

The Compositors will thank
Professor Henslow for the list of Plates
having composed all the MS.

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VIII. *On the Examination of the Hybrid Digitalis.*

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ALTHOUGH the propagation of hybrid plants has been much attended to of late years by several Horticulturists in England, their experiments, for the most part, seem to have been undertaken for the sole object of encreasing the forms of beautiful flowers, or of modifying the flavour of delicious fruits. But the more curious and important physiological facts elicited by the phenomenon of hybrid productions do not appear to have received a proportionate degree of attention from those who have been engaged in these experiments. Chance having favored me with a hybrid *Digitalis* during the past summer (1831), in my own garden, I employed myself, whilst it continued to flower, which was from June 19 to July 22, in daily examining its characters and anatomizing its parts of fructification/ I was careful to compare my observations, with as much patience and accuracy as I can command, with the structure of its two parents. It seemed to me not unlikely that something interesting might result from a rigorous examination of this kind, or at least that its recorded details might serve as a point of departure for future observations.

The plant in question was undoubtedly a seedling from a specimen of *D. lutea*. I have this species and *D. purpurea* alone of the genus cultivated in my garden, where several plants of each had been allowed to scatter their seed, and the seedlings to grow wherever they chanced to come up. I had already remarked a singularity in the general appearance of one of these, and was watching the expansion of its flowers, when I was agreeably surprized to find it to be a decided hybrid, obviously having most of its characters exactly intermediate between those of *purpurea* and *lutea*. I had no doubt whatever of its being a seedling of *lutea*, from the position which it occupied in the garden/ in coming up amidst several plants of this species in a spot where an old plant had grown the year before/ Neither had any plant of *purpurea* been growing in the same border. Besides which, my plant exactly agrees in most particulars with a hybrid procured by Koebreuter in 1768 from seeds of *lutea* fertilized by the pollen of *purpurea**. His account is accompanied by a rude and inaccurate figure, by no means tallying with his own description. In general habit, this hybrid approaches much nearer *lutea* than *purpurea*, Plate xv. fig. 1. It is however decidedly taller and more robust than any specimens of the former species which my garden ever produced. Koebreuter indeed asserts that the specimens raised by him were taller than either of their parents, but he assigns a lower limit to the height of *purpurea* than that to which many plants of this species have attained with me. Notwithstanding its more robust character and somewhat darker hue, the eye would scarcely have recognized, upon a mere casual observation and

* Acta Acad. Petropol. Anno 1777.

before its flowering, any peculiarity sufficiently striking to class it apart from some of the varieties of *lutea*, but a little closer inspection immediately detected certain decided points of difference. The whole plant is not so smooth as *lutea*, having a decided tendency to become downy, and being completely so on the under surface of the leaves, Plate xv. fig. 2. The glabrous surface of *lutea* is one great characteristic of the species; though, if the *D. rigida* of Lindley* is to be considered as a variety of it, which he seems to think probable, even this character fails. A few hairs are always indeed distributed here and there in the ordinary state of this plant, and seem to indicate the possibility of a transition from the one condition to the other, dependant probably on certain circumstances of soil or situation. From the ordinary condition of the leaves of *lutea*, however, those of the hybrid differ in a marked manner. They are even nearly as woolly on the under surface as the leaves of *purpurea*.

On the external characters of the Hybrid. I shall first describe the external characters of its several organs, comparing them with those of the parent plants. In Plate xvi, the corresponding parts of fructification in the parents and their hybrid are arranged in three columns, those of the latter occupying the middle column. A single glance of the eye will thus be sufficient to shew how exactly intermediate most of its organs are both in size and form, and in some cases also in color, to those of the two parents. There are however some remarkable deviations from this condition, which will be presently noticed.

* Lindley *Digitalium Monographia*, fol. Lond. 1821.

Comparative view of the external characters of the three plants represented in PLATES XV. and XVI.

