# Part Second.

# PHARMACOLOGIA SPECIALIS.—SPECIAL PHARMACOLOGY.

SPECIAL PHARMACOLOGY treats of medicines individually. These I shall, for the most part, arrange in Natural-Historical Order.

Natural bodies are divided into two groups, called *Kingdoms;* the *Inorganized* and the *Organized.* The latter is subdivided into two *Sub-Kingdoms,* the *Vegetable* and the *Animal.*

Formerly naturalists admitted three kingdoms; the Mineral, the Vegetable, and the Animal. But the impossibility of so characterizing the latter two as to distinguish them from one another, has led later writers to unite them into one kingdom.

Brogniart (*Tableau de la Distribution Méthodique des Espèces Minérales.* Paris, 1833.) makes three divisions of bodies,—the *Inorganic,* the *Organic,* and the *Organized.*

## I. INORGANIZED KINGDOM.

### Class I. Non-Metallic Substances.

(Metalloids.—*Berzelius.*)

### ORDER I. OXYGEN, AND ITS AQUEOUS SOLUTION.

#### OXYGEN'IUM.—OXYGEN.

HISTORY, SYNONYMES, and ETYMOLOGY.—Oxygen gas was discovered, on the 1st of August, 1774, by Dr. Priestley, (*Experiments and Observations on different kinds of Air,* vol. ii. p. 106. Birmingham, 1790.) who denominated it *dephlogisticated air.* In the following year, Scheele also discovered it, without knowing what Priestley had done, and he called it *empyreal air.* Condorcet termed it *vital air.* Lavoisier called it *oxygen,* (from οξυς, *acid;* and γεννάω, *I engender* or *produce.*)

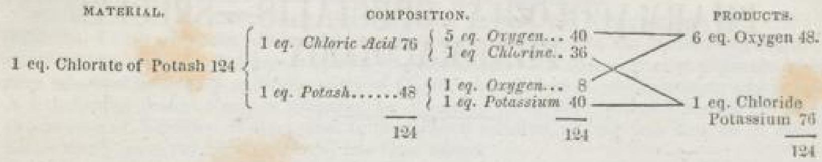
NATURAL HISTORY.—Oxygen is found in both kingdoms of nature.

α. IN THE INORGANIZED KINGDOM.—Oxygen is, of all substances, that which is found in the largest quantity in nature, for it constitutes at least three-fourths of the known terraqueous globe. Thus, water, which covers about three-fourths of the surface of the earth, contains eight-ninths of its weight of oxygen; and the solid crust of our globe probably consists of at least one-third part, by weight, of this principle; for silica, carbonate of lime, and alumina, the three most abundant constituents of the earth's strata, contain nearly half their weight of oxygen. Mr. De la Beche (*Researches in Theoretical Geology,* p. 8. Lond. 1834.) calculates that silica alone constitutes "forty five per cent. of the mineral crust of our globe." Of the atmosphere, oxygen constitutes twenty or twenty-one per cent. by volume, or about twenty-three per cent. by weight, to which must be added eight-ninths, by weight, of the atmospheric aqueous vapour.

IN THE ORGANIZED KINGDOM.—Oxygen is an essential constituent of all living bodies. Vegetables, in the sun's rays, absorb carbonic acid, decompose it, retain the carbon, and emit the oxygen. Hence they have been supposed to be the purifiers of the atmosphere.

Preparation.—There are several methods of procuring this gas, but I shall notice three only:—

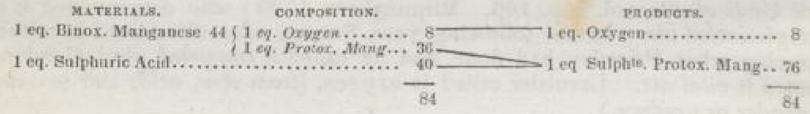
1. *By heating Chlorate of Potash in a green glass-retort.*—This method yields pure oxygen gas. (From 100 grains of the chlorate we may expect to obtain nearly 100 cubic inches of the gas.—Brande.) One equivalent or 124 parts of chlorate of potash yield six equivalents or 48 parts of oxygen, and one equivalent or 76 parts of chloride of potassium.




