into a smaller tube, and then place it in a coloured solution of a strong syrup, such as sugar dissolved in water, the coloured solution will gradually pass through the bladder into the wide tube; it will then enter the smaller tube, and will in time flow over at the top. Deutrochet attributed these effects to the action of electric currents; this throws some light on the mode in which the sap rises up and descends; the process will continue until the two liquids become of the same density. Dr. M next referred to the ultimate elements of plants, which are carbon, oxygen, hydrogen, nitrogen; there are also phosphorus, sulphur, and other ingredients, forming the inorganic portion of plants; these exist in almost all vegetables. Carbon forms a large portion of the plant; it is derived from various sources, such as from the decompositon of dead bodies, from manure, &c., but by far the largest supply is obtained from the atmospheric air, acting upon the leaves of the plant. The part of the plant derived from solid inorganic substances enters in also at the roots. The oxygen of the plants is derived from several sources; it forms a large constituent portion of water itself, and is also absorbed by water; it is easily separated from the hydrogen of the water, and hence a large supply is kept up. The atmosphere contains 21 per cent of oxygen, and the leaves of plants absorb it in certain cases; it enters into solution with water. Hydrogen is also obtained from water; from the facility of combination and decomposition between the elements of water, these changes are constantly occurring in the vessels of plants; there are other sources of hydrogen; caburetted hydogen is obtained from the decomposition of vegetable matter; a considerable portion is extracted from ammonia, the ammonia containing hydrogen and nitrogen; hydrogen will also be obtained from the soluble organic substances entering the roots of plants. The nitrogen of plants is in so small a quantity that we might suppose that it was scarcely essential, or that it exercised no important influence in the growth of the plant; but we find that this element is equally essential with any of the others, for if these small quantities are absent, the physical and chemical properties of plants are very materially altered, and an injurious effect is produced both upon animal and vegetable life; when we consider the whole quantity of nitrogen in a crop, it is absolutely large; if we take a crop of hay obtained from an acre of ground, we shall find the quantity of the whole of the nitrogen contained in it to be large; hence its important influence; nitrogen does not exist in the solid matter of the globe; there is no source but the atmosphere from which it can be derived, and the nitrogen of the atmosphere to a small extent may enter by solution with water, or be absorbed by the leaves; the quantity observed by water, however, is exceedingly small, and it is therefore improbable that plants can derive any considerable portion from it; ammonia is capable of entering plants in large quantities, and of yielding up its nitrogen; this is an abundant source; nitric acid can enter into vegetables, and produce nitrogen; we have an example of this in the application of saltpetre or nitre, from which nitric acid is produced; it is supposed that the salts formed by nitric acid are much more abundant in manure heaps than has been generally thought; it is found that this acid is readily formed where animal or vegetable matter is undergoing decomposition; other animal compounds, such as urine and night soil, afford a large quantity of nitrogen to the growing plants. In this mode a perfect plant derives its food. The next points to be considered are, the period of germination, the expansion of the leaves to the flowering, from the flowering to the ripe seed, and from the ripening to the fall of the leaf. First, the period of germination; the circumstances indispensable to the process are, first, moisture, second a free exposure to air, and third, a due degree of warmth. No circulation can take place in the plant until water is largely imbibed; no food can be conveyed through the vessels unless there be a constant supply of fluid. A slight elevation of temperature is necessary for the process of germination, and in most cases absolutely necessary, though some plants grow with a very little increase. Exposure to air is necessary, as shown by the fact that seeds will not grow if excluded from air; if buried deep in the soil, they remain long unchanged, sometimes for years, but when the soil is turned up, they speedily begin to grow. Light is positively injurious to germination; in the mode of sowing, much of the grain remains uncovered, and the prejudicial influence of light is one reason why by dibbling fewer seeds fail; the reason of the injurious effects of light is that the young germ requires to get oxygen from the air, and to evolve carbonic acid, and the opposite of this takes place under exposure to light: When the germ has extended to a sensible length, it has a sweetish taste—the saccharine matter, commonly called grape sugar, is formed in the sap of the young plant, which is one of the first changes of the starchy matter; the young wood consists of a mass of vessels, which increase and expand into leaves, when a different change takes place, the plant deriving its food from the air, under the influence of light, to which it has now become exposed; the leaf absorbs carbonic acid and evolves oxygen; it is therefore in the light plants increase in size and growth; as carbon is added to the plant in the presence of light, the sap unites with it, and forms any one of these compounds presented by carbon and the elements of water; the solid parts of plants are principally made up of carbon. The opening of the flower is the first and most important change towards the production of the seed; at first the flower leaves absorb oxygen and emit carbonic acid, and occasionally they emit pure nitrogen, but this process ceases when the flowers are matured; and in those plants which afford large quantities of sugar, the sugar becomes less abundant, passing into the state of starch or gluten, and beginning to form the husk of the future seed; it is first tasteless, afterwards sour, and finally sweet; lastly, the fruits, when green, act upon the air, absorbing carbon and evolving oxygen; but when they become ripe they absorb and retain oxygen; the same is the case with unripe fruit when taken from the tree. The chief energy of plants before flowering is spent in the formation of woody fibre; after the expansion of the flower, the woody fiber is not required, and the remaining functions are the formation of starch and gluten for the seed, and the husks to cover them; when the seed is fully ripe, the growth of the plant is ended: they no longer require carbonic acid as their food, having attained full maturity; their leaves therefore change their functions, absorb oxygen only, and resolve again into their elementary substances. Singular as these changes are, the rapidity with which they are carried on is surprising: tropical plants sometimes grow six inches or more in the course of a day, and when the solar heat is great they probably rise more. The rapidity of growth, and the quality of the plant are equally affected by circumstances, in the controlling and producing of which the practice of agriculture depends. On the deposit of rain, the action of solar light, and things of that kind, we have no control; but there are artificial methods by which we can hasten the growth, as in regard to the first change, that of germination, we can hasten it by moistening the seed with a certain solution. With water containing a solution of chlorine or iodine, the seeds germinate much faster. With sulphate of copper Sir Humphrey Davy ascertained that they germinated in two days, with sulphate of iron three days, nitric acid five days, and sulphuric acid in eight days. These substances seem to act as stimulants, and not as furnishing food to the plant. From what has been stated of the structure of plants, we will understand in what way the food is conveyed into them. The next inquiry will be into the chemical changes, by which the food is converted into the bodies of which the plants consist. The principles of plants are, as has been stated in a former lecture, divided into two classes ultimate and proximate. The ultimate or elementary principles are carbon, oxygen, hydrogen, and nitrogen; these four are the great constituents; they are simple bodies, and we call them elementary. The proximate principles of vegetables, are compound bodies such as woody fibre, starch, gum, sugar, gluten, vegetable albumen, diastase and vegetable ashes. Lignin, or woody fibre, which forms the great bulk of the plant, is composed of carbon, hydrogen, oxygen, and a little nitrogen. In this composition, hydrogen and oxygen are in the same proportions as are necessary to form water; hence, the composition may be represented by equal parts of carbon and of water. When the solid substance of the wood is examined,