air, which experiences this purification, must contain a por­tion of carbonic acid, either in an elastic form, or held in solution by water, and that it must be exposed, with the plant confined in it, to the influence of the solar rays ; that neither the plant alone, nor light alone, will effect the de­composition of carbonic acid gas, which is accomplished only by their united agency; that only the leaves and other *green* parts of plants are able, by this decomposition of carbonic acid, to produce oxygen gas; and that the bulk of oxygen produced in these circumstances is exactly *equal* to that of carbonic gas which has disappeared. Hence, if plants be made to vegetate in a given bulk of atmospheric air, and placed alternately in obscurity and sunshine, carbonic acid is successively formed and decomposed; so that, as De Saussure ascertained, the air suffers no permanent change either in its bulk or composition.

This operation of plants in purifying air was deemed by Priestley a *vegetative* function carried on by the aid of light; and by Ingenhousz it was ascribed not to vegetation, but to the influence of light combined with a certain state of ve­getable structure. As plants grow in obscurity, where they produce no oxygen gas, this operation cannot be deemed essential to vegetation ; and, on the other hand, the decom­position of carbonic acid is effected by the combined agency of plants and solar light, in situations and under circum­stances where vegetation cannot exist. Thus, if plants be placed in sunshine, they produce oxygen gas either when immersed in vessels of water saturated with carbonic acid, or when confined in pure carbonic gas. So likewise a si­milar decomposition of this gas is accomplished by plants, with the aid of light, in temperatures many degrees below freezing, and in such a state of mutilation as is incompatible with the proper exercise of their vegetative powers. Hence, in these different instances, the decomposition of carbonic acid is effected by plants without the aid of that oxygen gas, or that degree of heat, or that condition of structure, which are essential to vegetation ; while, on the contrary. It occurs only under exposure to light, which, as we have seen, is not necessary to vegetable nutrition and growth.

But the operation of light, which is thus necessary to the decomposition of carbonic acid, is required also to produce the *green colour* in plants ; and exclusion of light, which prevents this decomposition, prevents also the appearance of that colour. The two effects, indeed, are not only ac­complished by the same agents, acting in the same circum­stances, but, as far as observation extends, are simultane­ously performed ; whence it may be inferred, that some ne­cessary connection subsists between them ; and, could we discover this. It might lead us to an explanation of the green colour of plants.

Senebier observed, with great care, the operation of light in rendering white leaves green. At first, in different places are seen yellow spots, which gradually become deeper, and at length green. These spots multiply, extend, and meet on the face of the leaf, till at last it is rendered entire­ly green. If part of a white leaf be secluded from light, by covering it with tinfoil, that portion continues white, while the other parts become green; or, if a green portion be similarly covered, so as to exclude the light. It gradually Joses its green colour, while the neighbouring parts retain it. From these and similar facts, Senebier considered the green colour in plants to be effected by the direct agency of light, independently of vegetation. He remarked, that a singular relation subsists between the parts of green leaves that furnish most oxygen, and those parts of white leaves which first become green; and from the circumstance of carbonic acid being decomposed and its oxygen expelled only when these parts became green, he was led to ascribe the green colour to the retention of the carbon of the de­composed gas, and its deposition in the cellular tissue of the leaf.

Mr. Ellis considers that the deposition of carbon in the manner above stated is not sufficient to change the colour­less juice of the leaf to a green hue, and supposes that these colours are owing to the predominance of acid or alkaline mat­ter. In support of this theory, he states that alkaline matter is an abundant ingredient in leaves ; and the observations of Hales, Du Hamel, Coulomb, Knight, and others, show that carbonic acid is largely carried in with the sap, either in solution or in combination with alkaline matter. With the alkali already present in the leaf, the excess of acid in the sap will readily combine ; and according to the propor­tion in which acid and alkali are present, the leaf will be variously coloured. If the acid abound, as in etiolated leaves, the leaf will be white ; but if means can be found to withdraw this acid, and render the alkali predominant, then the green colour will appear. “ Now, the decomposi­tion of carbonic acid in plants, by the agency of solar light, seems to be the mean employed by nature to accomplish this purpose ; for by this mean,” says Mr. Ellis, “ the acid is not only withdrawn from its combination, and its oxygen expelled, but the alkali at the same instant becomes predo­minant, and exists, therefore, in a state fitted to exert its specific action on the colourless juices of the plant, which, in consequence, are rendered green. The coloration of the leaf, therefore, is not owing immediately to the decomposition of carbonic acid and expulsion of oxygen, but to the predominance of alkali which that decomposition occasions. Hence, in the earlier stages of the process, we cannot so properly say that the green leaf affords oxygen, as that it becomes green when that gas is expelled ; and thus it is that the decomposition of carbonic acid in leaves, by the agency of solar light, gives rise at once to the production of oxygen gas and the formation of the green colour in plants.”

But though light thus appears to be the active cause of colour in plants, yet, as it acts only by rendering alkali pre­dominant in their juices. It follows, that if, from the soil, or in any other manner, a similar predominance of alkali arise, these juices will be rendered green. Hence certain buds and the germs of some seeds, and parts which lie within the bark of certain herbs, exhibit a greenish hue, though per­fectly secluded from light ; so that it is not to be doubted, as Senebier remarks, that plants, and parts of plants, may become green, although light should not act immediately upon them.

If thus the predominance of alkali occasion a green co­lour, then deficiency of it, and, still more, excess of acid, should have a contrary effect. Accordingly, when light is excluded from plants, no carbonic acid is decomposed in the leaf, and then its retention and accumulation, by saturating the alkali, subdue the green colour, and give rise to the white appearance observed in etiolated plants. So, like­wise, the changes of colour which leaves exhibit in autumn seem to arise from the abundance of acid matter, not, how­ever, occasioned by the absence of light, but developed under the various conditions of decay and decomposition in which they are then placed.

From the facts stated above, with regard to the alter­nate consumption and production of oxygen gas by grow­ing plants, a question has arisen, whether, on the whole, vegetables purify or deteriorate the atmosphere. We cannot enter further into this question than to observe, that it is not to be decided altogether by experiments made in close ves­sels of artificial mixtures of air, but demands a comprehen­sive survey of vegetation in different climes, and a know­ledge of the times and circumstances in which the one or other process prevails, or is variously accelerated or retard­ed. Since the production of oxygen arises solely from the decomposition of carbonic acid in the plant, we must also know the modes and quantities in which that gas is supplied to plants ; for the power of plants to produce a