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JULIEN-JOSEPH VIREY

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ABSTRACT

Jean-Joseph Virey (1775-1846) was a French physician and naturalist to whom we owe a systematic study of the relation between the color of a medicine and its action, the color of flowers and other parts of the plant as a distinguishing property, and the odors of different substances. The colors of vegetables indicated, in general, their dominant principles and could serve to establish the difference in medical matter. The odors of different natural substances, and particularly those of medicines, constituted an essential part of their properties. Odors acted upon the different systems of a body and operated on humans like medicines. Virey believed that the aphrodisiac *dudaim* of the Bible were an orchid, probably one of those from which the salep was prepared. Plants were able to experience impressions of excitability from light, heat, dry or humid air, electricity, and other surrounding agents. Vegetable and animal poisons usually operated on living organisms and according to the organization mode of the species upon which they acted; they could become food, medicine, or poison to the entities that absorbed them. The production of a gall was a clear manifestation of the irritability of the tissue of vegetables, analogous to the bite of the insect, which deposited an acrid and stimulating poison on the wound of an animal. Virey speculated on the effect of cold on organized organisms in general and on the wonderful art that nature appropriated these beings to the coldness of the poles or to the equatorial ardor, to assure their subsistence.

Keywords: aphrodisiacs, cold, color of medicinal plants, flowers, galls, odors, poisons.

RESUMEN

Jean-Joseph Virey (1775-1846) fue un médico y naturalista francés al que debemos un estudio sistemático de la relación entre el color de una medicina y su modo de acción, el color de las flores y otras partes de las plantas como una propiedad de identificación, y el olor de diferentes substancias. Los colores de los vegetales indicaban, en general, los principios dominantes y podían servir para establecer su acción médica Los olores de diferentes substancias naturales, particularmente las medicinales, constituían una parte esencial de sus propiedades. Los olores actuaban sobre los diferentes sistemas del cuerpo y operaban sobre los seres humanos como medicinas. Virey creía que el afrodisíaco *dudaim* de la Biblia era una orquídea, probablemente una de los cuales se preparaba el salep. Las plantas eran capaces de experimentar impresiones de excitabilidad de la luz, calor, aire seco o húmedo y otros agentes ambientales. Los venenos vegetales o animales operaban generalmente sobre organismos vivos de acuerdo su modo de organización; ellos podían ser alimento, medicina, o veneno para los entes que los absorbían. La producción de una agalla era una clara manifestación de la irritabilidad del tejido vegetal, análoga a la mordedura de un insecto que depositaba un veneno amargo e irritante en la herida de un animal. Virey especuló acerca del efecto del frío en los seres organizados en general y sobre los maravillosos medios que la naturaleza les comunicaba en los polos o en el ecuador para asegurar su sobrevivencia.

Palabras clave: afrodisíacos, agallas, color de plantas medicinales, flores, frio, olores, venenos.

INTRODUCTION

Life and career (Anonymous, 1845-1846; Anonymous, 1846; R.P., 1846; Souberain, 1846; Berman, 1965; Anonymous, 2022)

Julien-Joseph Virey (Figure 1) was born in Langres (Haute-Marne, France), on December 21, 1775, the son of Marie Adelaide Voillemin and Nicolas Virey, the royal notary at the village. He took his basic education at the Collège de Langres and then became an apprentice to his uncle, a pharmacist. In 1795 he joined the French Revolution and was shortly thereafter appointed assistant pharmacist (pharmacist of third class) to the military hospital of Strasbourg. His professional abilities came to the attention of Antoine Augustin Parmentier (1737-1813), his administrative chief, who invited him to Paris to serve at the military hospital of instruction Val-de-Grâce, where after a brilliant career he was appointed pharmacist-in-chief, a position he kept between 1804 and 1812.

Fig. 1: *Jean-Joseph Virey (1775-1846)*

He taught natural history of animals at the hospital and also at the public forum of the Athénée. However, in 1813 he was forced to resign because he was "accused of spending his time cloistered in studies, devoting himself exclusively to his own books and articles of philosophy and medicine, at a time when the army needed a chief pharmacist active". He then enrolled at the Faculté de Médicine de Paris and in 1814, at the age of 39 years, he received his degree of docteur ès-médicine after successfully defending a thesis about *Ephemerides of Human life* (Virey, 1814; Reinberg & Lewy, 2000). In this this thesis Virey analyzed biological rhythms and concluded that they were innate in origin and controlled by living clocks entrained by periodic environmental changes, such as the day-night alternation in light and darkness. He justified this claim preparing quantified time series that demonstrated human circadian and annual mortality rhythms. In 1823 he was appointed member of the Académie Royale de Médecine and served as secretary of the Pharmacy section (1825 to 1829). A large part of his work was devoted to anthropology, sociology, and philosophy where he published many books opposing Lamarck's theory and proposing his own racial theories, basically polygeny (the theory that humans evolved from several independent pairs of ancestors) and transmutation of species. He postulated that humans descended directly from the apes and that there were basically two human species (White and Black), divided into six chromatic races. Politically, Virey belonged to the central stream; he was elected to the Chamber of Deputies of the Haute-Marne, a position he occupied from 1831 to 1837. He was a member of many scientific societies and public organizations, among them the Société de Pharmacie, the Comité des Travaux Historiques et Scientifiques, the Conseil Supérieure de Santé, etc. In 1831 Virey was appointed Chevalier de la Légion de Honneur and in 1835 promoted to Officier.