Purpurea.	Hybrida (<i>purpureo-lutea</i> *).	Lutea.
<p>Biennial.</p> <p>3—5 feet.</p> <p>1½—3 feet.</p> <p>less secund, and laxer.</p> <p>woolly.</p> <p>very soft.</p> <p>crenato-dentate.</p> <p>petiolate, oblong.</p>	<p>PLATE XV.</p> <p>Root. Perennial, according to Koehpreuter, and apparently so in the present instance, the plant having thrown out several offsets.</p> <p>Stem. About 3½ feet.</p> <p>Raceme. About 1½ feet.</p> <p>secund, dense, nodding above.</p> <p>Leaves. Nearly smooth above, quite woolly below. Somewhat soft.</p> <p>Dentate.</p> <p>radical, sub-petiolate, broadly-lanceolate (lanceolate, Fig. 2.</p> <p>caulinar, sessile, narrower.</p>	<p>Bi-triennial.</p> <p>2—3 feet.</p> <p>¾—1¼ feet.</p> <p>denser.</p> <p>glabrous.</p> <p>firmer.</p> <p>dentate.</p> <p>somewhat narrower.</p>
<p>broader and shorter.</p> <p>longer than the Calyx and frequently than the bractes.</p> <p>large, cernuus.</p>	<p>Bractes; Lanceolate.</p> <p>Pedicels. About the length of the Calyx, and and somewhat shorter than the bractes.</p> <p>Flowers, medium size, nearly horizontal.</p>	<p>narrower & longer.</p> <p>shorter than the Calyx and much shorter than the bractes.</p> <p>small, more drooping.</p>
<p>I.</p> <p>more spreading.</p> <p>broader.</p>	<p>PLATE XVI.</p> <p>1. Calyx, moderately spreading in flower, afterwards connivent.</p> <p>a. sepals, ovato-lanceolate, the odd one much narrower.</p>	<p>III.</p> <p>less spreading, at length more closed.</p> <p>narrower.</p>

* If a general rule for naming Hybrids should be thought advisable, perhaps it will be found convenient always to prefix the name of the plant which supplies the pollen to that which furnishes the ovule.

of a Hybrid Digitalis.

Purpurea.

Hybrida (purpureo-lutea.)

Lutea.

more hairy.
purple.
spots deep purple,
and rings paler.
less hairy.
obscurely 4 lobed,
the upper emar-
ginate.

half the length
converge

deeper orange
yellow with nume-
rous spots often
confluent.

much more oblique.

few hairs.

much more acute.

more ovate and
more pubescent.

much more nume-
rous.

b. hairy on the margins.

2. Corolla, Red, blending with a yellow ground.

A few dark purplish red spots surrounded
with a paler ring in the throat and tube.

Smooth with hairs in the mouth.

Distinctly 4 lobed, the lobes blunt, the
uppermost notched.

3. a. Stamens length of the tube, nearly
parallel.

b, c: Anthers yellow inclining to orange, with
a few small scattered purple spots.

Oblique to the filament, converging above.

d, e: Pollen White, elliptic when dry and
spherical when moist. Some of the grains
obscurely three-cornered, many are abortive,
but those perfect are of exactly the same
size and shape as in *p.* and *l.* being some-
what less than $\frac{1}{2500}$ of an inch.

4. a. Pistil, covered below with small glandu-
lar hairs.

style cylindrical, with a few hairs on the
lower part.

b. stigma clove, very obtuse.

c. ovarium oblong, pubescent.

ovules numerous, and exactly the same
shape and absolute size as those of *p.*
and *l.* being about $\frac{1}{2500}$ of an inch.

less hairy
yellow.

no spots.

more hairy.

4 lobes deeper,
acute, the upper
more deeply
notched.

somewhat more
extended and di-
vergent accord-
ing to Koebreu-
ter, but I could
see no very ap-
preciable differ-
ence.

lighter yellow, no
spots.

hair reaches higher
up.

more acute.

more acute and
less pubescent.

much less nume-
rous.

1150/ in diameter. / purple / lutea

4/ 8/ purple / lutea / d/

Commentary on some parts of the preceding comparison.

Raceme. Although one of the characters of *lutea* lies in the very decidedly secured position of the flowers, some plants have them disposed in a squarrose manner round the axis.

Calyx. About one half the number of the flowers of the hybrid had five sepals and the other half six, (Plate xvi. II. 1. C.) and the sections given (from *d.* to *l.*) represent the different modes of their arrangement. Figs. *d.* and *h.* however appear to be their normal condition in æstivatio, the other modifications having resulted from inequalities introduced during the expansion of the flower. The occasional development of a sixth sepal is probably no uncommon occurrence in this genus, and I have met with it several times in specimens of *lutea* and *ferruginea*.

