt	76
Magnesia	38	Nickel	ib.
Alumine	39	Manganefe	77
Silex	40	Arfenic	78
Strontites	ib.	Molybdena	79
Jargon of Ceylon	41		
Glucine	ib.	Vegetable kingdom	80
Agustine	ib.	Fermentation	91
Adamantine spar	ib.	Art of dying	97
Saline stones or combinations of earths with acids	42	Animal kingdom	102
		Putrefaction	111
Mixture of earths	47	Mineral waters	112

John A. Edmunds, junr.

Book D 1808



Alconorogue Tree.

is a Specific in all diseases of the Liver & Lungs
Its Virtues were communicated by an Indian
of Carraccas. Two Cases are given: One of
~~them~~ one of them is signed By P. Badollet
who had been cured of a pulmonary ⁱⁿ Comp^lta
pronounced by the Physicians, tubercles on the
Lungs; the other By Don Macias who had been
cured of an abscess on the Liver, which previous^{ly}
had baffled all the Art. of his Physicians.
To prepare the dose, he infused 12 oz. of the
Alconorogue, (the outer Bark taken off) in
a regular quantity of pure water. a Glass
full to be taken next morning & night like water
with two spoon fulls of honey, and to be used
cold as the ordinary drink of the day. 3 Bottles
were used each day divisible in to 8 or nine glass.
If a great deal of heat is felt on using it. barley
water is to be drunk without any acid in it
every Irritating thing is to be laid aside.
Beside this, Don M. applied a cataplasma to the
Region of the Liver, and the pains instantly abated,
From being in the most miserable State, bringing away
13 Blood & Pus, 12 Days use of the alconorogue effected
a complete Cure, the whole of the abscess being
violently discharged by the mouth.

After the Cure some cooling medicines
are to be administered, as the almonorque
is extremely hot

(see N. H. Patriot Oct 30th 1810)



Durable Dyes. from M^{rs} Gayham.

To dye scarlet. One pound of Madder
Fresh gathered from the garden will dye 2
pounds of Wool. The wool must be washed clean
then boiled 15 minutes in strong allum-
water. the Madder is to be boiled in thin
Bran water (the Bran to be carefully
strained from the water; the wool dripped
from the allum Water, and put in the Bran
Water, must boil 15 or 20 minutes, and
Washed out in soft soap suds when cool
by leaving out the allum it dyes a good Brown Co.

To make a Crimson Colour, to 2 Gallons
of Juice of poke-berries, when they are quite
ripe add half Gallon strong Vinegar made of
the wild crab apple. to dye one pound of the
Wool, which must first be washed very clean
with hard soap. the wool then wrung dry
is to be put into the Vinegar & poke-berry Juice, and
simmered in a Copper Vessel for one hour.
then take out the wool and let it drip a while
then spread it in the Sun. The Kettle must
be free from grease of every kind.

To make an Orange Colour

Take a quantity of Touch-me-not gathered on the
Stems. and bruise it well in a mortar of Wood.

On layers of Touch-me-not and wool alternately pour
soft Spring or Rain water, untill they are covered
Let it stand 24 hours, then have ready a strong
Lather of soft Soap. and wash it out and put it
immediately in the Sun to dry. Salmon Colour

may be made by using hard soap instead of soft
these Colours brighten, in stead of fading, by working
Touch-me-not is found in low places.

The Stem is pale green, and the flower near of
the Color it dyes. it grows as high as 6 feet