Virey died in Paris on March 9, 1846, as a result of a cerebral congestion.

Scientific contribution

Virey wrote more than 200 papers (most of them very short) and books (e.g., Virey, 1800, 1811c, 1814a; 1820b) on the subjects of inorganic, organic, and agricultural chemistry, vegetable principles, physiology, toxicology, anthropology, sociology, etc. He also wrote a booklet describing his research activities and achievements (as usual for candidates to the French Academy of Sciences) (Virey, 1842). In addition to the subjects described below, he discussed the uses of the beans of Tonga for perfuming tobacco (Virey, 1811a), studied the different quinquina (Virey, 1812a); the formation of bubbles on the surface of liquids (Virey, 1814b); the medical properties of tea and its varieties (Virey, 1815); the origin of sugarcane (Virey, 1816b); the formation of intestinal worms and their cure (Virey, 1817); the historical background of the Biblical manna and its expression in the different cultures of the Middle-East (Virey, 1818); discussed the origins of phosphorescence in minerals, vegetables, and animals (Virey, 1819), the vegetables releasing the smell of vanilla or containing benzoic acid (Virey, 1820a), described the diversity of medicines used in India (Virey, 1828); the reasons for the variety of flower colors (Virey, 1838); etc. His publications about anthropology and sociology have been discussed in detail elsewhere (e.g., Benichou & Blanckaert, 1988) and will not be presented here.

The color and properties of vegetable medicines

Virey wrote that most botanists, including Carl Linnaeus (1707-1778), had rejected the idea of using the color of flowers and other parts of the plant as a distinguishing property (Virey, 1811b). He remarked that this decision had not taken into consideration the fact that each color of the flower or another part of the plant was often the characteristic of some dominant principle. With the change of color, this principle, or the medical property, which it carried, changed and altered in the same proportion. In medicine, it was not the same to use the red or white carnation, or their mixture; the white or black poppy, the white or purple violet, etc., which had very different properties. Virey intended to go further and examine the relationships that Nature had put between such kind of colors and such properties among the vegetables. It was reasonable to assume that the more intense the color of a certain part of the plant, the more intense the pertinent property would be, compared to the less colored same substance. It was clear that although the color could be somewhat altered by controlled cultivation, the original color returned if the vegetable was abandoned to its natural environment. The influence of the soil was also critical, dry vegetables of the mountains were more active than and those of the humid and fertile valleys, and were more colored when they were grown at the same temperature. Virey went on to analyze the phenomenon accompanying flowers and other parts of the plant colored white, yellow, red, red-brown, green, blue, or black (Virey, 1811b).

White color

In general, white flowers were the ones that kept less their properties by desiccation, their principles were the most ephemeral (e.g., jasmin, privet, mimosa, and lily of the valley), they lost all their odor by distillation, were usually very aqueous and transparent or semitransparent (e.g., liliaceae, narcissus, and asphodels), had a nauseating taste, flowered at the beginning of spring and decayed rapidly with hot weather. The white color was typical of the flowers of the cold countries; they blossomed before the sun acquired its full strength, did not have tonic properties, were not astringent, and did not have a strong flavor and odor. Exception was the white flowers of the tetradynamus or cruciferae, which were more acrid and anti-scorbutic than the yellow flowers of the same species. Virey added that in a similar manner, the white varieties of fruits and trees were the most common in cold climates. All this information indicated that the white color was the less favorable to the most stimulating medical properties. Thus, the white scilla was poorer than the red one, the white carnation had less aroma than the red one, the gums and colorless or white resins were the purer, the white canella and the white quinquina were less active than the more colored species, etc. (Virey, 1811b).

Yellow color

This color was the most widespread in the vegetable kingdom, although it often combined with very different principles; it was almost never found with acids, on the contrary, it was the most constant indicator of a bitter principle (e.g., juice of aloes, roots of rhubarb, chicoracea, arnica, chamomiles, chrysanthems, safflower, artichoke, tansy, etc., were all yellow flowered). Inspection of all the bitter vegetables substances showed that very few of them did not have yellow flowers. The bitter property was also present in yellow substances produced by technology, for example, the bitter of Welter and other yellow products formed by the reaction of nitric acid with organized bodies. It was also a property of animal bile and the skin of the orange. The yellow quinquina were the most bitter. Nevertheless, there were no known yellow roots (such as carrots and licorice) that were bitter, as well as there were some bitter herbs that were not yellow (e.g., water clover and common hop). The above observations indicated that though the yellow color was not an absolute proof of the presence of bitterness in the plant, it usually offered a clear sign that it was present combined with aromas and purgatives (Virey, 1811b).

Red color

Virey wrote than in this category, only the rose genre proved the relation between the color of a flower and its properties: the white rose had a bland flavor and was the most laxative and emollient; the yellow roses (e.g., *Rosa sulphurea*, W. and *Rosa eglanteria*, L., *Bicolor cinnamomea*, L., etc.) possessed a bitter purgative and nauseating taste, while the red roses were astringent and contained an acid principle. According to Virey, in vegetables, the red color was almost a universal character of acidity and astriction. Acids were known to turn red many vegetable colors shades, particularly the blue ones. Flowers were known to change their color from red to blue or from blue to red, if the predominant conditions were basic or acid (e.g., borache, viper's bugloss, columbine, larkspur, etc.). There were very few red fruits that were not acid (e.g., cherries, gooseberries, strawberries, pomegranate. etc.). Insects that produced a red dye usually extracted them from acid or astringent plants (e.g., cochineal). Virey added that although there were some vegetable acids that were not red, he had never found a red vegetable that was not acid or astringent, or without containing some principle of this nature (Virey, 1811b).

