and this from the peculiarity of its situation, is always protected from the inclemencies of the weather.

170. That there is, in reality, a difference in the nature of vegetables as well as of animals, is very apparent; an orange tree will not form scales to protect its buds from cold; neither can the most delicate tropical animal resist the rigours of a polar climate.

171. There are cases, however, in which plants, as well as animals change their habits. The horse-chestnut, in India, its native climate, unfolds its leaves to the atmosphere, without receiving any check in their development; in a colder climate, the leaves, in attempting to unfold, are checked in their progress, degenerate into scales, and form buds.

172. Of the *bud*, there are three sorts; the *flower*-bud, *leaf*-bud, and *mixed*-bud.

173. 1st. *The flower-bud*, is of a short round form, and contains the rudiments of one or several flowers folded over each other, and surrounded with scales. It is often found at the extremities of small short branches; this is the kind of bud which is employed in grafting or inoculating. This operation is performed by cutting into the bark of another tree, and placing a bud in the aperture; the sap of the tree flows to it, and forms around it a substance which connects the bud to itself; in this situation it shoots forth, and becomes a fruit-bearing branch.

174. 2d. *The leaf-bud* contains the rudiments of several leaves without flowers; it is usually longer and more pointed than the flower-bud.

175. 3d. *The mixed-bud* contains both leaves and flowers. In the peach we have examples of the first two divisions, the leaf and flower-bud being distinct; in the lilac they are enclosed together in the same bud.

176. You have now seen the manner in which buds commence their existence; and how they gradually unfold themselves until they become, in their turn, branches covered with leaves and flowers. In considering this subject, you cannot but have been impressed with a sense of the goodness of that

170. Does there appear to be any difference in the nature of vegetables?
171. Do plants ever change their habits?
172. How many kinds of buds are there?
173. Describe the flower-bud.
174. Describe the leaf-bud.
175. Describe the mixed-bud.
176. What reflections arise when considering the progress of vegetable life?

great Being, who watches with unceasing care over his vast creation. To observe the progress of life, whether in the vegetable or animal kingdom, is highly interesting to an investigating mind;—but here the power of man can achieve nothing; he may plant and water, but God alone giveth the increase.

177. A bud lives; an infant lives; both are destined to grow and to pass through physical changes; but the bud, although active with a principle of life, knows not its own existence: while the infant becomes conscious of its own powers and faculties, capable of loving those who have contributed to its well-being, and of adoring the great Author of its existence.

CHAPTER IX.

Of Leaves.

78. The leaf is generally a thin, flat organ, consisting of an expansion of the fibres of the bark, connected by a substance which is called the *cellular tissue;* the whole is covered with a green coat or skin called the *cuticle.*

179. Leaves are furnished with pores for exhaling and inhaling gases; and as they present to the air a more extended surface than all other parts of the plant, they are of great utility to the vegetable, by imbibing suitable nourishment, and throwing off such gases as would be useless or injurious.

180. We have seen how the bud is formed, and by what curious means the principle of vegetable life which it contains is preserved and protected through the cold and dampness of winter. In the spring, when the sun has turned his course towards the north, re-crossed the equator, and is advancing towards the tropic of Cancer,* the vegetable world in our region quickened by its stimulating warmth, begins to awaken from its dormant state; the leaf-buds expand, and soon bursting their envelopes, the green leaves come forth.

* It is here presumed that the pupil has been instructed in the apparent course of the sun, as explained in the common school geographies.

177. What comparison may be made between a bud and an infant?
178. What is the leaf?
179. How do leakes inhale and exhale gases?
180. When do the leaves usually appear?

181. Some plants are destitute of leaves; they are then called *Aphyllous*, which term signifies *wanting leaves.*

182. In determining the species of plants, the leaves are much regarded. Specific names are often given from some circumstance of the leaf; for example, the HEPATICA *triloba* is that species of the Hepatica which has leaves with three divisions called *lobes;* the VIOLA *rotundifolia* is a species of violet with round leaves.

183. A knowledge of the various appearances presented by leaves, is of great importance; in order to become acquainted with all their varieties, considerable practice in the analysis of plants is necessary. Engravings will assist you in understanding definitions, but you must consult nature. There are many terms to express the varieties observable in leaves; we shall here explain some of the most important.

184. 1. *Seminal* leaves are those which come up with the plant when it first appears above the surface of the earth; as in the garden bean: these leaves are the cotyledons, or lobes of the seed, which, after nourishing the young plant, decay.

185. 2. *Primordial* leaves succeed the seminal ones, and resemble them in position, form, and size. The primordial leaf, according to the fanciful idea of a French botanist, is a sketch which nature makes before the perfection of her work.

186. 3. *Characteristic* leaves are found in the mature state of the plant; or according to the idea above advanced, nature here perfects her design.

187. It is not always, however, that this process with regard to change of leaves takes place; as in many cases the proper, or characteristic leaf, is the only one which appears.

188. There are many terms to express the *mode of insertion* of the leaf; such as *radical*, growing from the root (*radix*,) *cauline*, growing from the stem (*caulis*,) &c.

