THIRD DIVISION.—OF CHEMICAL REMEDIES.

Under this division are comprised those few classes of medicines, the operation of which either depends on the chemical changes they produce, or is materially modified by these changes. I have placed under it the classes of Refrigerants, Antacids, Lithontriptics, and Escharotics.

CHAP. XVI.

OF REFRIGERANTS.

The substances arranged by authors on the Materia Medica under the appellation of Refrigerants, have been defined, Such medicines as directly diminish the force of the circulation, and reduce the heat of the body, without occasioning any diminution of sensibility or nervous energy. The theory delivered of their operation is unsatisfactory and obscure; nor are even the facts adduced to establish the existence of such a class of remedies altogether precise. It is acknowledged by Cullen, that "in many trials made on purpose, it did not appear that the supposed refrigerants diminished that

temperature of the body, which is the ordinary temperature of it in health." He concludes, therefore, that the definition should apply only to the reduction of the temperature when it has been morbidly increased; and even in this case the effect of these medicines is allowed by practical writers not to be considerable.

It is not necessary to review the opinions that have been advanced on the mode of operation of these substances; they are in general absurd and unintelligible. Dr Cullen, in particular, gives an explanation on this subject, founded on the most obscure and hypothetical ideas, and which, indeed, it is scarcely possible to understand. Its basis, he remarks, is a doctrine delivered by Needham, "that there is every where in nature an expansive force and a resisting power; and that, particularly under a certain degree of heat, the expansive power appears in all the parts of organized bodies, in consequence of which they shew a singular vegetating power; while, at the same time, in other bodies there is a power resisting and preventing the action of this vegetating power, and at least of diminishing its force." This power, it is added, is found in those saline substances commonly supposed to be refrigerants; and "as an increase of heat is no other than an increase of the expansive force in the heated parts, it may be understood, how resisting powers may diminish any preternatural expansive force and heat in our bodies."

The discoveries of Modern Chemistry furnish some facts, which may perhaps be applied to this subject; and indeed it is only to those discoveries which establish the source of animal temperature, that we are to look for an explanation of the changes to which it is subject.

It is established by experiment, that the consumption of oxygen in the lungs is materially influenced by the nature of the ingesta received into the stomach. When the food and

drink are composed of substances which contain a small proportion of oxygen, the consumption of oxygen is increased, and this even in a short time after the aliment has been received. Thus Mr Spalding, the celebrated diver, observed, that when he used a diet of animal food, or drunk spiritous liquors, he consumed in a much shorter time the oxygen of the atmospheric air in his diving-bell; and therefore he had learned from experience to confine himself to a vegetable diet, and water for drink, when following his profession. During digestion too, it was established by the experiments of Lavoisier and Seguin, that a larger proportion of oxygen than usual is consumed.

The animal temperature is derived from the consumption of oxygen gas by respiration; and an increase in that consumption will occasion a greater evolution of caloric in the system, and consequently an increase of temperature in the body, while a diminution in the consumption of oxygen will have an opposite effect. If, then, when the temperature of the body is morbidly increased, we introduce into the stomach substances containing a large proportion of oxygen, especially in a loose state of combination, we may succeed in reducing the general temperature. This we accomplish in part by a vegetable diet, but still more effectually by the free use of *acids*. The vegetable acids in particular, which by experience are found to be the best refrigerants, are readily acted on by the digestive powers, and assimilated with the food. And as the large quantity of oxygen they contain is already in a concrete state, little sensible heat can be produced by the combination of that element with the other principles of the food. The nutritious matter which is received into the blood, containing thus a larger proportion of oxygen than usual, will be disposed to abstract less of it from the air in the lungs, and consequently less caloric will be e-

volved. The temperature of the body will be reduced, and this again operating as a reduction of stimulus, will lessen the number and force of the contractions of the heart.

It might be supposed, that any effect of this kind must be very trivial; and it actually is so; for we find in practice that refrigerants produce no sudden or great change. They operate slowly, and have little other effect than moderating the morbidly increased temperature. The whole of their effects, as Dr Cullen remarks, are so slowly produced, as not to be very evident to our senses, nor easily subjected to experiment, being found only in consequence of frequent repetition.