Red-brown color

This shade was the constant of tonic and astringent properties that appeared particularly in the ligneous parts of the vegetable, such as roots, wood, and bar (e.g., oak tree, nut tree, elm, heather, madder, quinquina, etc.). Experience indicated that the redder was also the most astringent, although this not always true for the febrifuges; these qualities were present in the coffee tree. The astringent principle was so inherent to this color that they never appeared separated, as in Kino, cashew, roucou, bdellium, myrrh, and all red brown resins. This tonic principle appears combined with aromatic oil in the bark of canella, laurels, betel, sassafras, Chinese cinnamon, and other red brown aromatic substances (Virey, 1811b).

Green color

This color presented a variety of properties. In general, the green carried with it the scathing and styptic savors. All the fruits, before complete maturity, exhibited this savor; chewed fruits that remained green, like the olive, holly, and the buckhorn, kept a strong and unpleasant astringency. The condiments named fine herbs, owed their intense flavor to their extreme greenness (e.g., burnet, leek, shallot, etc.). The scathing flavor was clearly related to the green color and could not be separated by means of oil or ether. This principle appeared combined with the bitter principles in absinth, maritime ambrosia, lemongrass, etc., all plants that produced intense green ethereal extracts (Virey, 1811b).

Color blue

It was mentioned above that the passage from red to blue or from blue to red in flowers was due to acidity or alkalinity. Many chemical facts supported this claim: the blue of litmus, orseille, and lichens. These examples showed that the properties of this color gender were the opposite of those of the reds that were never poisonous. Thus, many blue flowers did not indicate safe use, although there were some exceptions. In general, a blue or glaucous color in vegetables and their flowers indicated the probable presence of alkalis, and should, therefore, inspire distrust for internal use. Flowers like violets, mauve, hibiscus, and similar, were exempt of danger (Virey, 1811b).

Color black

This color manifested very rarely in petals; it was more common in the bark that surrounded roots and the skin of seeds. The brown flowers, and those pulling to black (e.g. belladonna, *Hyoscyamus niger*, figwort, Dutchman's pipe, parisette, etc.) contained a nauseating compound, more or less acrid and deleterious. The nightshades had black foliage, indicating their qualities. Species that presented leaves spotted black, contained principles, more or less caustic or deleterious, not present in neighboring species.

Virey concluded as follows: (1) The colors of vegetables indicated, in general, their dominant principles and could serve to establish the difference in medical matter; (2) the colors pointed to the following properties: white: emollient, refreshing, nutritive, and humectant properties; yellow: acid, purgative, stimulant, anthelmintic; red: acid, ant bilious, astringent, diuretic; red-brown: febrifuge, stomachic, tanning; green: scalding, styptic, astriction; blue: acrid, alkaline, caustic; and black: deleterious, nauseating, stupefying, and acting on the nervous system (Virey, 1811b)

Odors, their nature and modification

Virey wrote that the odors of different natural substances, and particularly those of medicines, constituted an essential part of their properties. He was especially interested in examining the very singular effects of diverse emanations, sweet or fetid, over the nervous system, the brain, the stomach, and, superficially, over the sexual organs. His purpose was to classify the different odors, agreeable or fetid, observe their nature and combinations, and the manner in which they were modified or destroyed (Virey, 1812b).

The first part of his paper was devoted to a short historical synopsis of the subject. He mentioned that the Greek philosopher Theophrastus (371 BCE-287 BCE) had made some ingenious observations about vegetable and animal odors, and on the preparation of aromatic wines and oils with about 20 kinds of proper substances. The physician Crito of Alopece had placed odors in the list of medicines and used them to treat several illnesses (a practice that is still preconized today: aromatherapy). Virey cited a long list of scientists that had written about odorants, mentioning that the most important and more philosophical work was the one of Robert Boyle (1627-1691) about the nature of body effluents (Boyle, 1673). He asked the question if it was possible that all the odors were derived from some primitive ones, as did all the color nuances. His answer was negative: odors admitted as many principles as there were different bodies. Among the plants above all, they were a multitude of classes apart. More than that, a particular odor for an individual could be completely different for another individual. A dog was able to sense the animal exhalations of a hare but seemed to be insensible to the smell of a rose. The vultures and certain beetles enjoyed themselves in the rottenest carrion and excrements. Often an odor displeased when it was too strong and became pleasant when diluted (e.g., saffron, lily, and narcissus) (Virey, 1812b).

Virey described then the characteristics odors of food, medicines, charm, and toilet.