189. To express the *position* of leaves, we find the terms, *opposite*, *alternate*, &c.

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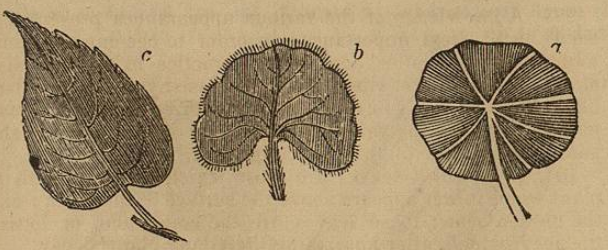
181. What are plants destitute of leaves called?
182. Is the leaf noticed in determining the species of plants?
183. What is the best way of learning the varieties of leaves?
184. Describe the seminal leaf.
185. Describe the primordial leaf.
186. Describe the characteristic leaf.
187. Does this process with respect to the change of leaves always take place?
188. What are some of the terms which express the mode of insertion of the leaf?
189. What terms express the position of the leaf?

190. The *form* of the leaf is expressed by various terms, borrowed from the names of different objects; as *digitate*, (from *digitus*, the finger,) &c. For the explanation of these different terms you must consult the vocabulary as often as you find those you do not understand. We will, however, illustrate some of the most common forms of simple leaves

Fig. 27.

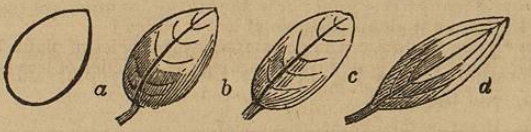


191. *Orbicular*, or the round leaf; the Nasturtion affords an example of this kind; (see Fig. 27, *a*;) this is also *peltate*, having its petiole inserted into the centre of the leaf, and thus resembling a shield.

192. *Reniform*, (from the Latin *ren*, the kidney,) or as it is sometimes called *kidney-form;* the Ground-ivy (Glechoma) has a leaf of this kind. (See Fig. 27, *b*;) It is *crenate*, or has a margin with scolloped divisions, *ciliate*, being fringed with hairs like eyelashes.

193. *Cordate*, (from the Latin *cor*, the heart,) or *heart-shaped.* Fig. 27, (*c*,) represents a cordate leaf with an *accuminated* point; that is, acute and turned to one side; the margin is *serrated;* an example of this kind of leaf may be seen in one species of the Star-flower, *Aster cordifolium.*

Fig. 28.



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190. What terms express the form of the leaf?
191. Describe an orbicular leaf.
192. What is a reniform leaf?
193. What is cordate?

194. *Ovate, obovate, oval;* these are terms derived from the Latin *ovum*, an egg; suppose the figure at 28, *a*, to represent an egg, you observe that one end is broader than the other, now if to this broad end you add a petiole prolonging it into a mid-rib with some lateral divisions, you have, as at *b*, the representation of an *ovate* leaf. If the petiole, were placed at the narrowest end, it would be an *obvate* leaf. An *oval* leaf (*c*) is when both the ends are of equal breadth. When the length is much greater than the breadth, the leaf is said to be *elliptical*, as at *d*.

Fig. 29.

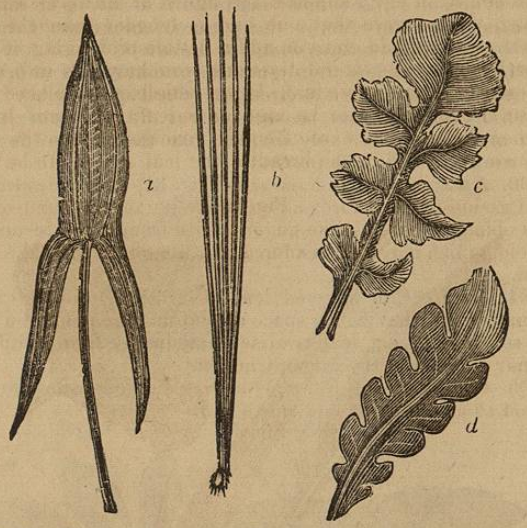
195. *Lanceolate*, this kind of leaf may be seen in the peach tree; it is represented in Fig. 29, *a;* this has a *serrulated* or slightly notched margin; at *b*, may be seen the cleft *stipules*, or appendages of the leaf.

196. *Linear*, as the grasses and Indian corn, Fig. 29, *c*, represents a leaf of this kind; it is *sheathing*, or encloses the stem by its base, as may be seen at *d*.

197. *Deltoid*, from the Greek letter *delta* Δ; this kind of leaf is represented at *e*, Fig. 29; the Lombardy poplar affords an example of the same.

194. Describe the terms ovate, obovate, and oval.
195 Describe a lanceolate leaf.
195. What is a linear leaf?
197. What is a deltoid leaf?

Fig. 30.



198. *Sagittate*, (from *sagitta*, an arrow,) or arrow shaped leaf; this is represented at *a*, Fig. 30; the *Sagittaria*, or Arrow-head, an aquatic plant, affords an example of this leaf.

199. *Acerose*, or needle shaped; this is represented at *b*, Fig. 30. Leaves of this kind are mostly clustered together, as in the pine; they are *subulate*, or pointed like a shoemaker's awl; they are *rigid*, or stiff, and *evergreen*.