This is probably the action of acids. The other refrigerants, the neutral salts, perhaps act in a similar manner; the acid they contain may yield oxygen, but they are still less effectual than acids, and their refrigerant power is even problematical, except in so far as they operate on a principle different from that which has been pointed out,—the power they have of producing in the stomach a sensation of cold. If a draught of cold water be swallowed, the sensation of cold it produces in the stomach is equivalent to a partial abstraction of stimulus, which being extended by sympathy to the heart, occasions a transient reduction in the force of the circulation, and by this, or by a similar sympathetic affection, causes a sensation of cold over the body. Nitre is an example perhaps of a refrigerant acting in this manner. It excites a sensation of cold in the stomach even when taken dissolved, and still more in the solid state; and this is quickly followed by a reduction in the number and force of the pulsations. Hence nitre acts more suddenly than any of the other refrigerants, and is more transient in its operation. It may also, however, operate in some degree more permanently, in the same manner as the vegetable acids; as it is pro-

bable that nitre, from the florid colour which it gives to blood, parts with oxygen readily.

It is evident that the indication to be fulfilled in the treatment of disease by the use of refrigerants, is the reduction of the morbidly increased temperature. Hence the propriety of their administration in synocha and other pure inflammatory diseases, and in typhus fever; in both of which the temperature of the body is increased, though from different causes. In inflammatory diseases, the circulation being so much more rapid than usual, a greater quantity of blood is sent both through the whole body and through the lungs in a given time; and the usual alterations of the blood taking place, the evolution of caloric, which is the consequence of these alterations, must be increased, and the temperature raised. In such cases, the use of acids, by lessening the disposition of the blood to consume oxygen in the lungs, may be useful in reducing the temperature; and nitre may be of advantage, as it diminishes the force of the contractions of the heart; but these means, it is evident, can have only a trivial effect, compared with those direct evacuations by which the force of the circulation is lessened.

The increased temperature in typhus fever cannot be ascribed to the same cause, but seems rather owing to the absorption of the animal solids, which, containing comparatively little oxygen, cause the blood to consume more of it in the lungs. The introduction of acids into the system, by affording this element in a concrete state to that matter, will lessen the consumption of it in respiration, and will of course moderate the morbidly increased temperature. In either of these forms of disease, therefore, refrigerants may be useful, and accordingly we find them very generally used in all the species of febrile affection; though they are still to be regarded as medicines of weak power.

REFRIGERANTS.

CITRUS MEDICA.
CITRUS AURANTIUM.
TAMARINDUS INDICA.
OXALIS ACETOSELLA.
ACETUM.
SUPER-TARTRAS POTASSÆ.
NITRAS POTASSÆ.
BORAS SODÆ.

ALL Acids are supposed to be Refrigerants; but the vegetable acids are allowed to possess this power in a more eminent degree,—a superiority which, according to the preceding view, must be founded on their being more easy of assimilation, and of being acted on by the chemical processes of the living system.

The native vegetable acids are found chiefly in the fruits of vegetables. The sour juice of these fruits consists of the Citric or Malic Acid, or more frequently of a mixture of both, sometimes with the addition of tartaric acid. The citric acid is that which is most largely employed, as it forms the acid juice of the orange and lemon, the two acid fruits in common medicinal use.

CITRUS MEDICA. Lemonum. Lemon. (Page 254.) *Succus fructus. Acidum concretum.*

THE juice of the fruit of the lemon consists almost entirely of citric acid, diluted with a portion of saccharine and mucilaginous or gelatinous matter. As the fruit cannot always be procured, various methods have been employed to preserve the juice. The most effectual is to add to it when newly expressed a portion of alkohol, and to put it aside until the mucilaginous matter is deposited, then by a moderate heat to evaporate the alkohol, and preserve the acid in bottles carefully closed. Even as prepared in this method, however, the juice is liable to chemical change.

By a different process, the citric acid can be procured pure and in a crystallized state. To the expressed lemon juice gently heated, carbonate of lime is added so as to neutralize it; citrate of lime is formed, and being insoluble is precipitated; it is washed with water to carry off the extractive and mucilaginous matter, and is then submitted to the action of sulphuric acid; which, when digested or boiled on it for a short time, combines with the lime, and disengages the citric acid; and by evaporation and cooling, this is obtained in a crystallized form. This process was originally given by Scheele, and it has been received into the London Pharmacopœia.