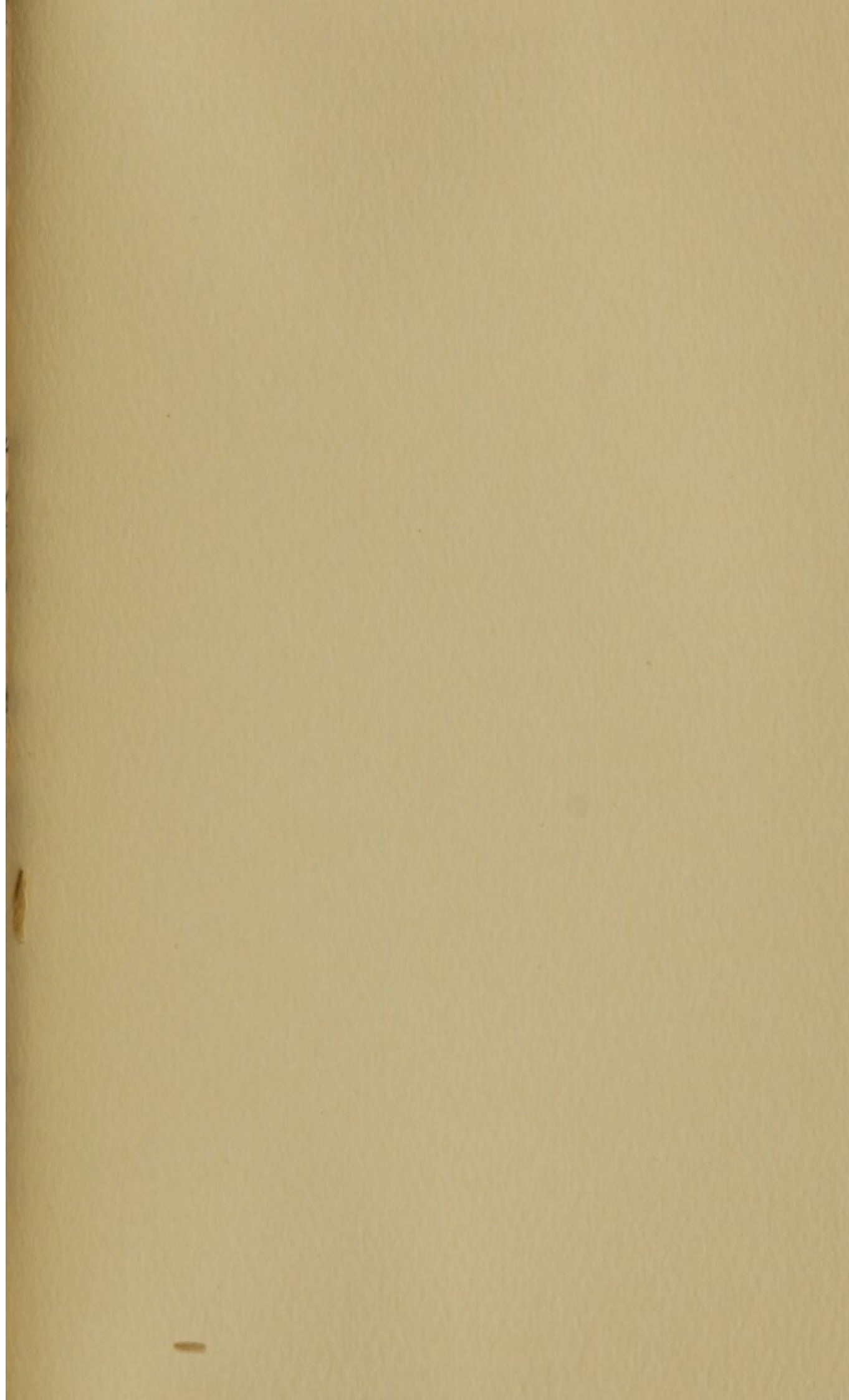
(For the above ——— (See F. Cabinet Jan^y 15. 1811.)

Cure for Dropsy

Recipe. is - Take two handfuls of the green or inner bark of the white, or common Elder; steep it in 2 qts of white Lisbon Wine 24 hours; take a gill of the wine in the morning fasting, or more if it can be borne. or if more convenient part in the morning & part at noon on an empty stomach.

The effect of the bark when prepared as above, or the expressed juice of the full grown which has been used with success where wine could not be had; is that it promotes all the animal secretions necessary to health which is the cause of its salutary effects in the dropsy

See - Patriot May 26th 1828 #
See also, Hitt N.H. Patriot Oct 5-1841



1890

Med. Hist.

WZ

270

J 17s

1802

c. l.

AT