200. Trees with acerose leaves, are usually natives of mountainous or northern regions; any other kind of leaves would in these situations be overpowered by the weight of snow or the violence of the tempests; but these admit the snow and wind through their interstices; their many points or edges, presented even to a gentle breeze, produce a deep, solemn murmur in the forest; and when the storm is abroad, and the tempest high.

"The loud wind through the forest wakes,
With sound like ocean's roaring, wild and deep,
And in yon gloomy pines strange music makes."

198. What is a sagittate leaf?
199. What is an acerose leaf?
200. What is observed of trees with acerose leaves?

The poet Burns, in describing such a scene, says: "this is my best season for devotion: my mind is wrapt up in a kind of enthusiasm to Him who, in the pompous language of the Hebrew bard, 'walks on the wings of the wind.'"

201. *Lyrate*, differs from pinnatifid in having its terminating segment broader and more circular. See Fig. 30, *c*.

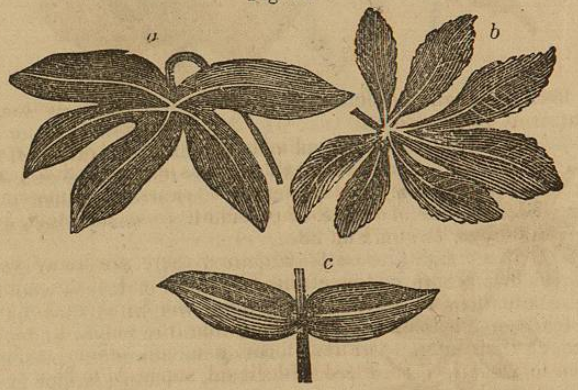
202. *Pinnatifid*, may be seen at Fig. 30, *d;* leaves of this form are sometimes finely divided, like the teeth of a comb; they are then said to be *pectinate*.

203. *Palmate*, or hand shaped, (Fig. 31, *a;*) one species of the Passion-flower affords a good example of this kind of leaf. The oblong segments like fingers, arise from a space near the petiole, which may be considered as resembling the palm of the hand.

204. *Digitate*, or fingered leaf, (Fig. 31, *b,*) differs from the palmate leaf in having no space resembling the palm of a hand; but several distinct leafets arise immediately from the petiole as may be seen in the Horse-Chestnut.

205. *Connate*, (Fig. 31, *c;*) the bases of opposite leaves are united so as to appear one entire leaf.

Fig. 31.

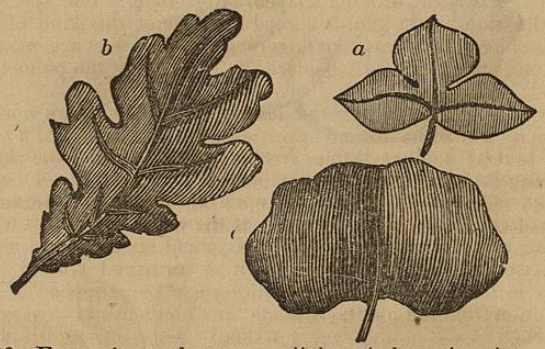


201. Describe a lyrate leaf.
202. What is a pinnatifid leaf?
203. What does palmate signify?
204. What is a digitate leaf?
205. What is a connate leaf?

206. *Lobed;* when leaves are deeply indented at their margins, they are said to be lobed, and according to the number of these indentures, they are said to be *three lobed*, *four lobed*, &c. Fig. 32, *a*, represents a three lobed leaf, as may be seen in the *Hepatica triloba.*

207. *Sinuate*, from the Latin *sinus*, a bay; this term is applied to leaves which have their margins indented with deep, roundish divisions, as at *b*, Fig. 32.

Fig. 32.



208. *Emarginate*, denotes a slighter indentation than sinuate, as at *c*, Fig. 32.

Fig. 33.

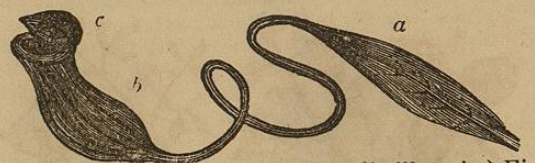
209. *Stellated*, or whorled; (from *stella*, a star;) this term is applied both to leaves and flowers, and relates to the manner in which they radiate from the stem, as in Fig. 33.

210. *Tubular*, there are many varieties of this kind; the leaf of the onion is a complete tube; the Saracenia, or side-saddle flower, has the sides of its leaf united, forming a cup which is found filled with liquid, supposed to be a secretion from the vessels of the plant. In some countries of the torrid zone is the

206. What does lobed signify?
207. What is sinuate?
208. What is emarginate?
209. What does stellated signify?
210. What leaves are called tubular?

wild pine, *Tillandsia*, the leaves of which are hollowed out at their base, so as to be capable of containing more than a pint of liquid. A traveller says, "by making an incision into the base of this leaf, and collecting the water in our hats, we could obtain a sufficient supply for the relief of the most intense thirst." The fluid is not a secretion from the plant, but is deposited during the rainy season.

Fig. 34.