Lemon juice may be regarded as the principal refrigerant; it is preferable to all the other acids, being more mild and grateful, and deriving perhaps some advantage from being more easily assimilated. It is therefore used for the general purposes of refrigerants,—to cool and quench thirst in febrile affections. A grateful beverage is formed from it, diluted largely with water, and sweetened a little with sugar: or the fruit sliced down is added to any mild diluent. A pre-

paration from it, which is used as a refrigerant in fever, is what is named the Saline Mixture, formed by neutralizing lemon juice by the addition of a sufficient quantity of carbonate of potash, adding to this water, with a little sugar and a small portion of any distilled water. Of this mixture, a table-spoonful is taken occasionally; it is grateful, but cannot be considered as possessed of much power, any refrigerant quality which may belong to the acid being probably lost by its neutralization.

Another form under which lemon juice is used in fever, principally with the view of relieving nausea or checking vomiting, is that of the Effervescing Draught, as it has been named. A solution of carbonate of potash, and diluted lemon juice are mingled together, and while in the act of effervescence, the mixture is swallowed. The efficacy of it is probably dependent on the pungency and stimulant operation of the carbonic acid, but it affords a grateful form under which this can be administered.

The juice of the lemon, and indeed the citric acid, as it exists in any vegetable fruit, has been long known as nearly an infallible remedy in scurvy. A theory of its operation in removing this disease has been given, founded on its chemical agency, and particularly on the supposition that it imparts oxygen to the system, which is not without probability. In some forms of urinary calculus it affords relief.

Lemon juice was employed as a remedy in syphilis, at the time nitric acid received a trial, and cases were given in which it proved successful. These are doubtful, and it has never been established in practice.

The crystallized citric acid may be supposed to have the same power as the native lemon juice. This, however, is somewhat uncertain, especially with regard to the treatment of scurvy, the disease in which the medicinal efficacy of this

acid is most important. It is also deprived of the agreeable flavour of the lemon juice, and is hence even a less grateful refrigerant in fever. The flavour may be communicated to it, however, to a certain extent, by infusing a little of the rind of the lemon in the water in which it is dissolved. It is used medicinally, principally in forming the effervescing draught, its solution being added to the solution of carbonate of potash. One ounce of it, dissolved in a pint of water, is said, by Dr Powell, to be equal in strength to one pint of common lemon juice.

CITRUS AURANTIUM. The Orange. *Succus fructus.* (Page 253.)

THE juice of the orange has a certain degree of sourness, accompanied in the variety named the China Orange, when ripe, with a sweetness; in that named the Seville Orange, with slight bitterness; and this sourness appears to depend on citric acid. The former is used as a refrigerant in febrile affections, more grateful, but less powerful than the fruit of the lemon. It is also used as a remedy in scurvy.

TAMARINDUS INDICA. Tamarind. (Page 337.)

THE fruit of the tamarind contains an acid pulp, which is preserved by the addition of a quantity of unrefined sugar, this forming the Tamarinds of the shops. The acid is principally the citric, sixteen ounces of the prepared pulp containing, according to Vauquelin's analysis, an ounce and a half of citric acid, half an ounce of super-tartrate of potash, two drachms of tartaric acid, and half a drachm of malic acid. This pulp forms a grateful refrigerant beverage, a little of it being infused in tepid water, which is often taken in febrile affections.

OXALIS ACETOSELLA. Wood Sorrel. *Decand. Pentagyn. Gruinal. Folia. Indigenous.*

THE leaves of this plant have a very sensible sourness, and by expression they afford a juice strongly acid. Its acidity is owing to the presence of oxalic acid, combined with potash, the acid being in excess; and this salt,—the superoxalate of potash, is sometimes extracted from it, and purified by crystallization. It forms the Salt of Lemons of the shops. The leaves of sorrel have sometimes been used from their acidity as refrigerant, under the form of the whey obtained by boiling them in milk. They have also been employed with advantage, in their recent state, as a stimulating application to scrofulous ulcers.

ACETUM. Vinegar. Acidum Aceticum Dilutum.

VINEGAR is a weak acid, formed by that species of fermentation which succeeds to the vinous fermentation, when the fermented liquor is submitted to the due degree of temperature. The temperature which is most favourable, is between 60° and 70°; the presence of a portion of the yeast formed during the vinous fermentation promotes the process, and the air must not be excluded. The spiritous flavour and pungency, and intoxicating quality of the fermented liquor, are lost, and it becomes more or less sour. While this state of fermentation, denominated the Acetous, proceeds, the oxygen of the air is absorbed; according to the experiments of Saussure, carbonic acid is also formed; and the formation of the acid appears therefore to be owing to these changes of composition in the principles peculiar to the vinous fermented liquor. The product differs according to the kind of fermented liquor from which it has been obtained. In

general it is more acid as this has been more spiritous. Vinegar from wine, therefore, is strongest, and its odour too is more grateful. It is obtained of inferior quality, both with regard to purity and strength, from fermented malt liquors, or from a solution of sugar, in which fermentation is excited by yeast.