2. *By heating Binoxide of Manganese in an iron bottle.*—This is the cheapest method; and, for ordinary purposes, it yields Oxygen gas sufficiently pure. To remove any carbonic acid, the gas is to be washed with lime-water or a solution of caustic potash. One pound of the commercial binoxide usually yields from 30 to 40 pints of gas: but, from fine samples, 40 to 50 pints may be procured. Two equivalents or 88 parts of pure binoxide yield one equivalent or 8 parts of oxygen, and two equivalents or 80 parts of the sesquioxide of manganese.

| MATERIAL. | PRODUCTS. | |
|---|---|---|
| 2 eq. Binoxide Manganese = 88 | 1 eq Oxygen.................... | 8 |
| | 2 eq. Sesquioxide Manganese .. | 80 |
| | | 88 |

3. *By heating Binoxide of Manganese with about its own weight of Oil of Vitriol in a glass retort.*—The quantity of acid to be employed should be sufficient to form, with the binoxide, a mixture having the consistence of cream. This method is convenient when an iron bottle cannot be procured, or when a small quantity of gas is wanted at a very short notice; but it is not economical. One equivalent or 44 parts of the binoxide yield one equivalent or 8 parts of oxygen, and one equivalent or 36 parts of the protoxide of manganese: the latter substance forms, with an equivalent or 40 parts of anhydrous sulphuric acid, one equivalent or 76 parts of sulphate of the protoxide of manganese.




Properties.—It is elastic, colourless, odourless, tasteless, incombustible, but a powerful supporter of combustion. According to Dr. Thomson, 100 cubic inches of this gas weigh, at the temperature of 60° F., and when the barometer stands at 30 inches, 34·60 grains: hence its specific gravity is 1·111; 100 cubic inches of air being taken to weigh 31·1446 grs.—(According to Berzelius and Dulong, the sp. gr. is 1·1026.) Its atomic weight is 8: its atomic volume 0·5; hydrogen being in both cases unity.

| 1 eq. Oxy. = 8 |
|---|

*Characteristics.*—If a taper or match be plunged into this gas after the flame has been blown out, but while the wick or charcoal is yet glowing, the flame is instantly reproduced. The only gas likely to be confounded with oxygen in this respect is the protoxide of nitrogen, from which oxygen is distinguished by exploding it with hydrogen. A mixture of one volume oxygen and two volumes hydrogen yields, by explosion, water only; whereas a mixture of one volume of the protoxide of nitrogen with one volume hydrogen yields water and one volume of nitrogen. Moreover, a taper burnt in a jar of oxygen gas yields no brown vapour.

PHYSIOLOGICAL EFFECTS. *α. On Vegetables.*—Oxygen gas is essential to the germination of seeds, and to the existence and growth of plants. Edwards (*Athenæum*, Feb. 2d, 1839.) says that the seeds in germinating decompose water to obtain oxygen. In the shade, vegetables absorb it from the atmosphere, and evolve an equal volume of carbonic acid; while, in the solar rays, the reverse changes take place; carbonic acid being absorbed and oxygen expired. The vigorous growth of plants in enclosed cases, as originally proposed and practised by my friend, Mr. N. B. Ward, (*Companion to the Botanical Magazine, for May*, 1836.) does not invalidate the above statements; since the cases are never completely air-tight, but allow the ingress and egress of air consequent on changes of temperature. The quantity of oxygen required for the growth of some plants, however, appears to be much smaller than was previously supposed.

The effects of pure oxygen gas on germination and vegetation have been examined by Theod. de Saussure. (*Recherches Chimiques sur la Végétation.* Paris, 1804.) He found that the period of germination is the same in oxygen gas as in atmospheric air, but that seeds evolve more carbonic acid in the former than in the latter. (See pp. 11 and 12. *op. cit.*) Plants do not thrive so well in an atmosphere of oxygen gas in the shade as in one of common air; they give out more carbonic acid, which is always injurious to vegetation in the shade. When exposed in oxygen gas to the direct rays of the sun, they augment in weight about as much as in atmospheric air. (See p. 93, *op. cit.*)

*β. On Animals generally.*—It is usually asserted that all animals require the influence of oxygen, or rather of air, to enable them to exist: but this assertion cannot be proved in the case of some of the lower animals. Thus intestinal worms seem to dispense with respiration. (Müller's *Physiology*, by Baly, vol. i. p. 295.) Some animals, which respire, have no organs especially devoted to this function: in these the cutaneous surface effects respiration; as in the *Polypifera*. In the *Infusoria* the respiratory organs are delicate cilia. Many animals have branchiæ, or gills, for respiration, as some *Mollusca*, some *Annelida*, and Fishes. Leeches respire by sub-cutaneous sacs, which open externally. The respiratory organs of Insects are ramifying tracheæ. Lastly, the higher classes of animals, as the Mammals, respire by means of lungs. Whenever respiration is effected a portion of oxygen disappears, while a quantity of carbonic acid, nearly equal in volume to the oxygen consumed, is produced.