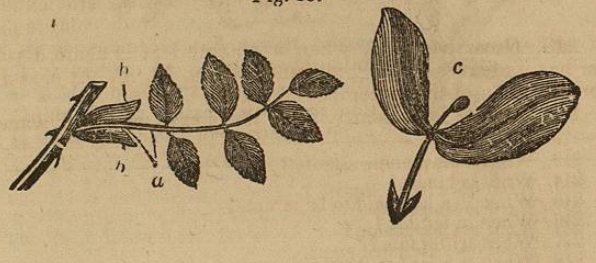


211. The Pitcher-plant, (*Nepenthes distillatoria*,) Fig. 34, affords a most singular tubular receptacle in an appendage to its lanceolate leaf; beyond the apex of the leaf *a*, the mid-rib extends in the form of a tendril; at the extremity of this tendril is the cylindrical cup or pitcher *b*, about six inches in length, and one and a half in diameter; it is furnished with a lid, *c*. This is usually found filled with pure water, supposed to be a secretion from the plant. Insects which creep into this cup are drowned in the liquid, except a small species of shrimp, which lives by feeding on the others. The Pitcher-plant is a native of Ceylon, where it is called monkey-cup, on account of its being frequented by these animals for the purpose of quenching their thirst.

Compound Leaves.

212. When several leafets grow on one petiole, the whole is termed a *compound leaf*, as in the Rose.

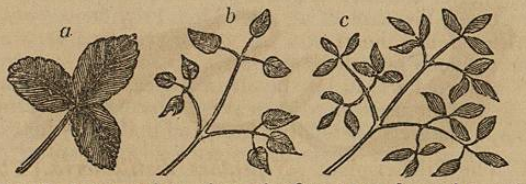
Fig. 35.



213. *Pinnate;* at Fig. 35, *a*, represents the petiole or principal leaf stalk; from this, spring out other divisions, each bearing a leafet; *b*, *b*, represent the stipules or appendages; the whole taken together forms one compound pinnate leaf. The term pinnate is from the Latin *pinna*, a wing or pinion.

214. *Binate;* when two leafets only spring from the petiole, as in Fig. 35, *c*.

Fig. 36.

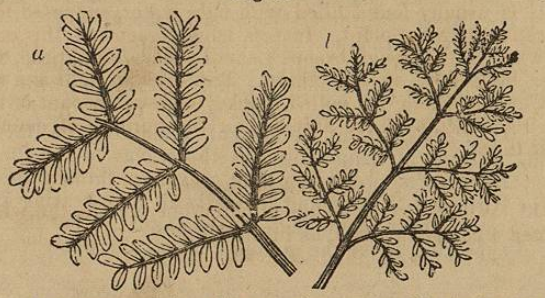


215. *Ternate;* when three leafets arise from the petiole, as Fig. 36, *a*.

216. *Bi-ternate* is a second division of threes, as Fig. 36, *b*.

217 *Tri-ternate* is a third division of threes, as Fig. 36, *c*

Fig. 37



218. *Decompound*, is when a pinnate leaf is again divided, or has its leaves twice compound, as Fig. 37, *a*. At *b*, is a representation of thrice compound leaves.

219. Leaves vary in size, from the small leaves of some of

213. What does pinnate signify?
214. What is binate?
215. When is a leaf said to be ternate?
216. When bi-ternate?
217. When tri-ternate?
218. When is a leaf said to be decompound?
219 What is remarked of leaves with respect to size?

the forest trees of our climate, to the spreading palms and bananas of the torrid zone. As we approach the torrid zone, the leaves increase in magnitude; we can however scarcely credit the report of travellers, who say, that the Talipot tree, in the island of Ceylon, produces leaves of such size, that twenty persons may be sheltered by one single leaf. Although this account may be exaggerated, there is no doubt of the fact, that the leaves of the torrid zone are of a wonderful size; and that whole families often dwell under the branches of these trees. Here we see the care of an ever kind Providence, which, in countries parched the greater part of the year by a vertical sun, has formed such refreshing shelters.

220. Mungo Park, in his travels in Africa, remarks upon the many important uses of palm leaves; serving as coverings to cottages, as baskets for holding fruit, and umbrellas for defence against rain or sun. These leaves are a good substitute for paper, and were so used by the eastern nations. Many suppose that the scriptures of the Old Testament were originally committed to palm leaves.

221 The magnitude of leaves often bears no proportion to the size of the plants to which they belong. The Oak, and other forest trees, bear leaves, which appear very diminutive when compared with the Cabbage, or Burdock.

222. Leaves, with respect to *duration*, are,

Caducous, or such as fall before the end of summer; *Deciduous*, falling at the commencement of winter; this is the case with most vegetables, as far as 30° or 40° north of the equator; *Persistent*, or permanent, remaining on the trees amidst changes of temperature, as the leaves of the Pine and Box; *Evergreen*, preserving their greenness through the year, as the Fir-tree and Pine, and generally all cone-bearing and resinous trees; these renew their leaves annually, but the young leaves appearing before the old ones decay, the plant is always green.