Vinegar when fully fermented is limpid, of a yellowish colour, has an odour which is agreeable and somewhat pungent, and a sour taste. The acid existing in it is very largely diluted with water, and there are also present portions of gluten, mucilage, and extractive matter, and frequently malic and tartaric acids. The presence of the vegetable gluten renders it peculiarly liable to that kind of decomposition whence it becomes mouldy on the surface; and hence the rationale of the process by which this may be counteracted, and vinegar preserved,—that of boiling it gently for a few minutes,—the gluten being separated by coagulation.

It is freed from its impurities by distillation, the process for which has a place in the pharmacopœias. The distilled vinegar is colourless, but its odour is less grateful than that of common vinegar. It is however purer, and is not liable to spontaneous decomposition; hence it is preferable for the preparation of medicated vinegars, and for other purposes in pharmacy.

The acid which is the basis of vinegar, the Acetic as it is named, can be obtained in a concentrated state by various methods, principally by the decomposition of its saline combinations; and processes of this kind are now received into the pharmacopœias. As obtained from the metallic acetates by heat, it is extremely strong and pungent; and at one time, the acid thus procured was supposed to differ in composition from that obtained by other methods, and was distinguished by the appellation of Acetic, while the other was

named Acetous Acid. It has been established, however, that they differ only in the degree of concentration, and the name Acetic is applied to the acid in all its states. When concentrated it is highly odorous and pungent, and is used principally as a stimulating perfume.

Common vinegar is sometimes employed as a refrigerant in febrile affections, being added to any common diluent. It is also much celebrated as an antidote to the vegetable narcotics, being swallowed in large draughts. Externally, it is used as an application to burns, and as a discutient. Its odour is grateful when it is sprinkled on the floor of the chamber of the sick in typhoid fevers, though it is not possessed of the virtue which has been ascribed to it, of neutralizing noxious or contagious effluvia. In pharmacy, distilled vinegar is employed as the solvent of the active matter of several vegetable substances.

Offic. Prep.—Acid. Acet. Dist. Acid. Acet. Arom. Acid. Acet. Camph. Syr. Acid. Acet. *Ed. Lond. Dub.*

SUPER-TARTRAS POTASSÆ. Super-Tartrate of Potash.

FROM the excess of acid which this salt contains, it possesses the virtues of a refrigerant. A solution of it in a large quantity of water, sweetened with sugar, and receiving flavour from the infusion of a small quantity of the rind of lemon, forms a cooling beverage, used in febrile affections, and recommended, especially in hospital practice, by its cheapness. Its only disadvantage is its being liable to prove purgative.

NITRAS POTASSÆ. Nitrate of Potash. Nitre. (Page 374.)

THIS salt impresses a sense of coolness in the mouth, and when taken in small doses frequently repeated, appears to

have the effect of reducing the force of the circulation. It is hence sometimes used as a refrigerant in inflammatory diseases, particularly in acute rheumatism, and in hæmoptysis. It is given in a dose of from 5 to 15 grains repeated every four or five hours. When given in larger doses, it occasions nausea, and pain of the stomach. It is often used as a refrigerant, under the form of gargle, in the different species of cynanche, one drachm being dissolved in six or eight ounces of water: or the nitre troches are allowed to dissolve slowly in the mouth.

Offic. Prep.—Troch. Nitr. Pot. *Ed.*

SUB-BORAS SODÆ. Sub-Borate of Soda. Borax.

THIS salt consists of boracic acid, united with soda, the soda being slightly in excess; it is brought from Thibet, where it is found in a native state, being dug from a lake in which it is spontaneously deposited. It is impure, but is purified in Europe by crystallization, and is usually in the form of crystalline masses of no regular figure; its taste is cool; it is soluble in eighteen parts of cold, and six of hot water.

Borax is not used internally in modern practice, nor does it appear to possess any activity. Its solution is in common use as a cooling gargle, to relieve the sense of heat in the mouth which attends salivation; and mixed with an equal part of sugar, it is used in the form of powder to remove the aphthous crust from the tongue in children. Mixed with honey, it forms an officinal preparation in the London Pharmacopœia, applied to the same purpose.

Offic. Prep.—Mel. Boracis. *Lond.*