Food

Virey wrote that odor and taste were intimately connected; odor should be considered a foretaste and many substances satisfied simultaneously these two indulgent senses (e.g., fruits and liquids simultaneously odorant and tasty). There were several bodies that were more sapid the more odor they had, as shown by species and other aromates. Odorless substances lost simultaneously their flavor. Substances having a bad smell were usually poor foods because the stomach revolted against them. There were also very sapid substances that were practically odorless (e.g., sugar and chilli pepper), others very odorous and little sapid (e.g., rose and carnation); in others a pleasant savor was accompanied by a repugnant smell (cheese, caviar, and the fruit of durian). On the contrary, some sweet perfumes had a terrible taste (as most of volatile oils). The most nourishing smells were those of the flesh, followed by those of fruit, starchy foods, and sweet juices. No mineral smell pertained to this class; in general, their taste was very bad. It was remarkable that the odors most appropriate to condiment meat were usually the tastier, being those that acted on the stomach (e.g., groceries, alliaceous, etc.). Virey mentioned 12 classes of food odors, among them, bland, leguminous, umbelliferous, fruits, anti-ascorbic, oleaginous, sickly sweet, meat, and fish. (Virey, 1812b).

Medicines

According to Virey, there were many examples of odors operating on humans like medicines, for example, orange flowers, linden flowers, most of the labiacea, etc. Depriving purgatives of their inherent fetidity removed also most of their activity. Aromas were appropriate to the main virtue of each substance. Thus, we did not see the peculiar nauseating smell of purgatives combined with, for example, astringent balsams. Roasting rhubarb until its nauseating smell had disappeared resulted also in the disappearance of its purgative effect, leaving only the astringent one. Odors were not only limited to a slight action on our bodies, sometimes they produced very violent and even fatal effects (e.g., the smell of dead bodies and the contagious vapors of certain illnesses). Odors acted upon the different systems of a body; for example, drugs like opium worked upon the nervous system and more or less numbed it; mixing these drugs with acrid purgatives resulted in a decrease of their activity. In several animals, certain odorant plants excited the sexual organs: boiled stinking goosefoot attracted dogs in heat and made them urinate. According to Virey, there were twenty fetid odors that found use in medicine, among them, nauseating, narcotic, acrid or corrosive, aphrodisiacs, emmenagogues (stimulators of menstrual flow), carminatives (flatulence relievers), and balsamic (Virey, 1812b).

Charm and toilet

Virey wrote that this category necessarily had to affect only the human species. In general, toilet odors penetrated rapidly all of the animal economy through the absorbing system. It was enough to apply them on the head or the abdomen to have it appear in the urine. But it was especially to the brain that the smells were directed and in order to be stronger, they had to cause a kind of vertigo. The odor of roses, oranges, and fruits were unable to do so (Virey, 1812b).

Virey ended this paper with a discussion of the action of putrefaction, heat, air and light and chemical reagents on odors, and some speculations regarding their nature. It was commonly said that all putrefying bodies stank, those of animals more strongly than those of vegetables. Nevertheless, there were substances that their putrefaction developed a more or less pleasant smell and others that felt worse in the healthy state than in that of corruption. For example, slightly putrefied human bile smelled like intense musk; cow urine exhibited the same behavior after a similar digestion. There were strong stinking smells that putrefaction destroyed them (e.g., those of champignons. agarics, etc.). Odors were no other than the volatilized parts of natural bodies. These emanations could only exist by the action of heat, and heat, by dispersing them, continued to scatter them. This was the reason why perfume makers kept the most fugitive under cold. The aroma of certain plants (Jasmin, iris, hyacinth, etc.) was so delicate that the heat of boiling water decomposed tem. Hence, they could not be obtained by distillation, implying that they were not composed of volatile oil. It was known that aromas and flavor developed at the same time, by a slight combustion or by cooking. Toasting was able to dissipate strong flavors and poisons but at the same time it could release many malign substances. It was easily observed that the air (actually the oxygen) was the principal destructor of odors. Sulfur, phosphorus, arsenic, etc., burned releasing strong odors that were completely odorless when in perfect acidity. Light had the ability of burning bodies; in vegetables it contributed to the formation of colors, flavors, volatile oils, and resins; there was little doubt that it also contributed to the formation of their aromas. Virey wrote that the above facts suggested that acids must destroy or weaken odors. This was true for mineral acids, particularly the most oxygenated. Vegetable acids had a weaker action, although they were able to destroy nauseating and fetid odors, Vinegar absorbed the odors of the labiaceae, alliaceous, etc. and became the vinegar used for toilet or medicine. Alkalis operated on aromas in two ways: Triturating musk with a caustic alkali caused the pertinent odor to disappear and be replaced by another that resembled ammonia. Similar or weaker results were obtained with the bicarbonates. Alkalis, particularly ammonia, developed or sharpened narcotic and nauseating odors (Virey, 1812b).

Virey wrote that in the old days it was believed that the aroma depended only of a volatilized essential oil, which formed a sort of atmosphere around the odorant substance. This was certainly true for certain plants like the labiaceae, umbeliferae, fraxinella, etc. The number of essential oils was then so large that it was impossible to assign them a fixed character. Nowadays it was possible to identify certain particular classes of odors, among then, acids, oily, sulfurized, aqueous, resinous, etc. The acids include those of the ants, the different kinds of artificial vinegar, volatile acids, and particularly that of benzoin. The odors of fruits and other sweet substances like manna, molasses, and honey, elicited acidity; rancidity also had an unpleasant acid odor. Virey was not sure if it was possible to assume the presence of phosphorus in the alliaceous odors, although it was well proven that sulfur was present in all the antiscorbutic aromas. Nitrogen was also supposed to play a particular role in all the narcotic aromas, as shown by the fact that the vegetables that exhaled them released ammonia during their analysis. Hydrogen, in a simple state or carbureted, seemed to be recognized in bituminous odors. Heated resins most certainly released hydrogenated aromas (Virey, 1812b).