223. In our climate the leaves are mostly deciduous, returning in autumn to their original dust, and enriching the soil from which they had derived their nourishment. In the regions of the torrid zone, the leaves are mostly persistent and evergreen; they seldom fade or decay in less time than six years; but these same trees, removed to our climate, some

220. What is said of the uses of palm leaves?
221. Does the size of the leaf correspond to the size of the plant?
222. How are the leaves divided with respect to duration?
223. What is observed of the leaves of our climate with respect to duration and what is said of the leaves of the torrid zone?

times become annual plants, losing their foliage every year.—The Passion-flower is a perennial evergreen in southern climates, though annual in ours

224. Leaves have not that brilliancy of colour which is seen in the corolla or blossom; but the beauty of the corolla, like most other external beauty, has only a transient existence; while the less showy leaf remains fresh and verdant, after the flower has withered away.

225. The substance of leaves is so constituted as to absorb the other rays of light, and reflect the *green* ray; this colour is, of all others, best adapted to the extreme sensibility of our organs of sight. Thus, in evident accommodation to our sense of vision, the ordinary dress of nature is of the only colour upon which our eyes can, for any length of time, rest without pain.

226. But although green is almost the only colour which leaves reflect, its variety of shades is almost innumerable.

> "No tree in all the grove but has its charms,
> Though each its *hue* peculiar; *paler* some,
> And of a *wannish gray;* the willow such,
> And poplar, that with silver lines his leaf;
> And ash far stretching his umbrageous arm;
> Of *deeper green* the elm; and *deeper* still,
> Lord of the woods, the long surviving oak."*

The contrast between their shades, in forests, where different families of trees are grouped together, has a fine effect, when observed at such a distance, as to give a view of the whole, as forming one mass.

CHAPTER X.

Leaves.—Appendages.

227. LEAVES perform a very important office, in sheltering and protecting the flowers and fruit. The fact of their inhaling or absorbing air, is thought to have been proved, by placing a plant under a bell glass exhausted of air, permitting the *leaves only* to receive the influence of air;† the plant remained

* Cowper.

† Natural philosophy will inform you of the manner in which a glass vessel may be thus exhausted by means of the air-pump.

224 What is observed of leaves with respect to brilliancy of colour?
225. What coloured ray do leaves reflect?
226. What is said of the different shades of green which may be seen in leaves?
227 What are some of the offices of leaves?

thrifty in this situation for a length of time; but as soon as the whole plant was placed under the receiver, it withered and died.

228. The upper surface of leaves is usually of a deeper green, and supposed to perform a more important part in respiration, than the under surface. The upper surface repels moisture you may perceive, by examining a cabbage leaf after a shower or heavy dew, that the moisture is collected in drops, but has no appearance of being absorbed by the leaf. It has been found that the leaves of plants, laid with their upper surface upon water, wither almost as soon as if exposed to the air, although the leaves of the same plants, placed with their under surfaces upon water, retain their freshness for some days.

229. But few among the vegetable tribes are destitute either of leaves, or green stems, which answer as a substitute. The *Monotropa*, or Indian pipe, is of a pure white, and looks as if made of wax. Mushrooms are also destitute of any green herbage. It is not known in what manner the deficiency of leaves is made up to these vegetables.

230. The period in which any species of plant unfolds its leaves, is termed *Frondescence.* Linnæus paid much attention to this subject; he stated as the result of his investigations, that the opening of the leaf-buds of the Birch tree, (Betula,) was the most proper time for the sowing of barley. The Indians of our country had an opinion, that the best time for planting Indian corn, was when the leaves of the white oak first made their appearance; or, according to their expression, are of the size of a squirrel's ears.

231. One of the most remarkable phenomena of leaves, is their *irritability*, or power of contraction, upon coming in contact with other substances. Compound leaves possess this property in the greatest degree; as the foreign sensitive plant, and the American sensitive plant; these, if the hand is brought near them, seem agitated as if with fear; but as they are destitute of intelligence, we must attribute this phenomenon to some physical cause, perhaps the warmth of the hand, which produces the contractions and dilatations of the leaves.

232. The *effect of light* upon leaves is very apparent, plants being almost uniformly found to present their upper surfaces

228. In what respects do the upper and under surfaces of leaves differ?
229. What plants are destitute of leaves?
230. What is meant by the term Frondescence?
231. What is said of the irritability of leaves?
232. What is said of the effect of light upon leaves?

to the side on which the greatest quantity of light is to be found. It has already been observed, that plants throw off oxygen gas; but for this purpose they require the agency of light.

233. *Carbonic acid gas* is a necessary food of plants; this consists of carbon and oxygen, and is decomposed by the agency of light; the carbon becomes incorporated with the vegetable, forming the basis of its substance, while the oxygen is exhaled or thrown off into the atmosphere.

234. Many plants close their leaves at a certain period of the day, and open them at another; almost every garden contains some plants, in which this phenomenon may be observed; it is particularly remarkable in the sensitive plant, and the tamarind tree. The folding up of leaves at particular periods, has been termed *the sleep* of plants; this may seem a singular term to apply to plants; but a celebrated botanist remarks, "this folding up of the leaves may be as useful to the vegetable constitution, as real sleep is to the animal."