The continued respiration of oxygen gas is injurious, and even fatal to animal life: this has been observed by all experimenters. Animals live longer in a given volume of oxygen than in the same quantity of atmospheric air, but the continued employment of it causes death. Mr. Broughton confined rabbits, guinea-pigs, and sparrows, in glass jars containing oxygen, and inverted over water. At first they suffered no inconvenience, but in about an hour their breathing became hurried, and the circulation accelerated. This state of excitement was followed by one of debility; the respirations became feeble, and were more slowly performed; loss of sensibility and of the power of voluntary motion supervened, till the only remaining visible action was a slight one of the diaphragm, occurring at distant intervals. On opening the body, the blood (both venous and arterial) was found to be of a bright scarlet hue; it was thin, and rapidly coagulated. The gas in which animals had thus been confined till they died, retained its power of rekindling a blown-out taper, and of sustaining, for a time, the life of another animal introduced into it; and Mr. Broughton hence deduced the inference that it does not contain so great an excess of carbonic acid as the gas left when animals have perished by confinement in atmospheric air, and he considered the train of symptoms induced by the respiration of pure oxygen gas as analogous to those which follow the absorption of certain poisons into the system. (*London Medical Gazette*, vol. iii. p. 775.) Injected into the pleura, oxygen gas is very quickly absorbed, without producing inflammation. Cautiously injected into the veins of dogs, it has no sensible effect on the system. (Nysten, *Recherches de Physiologie*, p. 60. Paris, 1811.)

γ. *On Man.*—If pure oxygen be inspired a few times it does not produce any remarkable phenomena; though some have ascribed various effects to it, such as agreeable lightness in the chest, exhilaration, increased frequency of pulse, a sensation of warmth in the chest, gentle perspiration, and an inflammatory state of the system. But several of these results arise probably from mental influence, others from the mode of inhaling the gas, and perhaps some might depend on the employment of impure oxygen.

USES.—Soon after the discovery of oxygen, the most exaggerated notions prevailed as to the remedial powers of this agent. Various diseases (scorbutus, for example) were thought to be dependent on a deficiency of it in the system; and it was, in consequence, submitted to a considerable number of trials, with, as it was at first asserted, remarkable success. But Chaptal (*Annales de Chimie*, t. iv. p. 21.) and Fourcroy (Ibid. t. iv. p. 83.) declared that it was injurious in phthisis. In England it was tried by Beddoes[1] and Hill.[2] The latter states that he found it beneficial in asthma, debility, ulcers, gangrene, white swelling, and scrofulous diseases of the bones. The beneficial results obtained by the use of acids, (especially nitric acid,) of the oxides of mercury, chlorate of potash, vegetable food, &c., were referred to the oxygen which these substances contained, and which they were supposed to communicate to the system. These notions are now exploded.[3]

In asphyxia arising from a deficiency of atmospheric air, or from breathing noxious vapours, the inhalation of oxygen gas has been said to be, and probably is, useful. On the same principle, it may be employed during an attack of spasmodic asthma, when there is danger of suffocation; but it is at best only a palliative, and has no power of preventing the occurrence of other attacks. Chaussier[4] has recommended its use in children apparently still born; I have known it used without benefit. To combat the asphyxia of malignant cholera, inhalations of oxygen were tried in Russia, Poland, Prussia, and France, but without success. (Mérat and De Lens, *op. supra cit.* t. v. p. 141.) On the whole, then, I believe oxygen to be almost useless as a remedy.[5]

**AQUA OXYGENII.** *Oxygen Water.*—At the mean pressure and temperature of the atmosphere, 100 vols. of water dissolve, according to Dalton and Henry,[6] 3·7 vols. of oxygen gas; according to Saussure,[7] 6·5 vols. By pressure in a proper machine, water may be charged with a much larger quantity. This solution has been termed *oxygenated water*, but is a very different substance to the peroxide of hydrogen, which has also been known by this appellation. Neither is it to be confounded with Searle's *oxygenous aërated water*, which is an aqueous solution of the protoxide of nitrogen. It has been used to the extent of one or two bottlefuls daily, as a slight excitant. It is said to increase the appetite and promote the secretions; and to be serviceable in spasm of the stomach, amenorrhœa, hysteria, atonic dropsy, &c.

---

[1] *Considerations on the Medical Use of Factitious Airs, and on the Manner of obtaining them in large Quantities.* By T. Beddoes and James Watt. Bristol, 1794–95.

[2] *Practical Observations on the Use of Oxygen, or Vital Air, in the Cure of Diseases.* Lond. 1800.

[3] For farther details respecting these opinions, see the *Dictionnaire Universel de Matière Médicale et de Thérapeutique Général*, par F. V. Mérat and E. J. De Lens, t. v. p. 136.

[4] *Histoire et Mémoires de la Société Royale de Médecine.* 1780–81; *Hist.* p. 346.

[5] It is remarkable that Electricity and Oxygen, two agents of vast influence in nature, should possess but slight remedial power.

[6] *Elements of Experimental Chemistry*, vol. i. p. 255, 10th edit. London, 1826.

[7] *Ibid.*