Aphrodisiacs drugs

Virey wrote that although the famous physician Claudius Galenus (119 CE-210 CE) had negated the existence of aphrodisiac substances, it was clear that in animals certain substances exerted such an action (Virey, 1813). For example, it was known that cats were particularly excited by cat thyme (*Teucrium marum*), catnip *(Nepeta cataria*), and Virginia snakeroot (*Aristolochia serpentaria*); birds by hempseed, common corn, and fenugreek; that rubbing the anus of a carp with musk or civet (*Trigonella foenum-graecum*) soon made them spawn; and that many animal odors had a strong effect on the female uterine system. This kind of medicines had been particularly investigated in the hotter climate countries, probably because hot weather resulted in earlier puberty and polygamy increased the enjoyments. Coffee was considered an anti-aphrodisiac because its action on the cerebral nervous system weakened other faculties (Virey, 1813). The Bible mention of Rachel, Jacob' wife, resorting to the aphrodisiac *dudaim* (דודאים) to become pregnant and give birth to Joseph, had become famous because of the difficulty the Bible interpreters and commentators had found in identifying the pertinent plant that produced the drug. The Septuagint and the Vulgate had translated this term as Mandrake (*Mandragora officinarum).* Many religious texts had claimed that the drug was the fruit of the narcotic plant *Atropa mandragora,* L. Virey added that dudaim were also mentioned in the book Song of Songs because of the pleasant odor of its flowers, while those of mandrake were highly virus. Virey added that the Dutch physician Levinus Lemnius (1505-1568) had remarked that aphrodisiacs did not necessary had to be body warmers, if they served as such, it had to be in the cold and humid countries of the North were animal economy required stimulants. This was not the case in the hottest skies of the East where refreshers were required to humidify and loosen the arid and dried organisms. Others believed that the dudaim was the small species of a yellow melon, of sweet odor, cultivated in Persia under the name *destenbuje* (*Cucumis dudaim*, L.) and whose fruits were placed in housings because of their pleasant smell (Virey, 1813).

Virey went on the give his own identification of the dudaim. He wrote that the Hebrew word dudaim came from *dadim* (מדדי), breasts, or from *dodim* (דדים) friends, cousins, neighbors, indicating that this plant had its parts grouped in pairs. It flourished in Mesopotamia at the time of the harvest time, that is, in May. It had a sweet smell, was used for making bouquets, and had aphrodisiac properties. "All this could not in any way be related to the plants mentioned by the commentators, but it fitted very well to the orchids, especially to those from which the salep flour made from the tubers of the orchid genus *Orchis*) is prepared in the East. The family name of these plants declared what the double bulbs of their roots are compared with, and the smell of sperm they exhale contributes to the opinion of their virtues, since long esteemed by the Orientals...One of the most common Palestinian varieties is the *Orchis sancta*, L." To Virey, all these facts were enough to declare that the dudaim were an orchid, probably one of those from which the salep was prepared (Virey, 1813).

Virey listed and described a large number of substances assumed to have aphrodisiac properties, among them, champignons (truffles and morels), aromates (seasonings with a strong pleasant odor), arums (monocotyledonous such as *Colocasia esculenta*, *Darcontium polyphyllum, and Calamus aromaticus*); bulbs of alliaceous, *Aristolochia* (birthwort and pipevine), bay laurel, *Solanaceae* (pepper, henbane, and Chinese lantern), ginseng, opium, etc. He also mentioned that certain Rubiaceae, such as quinquina, cafe, Kino, and madder, diminished substantially the secretion of sperm, when used frequently. Virey classified the aphrodisiacs as follows: (1) Emmenagogues antispasmodics (herbs which stimulate blood flow in the pelvic area and uterus), for example, musk, civet, amber, and castor; and simple emmenagogues, such as fetid resins and Aristolochia; (2) aromatic spices, such as pepper, betel, ginger, canella, clove, and nutmeg; and sweet aromates, such as laurels, mirth, sweet flag, avocado, garlic, etc.; (3) spice stimulants, such as aroids, *Colocasia*, areca nut, and cashew; (4) warmers, such as phosphorus, champignons, truffles, etc.; (5) simple diuretics such as artichoke, asparagus, black vine; and diuretic carminatives, such as ginseng, parsnips, and chervil; (6) flatulent foods, such as beans and other legumes; and stimulant foods, such as tetradynamia; (7) analeptic foods, such as cacao, figs, salep, sweet potato, and eggs; (8) foods exciting the cutaneous system, such as fish, mollusks, reptiles, crustaceans, and tested animals; (9) tonic substances, such iron containing food, salt, and salting foods; and (10) acrid and caustic foods, such as insects, cantharides, ants, etc. (Virey, 1813).