235. Linnæus was led to observe the appearance of plants in the night, from the following circumstance, which occurred in raising the Lotus plant; he found one morning some very thrifty flowers, but at night they had disappeared; this excited his attention, and he began to watch the plants through the night, in order to observe the period of their unfolding. He was thus led to investigate the appearance of other plants in the night, and to observe their different manner of sleep.—He found that some folded their leaves together, some threw them back upon their stems, or exhibited other curious appearances.—This phenomenon has been attributed to the absence of light.

236. The following experiment was once made by a botanist; he placed the sensitive plant in a dark cave at midnight, and then lighted up the cave with lamps; the leaves which were before folded up suddenly expanded, and when on the following day the lights were extinguished, the leaves again closed.

237. The period at which the leaves fall off is termed the *Defoliation** of the plant. About the middle of Autumn, the leaves of all annual, and of many perennial plants, begin to lose their vigour, change their colour, and at length fall from their stems.

* From *de*, signifying to deprive of, and *folium*, leaf.

233. What is a necessary food of plants?
234. What is meant by the sleep of plants?
235. How was Linnæus led to observe the appearance of plants in the night?
236. What experiment was once made with the sensitive plant?
237. What is the defoliation of plants?

238. The "fall of the leaf" may be referred to two causes; the *death* of the leaf, and the *vital action of the parts to which it is attached.* If a whole tree is killed by lightning, or any sudden cause, the leaves will adhere to the dead brancnes, because the latter have not the energy to cast them off.

239. The richness and variety of colouring exhibited about the end of autumn, by American groves and forests, is splendid beyond the power of the painter to imitate. Yellow, red, and brown, are the most common colours of the dying leaf; but these colours vary from the brightest scarlet, and the deepest crimson, to different shades of yellow, from the deep orange to the pale straw colour.

Appendages to Plants.

240. Plants have a set of organs called by the general name of *appendages.* These we shall now describe.

Fig. 38.

241. *Stipules* are membranous or leafy scales, usually in pairs, at, or near the base of the leaf or petiole. They are various in their forms and situations, are found in most plants, but are sometimes wanting. In the garden violet, *Viola tricolor*, (Fig. 38, *a*, *a*,) the stipules are of that form called *lyrate pinnatifid*, while the true leaf (*b*) is oblong and crenate. The most natural situation of the stipules is in pairs, one on each side of the base of the footstalk, as in the sweet pea; some stipules fall off almost as soon as the leaves are expanded, but in general, they remain as long as the leaves.

242. *Prickles*, arise from the bark; they are sometimes straight, sometimes hooked, and sometimes forked. They are usually found upon the stem, as in the Rose; but in some cases they cover the petiole, as in the Raspberry; in others, they are

238. To what may the fall of the leaf be referred?
239. What is said of the appearance of American forests in the Autumn?
240. What organs have plants besides those already named?
241. Describe stipules.
242. Describe prickles.

found upon the leaf or the calyx, and in some instances upon the berry; as in the Gooseberry.

Fig. 39.

243. *Thorns*, seem to be a kind of short pointed stem, easily distinguished from prickles, as they grow from the woody part of the plant, while the prickle proceeds only from the bark. On stripping the bark from a rose-bush, the prickles will come away with it, but let the same experiment be made with a thorn bush, and although the bark may be separated, the thorn will still remain projecting from the wood.

244. In this drawing (Fig. 39) you will observe the thorn (*a*) to remain on the stem, while the bark (*b*) has been peeled off. In the prickle (*c*) the whole appears separated from the plant. Thorns in some plants have been known to disappear by cultivation. The great Linnæus imagined that the trees were divested of their natural ferocity and became tame. A more rational opinion is given by another botanist, viz.: that thorns are in reality buds, which a more favourable situation converts into luxuriant branches. But in some cases they do not disappear even under circumstances favourable to vegetation. Thorns have been compared to the horns of animals.

245. *Glands* are roundish, minute appendages, sometimes called tumours or swellings; they contain a liquid secretion, which is supposed to give to many plants their fragrance.—They are sometimes attached to the base of the leaf, sometimes they occur in the substance of leaves; as in the Lemon and Myrtle, causing them to appear dotted when held to the light. They are found on the petioles of many plants, and between the teeth or notches of many others.

246. *Stings* are hair-like substances, causing pain by an acrid liquor, which is discharged upon their being compressed; they are hollow, slender, and pointed, as in the Nettle.

247. *Scales* are substances in some respects resembling the

243. What are thorns?
244. What does Fig. 39 represent?
245. What are glands?
246. What are stings?
247. What are scales?

coarse scales of a fish; they are often green, sometimes coloured, and are found upon all parts of vegetables, upon the roots of bulbous plants, and upon the stems and branches of other plants. They are *imbricated* upon the calyxes of most of the compound flowers. You have seen in buds, how important the scales are to protect the embryo plant during the winter. Scales surround the flowers of grasses, under the name of *glumes*. They envelope and sustain the stamens and fruit of the pine, oak, chestnut, &c.

Fig. 40.

