dian rubber plant, *chelidonium majus* or Celandine, *Alisma Plantago, Tradescantia,* &c.

For full particulars relative to these singular movements, the reader is referred to M. Schultz’s paper, which will speedily be published in the Mémoires de l’Académie des Sciences.

Art. III.—*Of the Qualities of the Sap, and the changes which it undergoes in the Leaves from the agency of the Air.*

Having said so much of the *motion* of the sap, and of the powers by which that motion is accomplished, let us next di­rect our attention to its *qualities.* If collected during the bleeding season, it is almost without taste, but sometimes a little sweet. It ordinarily yields, by evaporation, only a little mucilage; but that of the maple of Canada is said, by Du Hamel, to afford nearly 5 *per cent.* of sugar. The sap of the elm *(Ulmus campestris)* was examined by M.Vau- quelin at successive periods of vegetation. In his first ana­lysis he found 1039 parts of it to consist of sun flower, the area of the surface of which above ground was equal to 5616 square inches, gave off, by perspiration, in a warm dry day, about 20 ounces of fluid. In a warm dry night, without dew, it exhaled only three ounces. When the dew was sensible, there was no perspiration ; and when the dew was abundant, or the night wet, then the weight of the plant was increased. The more succulent leaves perspired more than those of firmer texture, and deciduous more than those of evergreens. In plants of the same species, and placed in similar circumstances, perspiration is proportional to the extent of perspiring surface : but in all plants, cold and humidity more or less diminish or entirely suspend this function.

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| 1027·904 water and volatile matter; |
| 9·240 acetate of potass ; |
| 1∙060 vegetable matter; |
| 0·796 carbonate of lime. |

At a later period, the vegetable matter was in greater quantity, and the saline ingredients had diminished ; and, at a period still later, these changes were still more evident. Other saps were analysed, and found to possess similar in­gredients ; and some others in addition. The sap of the beech contained gallic acid and tannin ; and that of the birch, sugar, and acetates of alumina, and lime. The sap of the vine, examined by Dr. Prout, resembled river water in appearance and specific gravity, but was sweetish to the taste. It yielded, by evaporation, a minute portion of *residuum,* consisting of a peculiar vegetable matter and car­bonate of lime.

The increase of vegetable matter observed in the sap as the season advances, suggests the idea that it becomes mixed with matter previously deposited in the tree. This idea occurred to Malpighi, who considered the sap, as it rose through the vessels, to be partly deposited in the cells, where it underwent changes which fitted it for supplying the first nutriment to the young buds and tender leaves. A similar opinion was held by Darwin, who also supposed the sweet juices found in certain roots, and in the knots and stems of some of the grasses, to serve the same purpose. From finding the specific gravity of the sap to increase as it rose higher in the tree, and the alburnum of a tree, felled in winter, to be heavier than in other seasons, Mr. Knight also supposed a deposition of nutrient matter to be made in the alburnum, through the latter part of summer and autumn ; so as to be ready to mix with the sap in the fol­lowing spring, and afford nourishment to the buds and leaves. Hence, we may consider the young bud, like the embryo of the seed, to draw its first nutriment from matter previously secreted, and in part deposited in cells, and afterwards reabsorbed and applied to its destined use.

The bud, thus nourished in~ its early growth by the ascending sap, is more or less rapidly developed, and the tree soon becomes clothed with leaves. Of the changes in the *motion* of the sap when vernation occurs, we have already spoken, and have now to describe others which are effected in the *qualities* of the fluid. The first action of the leaves upon the sap is to throw off a large portion of it. The insensible perspiration of plants has been particular­ly investigated by Woodward and Hales, and by Bon­net and Guettard. Dr. Woodward found that a sprig of mint, weighing only 27 grains, imbibed, in seventy-seven days, 2558 grains of water: yet its weight was increased only 15 grains; and it must therefore have given off in that time 2543 grains of fluid. Hales calculated that a

The fluid thus perspired was collected by Hales as it issued from the leaves of various herbs and trees. The liquor in all was very clear, nor could he distinguish any difference in its taste. It had nearly the specific gravity of water, but when exposed to a hot sun it began sooner to putrify. Senebier evaporated the perspired fluid of a vine: the *residuum* consisted of minute portions of resinous and gummy matter, and of carbonate and sulphate of lime, which ingredients seemed to augment as vegetation pro­ceeded.

By the loss of its more aqueous parts, the proportions of the remaining ingredients of the sap must be much changed. Grew, Malpighi, Du Hamel, and others, have pointed out the gre⅛t differences produced in the consistence, colour, odour, and taste of the sap during its transmission through the leaves ; differences peculiar to each species of plants, and which have obtained for the sap, at this stage of its movement, the appellation of Proper Juice. It is in this proper juice, says Du Hamel, that the narcotic power of the poppy, the corrosive quality of the fig, the diuretic vir­tue of the fir, and the purgative property of jalap, resides: and even the peculiar products obtained from the sugar cane and maple arise probably from the intermixture of the proper juice with the common sap: whence we may infer that the virtue of plants resides principally in their proper juice.

It is difficult to collect these juices in a pure state. Those which have been examined differ much in their chemical properties. In some of them, mucus is the pre­dominant ingredient, and such juices are generally mild and nutritious. Of the milky juices some are mild, others hot and acrid. From the proper juice of Euphorbia, Μ. Chaptal obtained, by the agency of chlorine, a white preci­pitate, consisting of two parts resinous matter and one part woody fibre. The juice of the *carica papaya,* a tree that grows in Peru, yielded M. Vauquelin a substance very like the fibrine of animal matter. From other juices, gums, resins, turpentines, balsams, tannin, sugar, and various other products, have been obtained : so that, in their sen­sible qualities, these juices differ as much from each other as they do from the common sap ; but all of them appear to contain a substance resembling in character the woody fibre.

That the difference of quality observed in the common sap and proper juices is effected chiefly in the leaves, seems now to be generally admitted. Some part of this difference is doubtless attributable to the concentration which these juices experience from the exhalation of so much water ; but a much larger part is to be ascribed to the effects which result from the combined agency of light and air. That air is essential to the vegetative process, and that the leaves of plants more especially act on the air, are positions long since established by decisive evidence ; but physiolo­gists are not yet agreed as to the nature and extent of this action, nor, consequently, as to the mode and degree in which it affects the vegetable fluids. This discordance appears to us to have arisen partly from imperfect experi­ment, and partly also from blending together two ac­tions performed by the leaves, which, in their nature, are