Night blooming flowers

Virey wrote that plants were able to experience impressions of excitability from light, heat, dry or humid air, electricity, and other surrounding agents. They slept and awake, flourished or closed at periods regulated by the course of time, advanced or withdrew their foliage according to the circumstances in which they vegetated and according to the periods of their existence (Virey, 1831a). Many naturalists had already observed some interesting facts of the life of vegetables. Linneus, René Louiche Desfontaines (1750-1833), Alexander von Humboldt (1769-1859), René Henri Dutrochet (1776-1847), and others had reported the sleep of plants and the clock of flora, and the existence of irritable parts of a large number of vegetables. Nevertheless, there was one phenomenon that had not been discussed in particular because it was considered a rare exception of the law that determined that plants opened during daytime. The fact that the flowers of certain plants opened as night and closed during the day was not different from the behavior of nocturnal animals of all classes (e.g., bats, edental quadrupeds, lizards, crustaceans, etc.). If nocturnal animals used darkness to surprise their prey, the vegetables unfolded their flowers at night in order to assure their pollination. Most flowers needed to be warmed by the sun or stimulated by the brilliance of its rays to carry on the reproduction act. Thus, the water lily, the lotus, the water nymph, and other aquatic plants bloomed their flowers on the surface of the waters and the various curvatures of the petals were able to converge the solar rays towards the center of the flower. Many examples could be also mentioned of plants that opened their flowers at a particular time of the day, which varied according to the climate of the habitat. So, the more or less delicate texture, the faster or slower excitability of the organs of the plant with respect to heat, light, humidity, dryness of the air, etc., determined mostly their time of flowering. Flowers having very tender tissues would try to avoid contact with a brilliant sun that would dry them. It was easy to observe that composite flowers (e.g. lettuce, salsify, dandelion, and cypress vine) closed their flowers towards midday (Virey, 1831a).

Virey carried a series of experiments (which he did not describe) to find the causes of these phenomena (Virey, 1831a). On the basis of his results, he concluded as follows: The cold and nocturnal humidity decreased the transpiration of vegetables. The sap, instead of ascending as during the day, now descended towards the roots. It followed that the sappy channels of these slender and thin parts of a large number of plants were then filled up and closed on themselves by their natural spring. This was the factor that that caused so many composite or syngeneic flowers, malvaceae, convolvulacea, etc., to close at the night or even when the sky was cloudy. On the contrary, when the sun raised on the horizon, its heat and strong light induced a strong flow of sap in the leaves and branches of plants, the petals of flowers, and the green cymes. In the case of nocturnal flowers, the strength of the sun acted strongly on the fragile texture of their petals, evaporating most of the sap and feeding juices, causing the flowers to fade and hide. In the freshness of the night the sap expanded its channels and flows, causing the flowers and foliage to open (Virey, 1831a).

Most nocturnal flowers possessed corollas having one very fragile petal (e.g. umbrellaworts, wild gardenia, angel's trumpet, night flowering jasmin, crucianella, etc.), which was short-lived and white or pale. The nocturnal polypetals also had also a delicate structure, like many grasses (e.g., large-flowered cactus, night-flowering catchfly, silene nocturna, etc.). An important fact was that almost all nocturnal flowers exhaled an exquisite and penetrating perfume, many times similar to that of vanilla. This perfume attracted the nocturnal insect to conduct the fertilization action (Virey, 1831a).

Virey ended this paper with a long list of nocturnal and semi-nocturnal plants, classified into flowers without calyx, monopetals, and polypetals (Virey, 1831a).

Poisons

According to Virey, poisons could be classified in two groups, *organic* and *inorganic*. The latter were never assimilable by vital functions; they operated upon all kind of living entities in about the same manner, decomposing them energetically into their parts but with different intensity and degree of activity. They usually tended to strongly disorganize the tissues, although the traces of their action were hardly noticeable. The violence of their action remained visible even in the death state (Virey, 1831b).

Vegetable and animal poisons usually operated on living organisms and according to the organization mode of the species upon which they acted. For example, although white arsenic oxide (As_2O_3) corroded or disorganized rapidly and in a more or less same manner all the animals or plants on which it acted, it did it only on certain living animal or vegetable orders. Other species were not affected at all and many of them derived their food from a substance that was deadly for other races. Mineral or vegetable poisons introduced in the living economy did not reproduce or propagate; animal poisons, on the contrary could become contagious and regenerate like the virus, miasma, and transmissible illnesses; they modified the living organism in such a manner that it became deleterious for others, at their time. Some of these substances did not affect the animal in which they fed but made them malign for other species that ate them. It was known that certain fish in the Antilles, such as the anchovy *Clupea Thryssa*, became poisonous to human in certain seasons, for having ingested jellyfish. Depending on the degree of digestibility of the deleterious animal or vegetable substance, it became food, medicine, or poison to the entities that absorbed them. Thus, the goat swallowed with impunity the henbane that killed the dog; horses or rabbits that ate putrefying substances developed all the symptoms of an illness, while the wolf and the hyena found in the infected carrion a delicious and healthy prey. Certain poisonous animals, for example, vipers, were immune to the bite of their species; the pertinent poisons were usually not decomposed by the digestive juices; they went unchanged through the economy without alteration and keeping their poisonous ability (Virey, 1831b).