248. *Tendrils*, or claspers, are threadlike, or filiform appendages, by which weak stems attach themselves to other bodies for support; they usually rise from the branches, in some cases from the leaf, and rarely from the leaf-stalk or flower-stalk. You have here the representation, Fig. 40, of a tendril. Tendrils are very important and characteristic appendages to many plants. In the Trumpet flower and Ivy, the tendrils serve for roots, planting themselves into the bark of trees, or in the walls of buildings. In the Cucumber and some other plants, tendrils serve both for sustenance and shade. Many of the papilionaceous, or Pea blossom plants, have twining tendrils, which wind to the right and back again. Some plants creep by their tendrils to a very great height, even to the tops of the loftiest trees; and seem to cease ascending only because they can find nothing higher to climb upon. One of our most beautiful climbing plants is the CLEMATIS *virginica*, or Virgin's bower, which has flowers of a brilliant whiteness; in autumn, its pericarps, with the long pistils remaining upon them, look like festoons of rich, yellowish fringe.

249. *Pubescence* includes all down, hairs, woolliness, or silkiness of plants. The pubescence of plants varies in different soils, and with different modes of cultivation. The species in some genera of plants are distinguished by the direction of the hairs. A microscope is sometimes necessary in determining with precision the existence and direction of the pubescence. It has been suggested that these appendages may be given to

248. What are tendrils?
249. What is included under the term pubescence?

plants for similar purposes as the fur, hair, and bristles of animals, viz.: to defend them from cold and other injuries.

Fig 41.

250. *The Bract* is a leaf among or near the flowers, different from the leaves of the plant. In this branch, (Fig. 41,) you observe the difference between the real leaves (*b b*) and the bract (*a*); the former being *cordate* and *crenate*, the latter *lanceolate* and *entire*.

251. In some plants, as in several species of the Sage, the transition from leaves to bracts is so gradual, as to render it difficult to distinguish between them, and a considerable part of the foliage is composed of bracts. In other plants, as the Crown imperial, the stem is terminated by a number of large and conspicuous bracts. The appendages are sometimes mistaken for the calyx.

252. We have now, in regular order, considered the first of the two classes of vegetable organs, viz.: such as tend to the support and growth of the plant, including *root*, *stem*, *leaf*, and *appendages*; we are next to enter upon the description of a class of organs whose chief use appears to be that of bringing forward the fruit

CHAPTER XI.

Different parts of the Flower.—The Calyx.

253. You are no doubt pleased to have arrived at the blossom, that part of the plant which is the ornament of the vegetable kingdom. Flowers are delightful to every lover of na

250. What is the bract?
251. Is it always easy to distinguish bracts from leaves?
252. What organs of the plant have we now considered?
253. What part of the plant is the ornament of the vegetable kingdom

ture; a bouquet, or even the simplest blossom, presented by a friend, interests the heart. How many pleasant thoughts are awakened by the fresh and perfumed incense which is offered by flowers! their odour has been poetically termed the language by which they hold communion with our minds.

254. Although every part of a plant offers an interesting subject for study, the beauty of the blossom seems by association to heighten the pleasure of scientific research. Flowers are indeed lovely, but like youthful beauty, they are fading and transient; they are, however, destined for a higher object than a short-lived admiration; for to them is assigned the important office of producing and nourishing the fruit. May those also who study this book, so improve the bloom of life, that when youth and beauty shall have faded away, their minds may exhibit that fruit, which it is the important business of the season of youth to nurture and mature.

255. The parts of the flower, or the organs of fructification are the following:

Calyx,	*Pericarp,*
Corolla,	*Seed,*
Stamen,	*Receptacle.*
Pistil,	

Calyx.

256. The Calyx is frequently wanting, as in the Tulip. The Corolla is also wanting in many plants, as in most of the forest trees, which to a careless observer, may seem to produce no flower, but the presence of a stamen and pistil, is in botany considered as constituting a *perfect flower*. These two organs are essential to the perfection of the fruit.

257. When a flower is destitute, either of stamens or pistils, it is termed *imperfect*. A flower is said to be *incomplete* when any of the seven organs of fructification are wanting.

258. The word Calyx is derived from the Greek, and literally signifies a cup; it is the cover of the corolla, and usually green; when not green, it is said to be *coloured*.

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254. Is there any other office assigned to flowers than those of pleasing the senses?

255. Repeat the names of the parts of the flower.

256. What parts of the flower may be wanting,—and what parts are essential?

257. What is the difference between an imperfect and an incomplete flower?

258. What does the word calyx signify,—and what is the usual colour of the calyx?

259. The leaves or parts of the calyx are called *sepals:* sometimes the calyx consists of one leaf or sepal, it is then called *monosepalous;* when it consists of several distinct leaves, it is called *polysepalous;* when one calyx is surrounded by another, it is *double;* when one calyx surrounds many plants, it is *common.*

260. The calyx is said to be *superior* when it is situated on the summit of the germ, as in the apple; it is *inferior* when situated below the germ, as in the pink. In many plants the calyx is neither superior nor inferior, but is situated around the germ.

261. When the calyx drops off before the flower fully expands, it is called *caducous;* the petals of the poppy are, at first, enclosed in a calyx of two large green sepals, but these fall off before the flower is full blown. When the calyx withers and drops off with the corolla, it is called *deciduous.* In many plants it remains until the fruit is matured; it is then called *persistent.* In a pea pod, for example, the calyx may be seen as perfect as it was in the blossom. In an apple or pear the dried leaves of the calyx may be seen on the tops of the fruit; this shows that the calyx was superior.