Experience showed that although several mineral substances like sulfur, iron, calcium carbonate, and sodium carbonate, were able to combine with the liquids or solids of animals and vegetables, none of them were capable of assimilating, that is, of assuming by themselves the organization and life of the organism. The mineral molecule was one; it only contracted chemical combinations, most of them fixed, saline, binary, and in definite proportions. These characteristics separated them from organic mixtures, formed of at least three elements, united in incessant mobile and variable proportions. This mobility made the most appropriate to undergo more easily the harmonic force of life that chained them during periodic times and variable movements (Virey, 1831b) The mineral, by its fixity, on the contrary, remained surly and untamable, when not an enemy. Minerals could be swallowed; some individuals loaded their stomachs with porous soil and never digested it. The molecules of a poisonous mineral, being of a pure chemical nature, could only act chemically upon the living economy. They could not associate, and thus act as a foreign body; they could not organize and act destructively until its damaging activity was neutralized and exhausted. Vegetables and animal substances were poisons for most living things for the simple reason that they were organic compounds, that is, variable in their elements. Their decomposition was possible by the appropriate living beings. Poisons not always acted by means of the nervous system because plants could be poisoned without having a nervous system. The absorbing system and the circulatory torrent, especially in animals, being first impregnated, underwent the first attacks. The poisons were transmitted in animals to the nervous centers by means of the blood or the lymphatic vessels. Also, of all the parts of an animal killed by the arsenic, only the spinal marrow acted like poison on the other animals. Rabies, all things considered, could be communicated to others by the nervous pulp, as shown by the experiences by Hartwich. Hence, every kind of poison had its specificity for every system of the living body (Virey, 1831b).

Virey provided numerous examples of lethal and innocuous action of the same chemical on different mammals. Humans could ingest with only purgative effect, an amount of aloe, which would kill dogs, foxes and animals of similar genre. Peter Simon Pallas (1741-1811) had shown that the hedgehogs (*Erinaceus auritus*) were able to ingest without damage large quantities of blistering cantharides (Pallas, 1811). These quadrupeds were insectivorous and built to digest this kind of food. Twenty-eight grams of arsenic would only purge a bear and another animal was found to tolerate 3.8 g of mercuric chloride. Sheep tolerated without problems very large amounts of mineral kermes; pig ingested a strong quantity of antimony sulfide without problems; camels ate with pleasure the acridest euphorbia, etc. Virey reached the following conclusions: (1) Inorganic poisons (purely chemical), such as oxides and salts of arsenic, copper, lead, mercury, etc., baryta and other earths, alkalis, and concentrated mineral acids, were enemies of all organisms, animal or vegetable; they acted on the structure of the living, dissolving the life resulting from the coordinated action of all their parts. These were abiotic materials, absolutely incapable of assimilating to organisms, and destroyers of vitality; (2) animal poisons were not universal; they acted only on a limited domain; (3) vegetable poison acted more on animals than on vegetables. Plants existed that fed on these poisons by first denaturalizing them; (4) materials poisonous to particular entities, were foodstuff for others, and vice versa; (5) vegetable poisons acted more strongly over carnivorous animals than on frugivorous or herbivores; (6) for an inverse reason, animal poisons, venoms, and putrefied animal matter, were less active on carnivorous, which assimilated well highly nitrogenated substances; (7) certain poisons could travel the economies without alteration and keep their harmful activity on other less appropriate organisms; (8) most organic poisons offered specific action over certain species and not over others; (9) the venoms were all the smaller as the assimilative functions had more energy to break them down; (10) depending if the state was healthy or ill, or the susceptibility of the organism, a particular venom could be a useful medicament, have no action, or be highly fatal; (11) chemistry could modify an innocent vegetable or animal substance into a poison for the organism from where it was extracted, for example, HCN, oxalic acid, ethanol, etc.; (12) food that was not digested could be more harmful than a digested poison. For example, certain fungus was only poisonous to organisms that digested them poorly; (13) animal venoms and virus acted upon the animal economy more violently and faster when the organisms were strongly excited; and (15) in the animal kingdom, the invertebrates and the warm blood animals were more resistant to poisons than the vertebrates and cold blood animals, respectively. Thus, insects assimilated more venomous substances than the birds and mamifers (Virey, 1831b)

Galls of vegetables

According to Jean Pierre Joseph D'Arcet (1777-1844) and Virey, galls were tumors formed in different parts of a plant as a result of the biting of different insects, such as sawflies (*Tenthredo*), false caterpillars, *Diptera*, L., caterpillars, gall wasps, true bugs, aphids, etc. (D'Arcet & Virey, 1820). They remarked that the bumps that grew around the grafts, and generally around the cuts made in the bark of the plants, gave an idea of the formation of the galls to which all the plants and parts of the plants were subject. It had been observed that almost all the leaves and each of their cells were born of a fiber. In general, the galls grew significantly and were not visible until they had grown to full size; however, there were such galls which did not reach it until after several weeks. Galls were of a large variety; for example, they did not have the same number of cells or a number of insects proportional to these cells. There were cells that contained one insect and others, much larger, that contained many insects. There were cells of similar size communicated one with the other; others grouped and separated by partitions; large cells surrounded by other smaller ones, etc. A gall could be more or less hollow, woody, branched, smooth, small as head pins, others the size of a walnut or a small apple. It seemed that the insect had a strong influence on the consistence of the gall; it had been observed that the galls produced by certain insects were always ligneous, while others produced by different insects on the same leaf, were always spongy. The gallnuts of the Levant were harder than the hardest tree. Galls were present in pomes, red currant berries, and particularly, on the oak kittens, D'Arcet and Virey classified the observed galls in 15 different groups, among them, the rugged galls of the oak leaves, the very small galls located on the upper part of the leaves of oak, galls in nutmeg of limonium, spongy galls on pomes, galls in nails or horns of linden leaves, red galls in the leaves of linden, etc. The production of a gall was a clear manifestation of the irritability of the tissue of vegetables, analogous to the bite of the insect, which deposited an acrid and stimulating poison on the wound of an animal and produced reddening, tension, and heat. Fleas and bugs took advantage of this excitation to suck more abundantly the blood. A wound in a tree resulted in a swelling that attracted sap, with the resulting super growth. A proof of this statement was the fact that a wound produced by a pointed object did not produce the same symptoms of inflammation because it was not accompanied by the introduction of an acrid and irritant principle (D'Arcet & Virey, 1820).