262. According to the divisions of Linnæus, there are seven kinds of calyxes; viz.:

Perianth,	*Glume,*
Involucrum,	*Calyptra,*
Ament,	*Volva.*
Spatha,	

263. *Perianth.* This term is derived from the two Greek words *peri,* around, and *anthos,* flower. This is the only real calyx or cup, as the term cup does not properly apply to the other kinds of calyxes. A good example of the perianth calyx is presented in the Rose, where it is *urn*-form, with divisions at the top resembling small leaves. In the Pink, the perianth is long and tubular, having the border dentate or toothed. The Hollyhock, Hibiscus, and many other plants, have a double perianth.

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259. What is a monosepalous calyx?—polysepalous?—double?—common?

260. What terms express the various positions of the calyx with respect to the germ?

261. What terms express the different degrees of duration of the calyx?

262. What are the different kinds of calyxes?

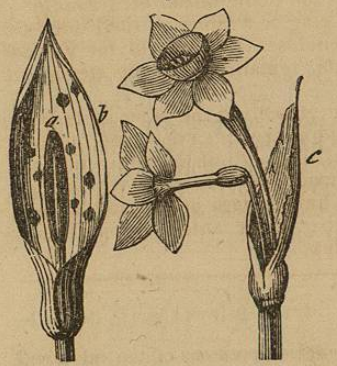
263. Describe the perianth.

264. *Involucrum.* This term is derived from the Latin, *in volvo*, to wrap up; this kind of calyx is usually found at the base of an umbel, as in the Carrot. It is said to be *universal* when it belongs equally to the whole of an aggregate flower and *partial* when it encloses one floret, which, with others, constitutes a compound or aggregate flower. The term involucrum is also applied to the membranous covering in the fructification of ferns.

265. *Ament*, or *catkin*, is a kind of calyx, by some classed as a mode of inflorescence; it consists of many chaffy scales, ranged along a thread-like stalk or receptacle; each scale protects one or more of the stamens or pistils, the whole forming one aggregate flower. The *Ament* is common in forest trees; as in the Oak and Chestnut, and is also found in the Willow and Poplar. In some trees the staminate flowers are enclosed in an ament, and the pistillate in a perianth.

266. *Spatha* signifies a sheath. It is that kind of calyx which first encloses the flower, and when it expands, bursts lengthwise, and often appears at some distance below it. The Wild-turnip, or ARUM, furnishes an example of this kind of calyx, enclosing a kind of inflorescence called a *spadix*. From the peculiar appearance of the spadix, as it stands up surrounded by the spatha, it is sometimes called *Jack in the pulpit*. (See Fig. 41, *a*.) The spatha is common in many of our cultivated exotics, as in the Daffodil, where it appears brownish and withered after the full expansion of the flower.—You see here a representation, (Fig. 41, *b*), of the spatha of the Arum, and of the Narcissus (*c*). In the Egyptian Lily, the spatha is white and permanent, and the stamens and pistils grow separately upon the spadix. Palms have a spadix which is branched, and often bears a great quantity of fruit.

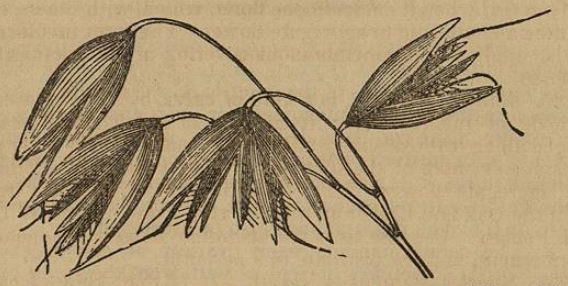
Fig. 41.



264. What is an involucrum?
265. What is an ament?
266. What is a

267. *Glume* is from the Latin word *gluma* a husk. This is the calyx of the grasses, and grass-like plants. In the Oat and Wheat it forms the *chaff*. In the Oat, (Fig. 42,) the glume calyx is composed of two pieces or valves; in some kinds of grain, of but one, in others, of more than two valves. To the glume belongs the *awn* or beard. The corolla of grasses is husky, like the calyx, and is sometimes considered as a part of it.

Fig. 42.



268. *Calyptra.* This term is derived from the Greek, and signifies a vail. It is the cap, or hood, of pistillate mosses, resembling in form and position the extinguisher of a candle.

269. *Volva*, or curtain, the ring or wrapper of the Fungus, or Mushroom plants. It first encloses the head of the Fungus, afterwards bursts and contracts, remaining on the stems or at the root. (See Fig. 23.)

270. The calyx is of use in protecting the other parts of the flower, before they expand, and afterwards supporting them, by keeping all in their proper position. Pinks having petals with long and slender feet, which would drop or break without support, have a calyx. Tulips having firm petals, and each one resting upon a broad strong basis, are able to support themselves, and they have no calyx.

267. What is the glume?
268. What is the calyptra
269. What is the volva?
270. Of what use is the calyx?