Virey examined under a microscope the structure of the spongy interior of the large galls of the Tauzin oak (*Quercus Toza*) and of the corn saw-wort (or way whistle, *Serratula arvensis*), and of the central portion of the galls the rose bush (Virey, 1823). This inspection indicated that the spongy interior of the Tauzin oak consisted of a very large number of utricular vesicles in the form of partially transparent and partially opaque branches. All these ramified portions entangled to conform the spongy tissue of the gall. Every utricular vesicle was composed of a pellucid lamellar envelope, containing a grumpy substance, tawny in the opaque portion, which was the material of the astringent principle of the vegetal and contained gallic acid and tannin. Boiling these parts in water resulted in the dissolution of the tannin in the water, and consequently, of the almost complete disappearance of the opaque part. The galls of *Serratula arvensis* presented the same structure, except that they contained less opaque matter and were less astringent. These substances did not consist properly of vegetable fibers. The swelling of the cellular tissue was occasioned by the irritation produced by the acrid venom of the *Cynips* while depositing its eggs (Virey, 1823).

Some early concepts about cold and its effects

Virey wrote that today, as in the time of the Greek philosophers, the positive existence of cold and heat continued to be debated (Virey, 1816a). Aristotle had stated that cold was only an accident or a quality that brought together, tightened, and condensed bodies, while heat was a contrary accident causing the dilatability of all substances. The epicureans and atomists had rejected this notion; they maintained that the cold was due to *frigorific corpuscles*, in the same manner that heat was due to *igneous atoms*. Thus, these corpuscles, assumed to be pointed particles, tugged and tightened the fibers of the skin when the wind and the rigorous aquilons (north-east winds) blew. The igneous atoms given off from the fire, creeped more or less violently between the molecules of our bodies and expanded or separated them. Eventually scientists abandoned this theory because they could not conceive the presence of such abundant frigorific matter in a substance and less occupying so much space. Nevertheless, the hypothesis of frigorific particles continued to have adepts; Pieter Musschenbrock (1692-1761) used it to explain the expansion of freezing water but René Antoine Ferchault de Réaumur (1863-1757) explained the similar expansion in iron on the basis that cast iron admitted a granular crystallization between its molecules. The same expansion phenomenon occurred with bismuth and antimony. Metals and other melted substances that did not crystallize upon cooling contracted in the same manner that did all bodies that lost caloric. Joseph Black (1728-1799) thought that he had put the theory of frigorific fluid to rest when he proved that a decrease in caloric (or less heat) was enough to explain all the phenomena of cold and crystallization. The proof that caloric was no more than an internal movement, or a vibration incited between the corpuscular particles meant that cold was simply total rest, or a weak agitation of these particles (Virey, 1816a).

Virey went on to speculate on the effect of cold on organized organisms in general; on the wonderful art that nature appropriated these beings to the coldness of the poles or to the equatorial ardor, to assure their subsistence. In the cold countries, particularly when winter approached, a thick and warm fur covered all the quadrupeds. The horse, pig, castor, etc., became covered by a tight and curly wood and the birds clothed with feathers down to the extreme of their feet to enable them run over the snow. The plants became surrounded by a thick and soft down that defended them from the piercing winds; some trees grew buds carefully wrapped with scales and small leaves well coated with a resin. Nature took these protective measures only in the cold countries; they were unnecessary in the warm ones. There were also some additional precautionary measures: all the green trees were resinous; the resins protecting from the cold; northern animals became fatter in winter, aquatic birds became impregnated with fluid fat, independently of their thick and oily feathers, impregnable to humidity. All the animals living in the poles became white; cold and lack of light whitened and blanched the skin. Humans of the north had blond hair and white skin; these colors became darker and stronger as they emigrated towards the south. Experience showed that nothing defended the skin better from cold than fats. Nature ensured animals by the same procedure. Plants subjected to cold and little sunlight developed almost no sugary matter, no volatile oils or aromas, no strong flavors and no strong and intense colors. Vegetables from the cold countries were mostly insipid, odorless, and aqueous and little appropriate to feed humans or animals. Cold did not make the meat of animals tastier and more substantial it only made it fatter. Dead organized matter suspended all decomposition process, be it acid fermentation or purification. Cold had the particular property of desugaring fruit almost completely; thus, frozen fruit did not have the same sweetness as fresh fruit (Virey, 1816a).

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This article has no conflict of interest