Corolla. In the colored copies of Professor Lindley's monograph, there are two varieties of *lutea* (Plate xxiv and xxv) in which the corolla is tinged with red. One of these (Plate xxiv.) he considers to be a hybrid plant. In shape and size it approaches very nearly to the subject of the present paper, but the other (Plate xxv) more closely resembles *lutea*. In his figure of *lutea* also, (Plate xxiii) there is a little tinge of red in the mouth of the tube, on each side the base of the lip. I have never myself found the slightest tinge of red in any specimen of *lutea*, though the yellow is deeper and more inclining to orange in the parts above mentioned. If however it should be quite certain that genuine specimens of *lutea* do occur with a tinge of red in any part of this corolla, this circumstance must considerably modify our speculations as to how far the present hybrid may have derived this color from the male parent.

Flowers of *lutea* are not unfrequent with the lower lip notched (fig. γ), which indicates the presence of a supernumerary petal blended into the tube of the corolla. In about half a dozen instances I even found this petal quite free, (fig. β) and I believe, occupying the same position as the sixth sepal in the anomalous cases just referred to. In *D. ferruginea*, however, I have sometimes found a sixth sepal and a notched lip in the same flower. These anomalies may therefore be considered analogous phenomena in the supernumerary developments of the two organs. 12/

^A *Pollen*. In comparing the action of the three pollens when immersed in water, I observed all the phenomena usually attendant on this experiment to take place in *purpurea* and *lutea*. Their grains quickly swelled and their granules were exploded in the form of a dense cloud (fig. Γ and ζ). Two kinds of granules were also observed, the smallest and most numerous of which were too minute for me to be able to ascertain their precise shape and dimensions by the highest power of my instruments, the others, much fewer in number, were considerably larger and lay dispersed among the smaller like pellucid spots; and these might even be distinguished through the coats of the grains before their expulsion had taken place. Some pollen of *purpurea* taken from a withering stigma exhibited very distinctly the presence of the asserted membranous tubes (*boyaux*) described by A. Brogniart, Amici, and others, in the *Ann. des Sciences*, (fig. ξ). Some of the granules also were marked by an appearance resembling ^{by} three notches or wedges on the surface (fig. η). Grains of pollen taken from the hybrid readily swelled upon immersion in water, though most of them appeared to be void of granules. Some few however certainly contained the

E/ X

on a darker ground

2/2/

blotches of light color

ca/

G the surface/

H/

larger kind of granules, and I could see them exploded ~~during~~ successive and sudden contractions and dilations of the grains themselves. But I could never detect the cloud of smaller granules emitted by the pollen of the parents, and which always proceeds from the grain by a continuous and slow emission, at one point of the surface, whereas the larger granules in the hybrid were discharged by separate efforts from the grain, and lay scattered at a distance from each other over the field of view. (17. 5)

Koepreuter has given his decided opinion, derived from his numerous experiments, that true hybrids never reproduce their kind. Later experimentors have doubted this fact, and some seem to consider the question as quite settled to the contrary, at least with respect to the possibility of fertilizing a hybrid by the pollen of one or other of the parent species. In prosecuting this enquiry we must be very cautious to keep in view the perfect distinctness of the two questions, whether it be *probable* and whether it be *possible* that hybrids should reproduce their kind. If it be *possible* that a true hybrid may do so, it may still be very *improbable* from some deficiency in that connection of circumstances, whatever it be, which is essential to secure the fertilization of the ovule. We might imagine for instance, so great a discrepancy to exist between the respective circumstances suited to the healthy action of its vegetative and reproductive functions, that although one climate may be adopted for securing the former condition, another might be required for the fulfilment of the latter, and thus the plant might continue to grow and flourish in one latitude, and yet be incapacitated for ripening its pollen or perfecting its ovules unless it were removed to another. There are certain plants, considered to be hybrids, which undoubtedly reproduce their kind freely enough, but some of

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75 Private }

of a Hybrid Digitalis.

these at least, if not all of them, are mere varieties of the same species. Thus Koe~~b~~reuter ascertained that all the plants raised between *D. purpurea* and *D. thapsi*, by fertilizing the ovules of either by the pollen of the other [^]were constantly prolific, but then he also ascertained that *D. thapsi* itself when cultivated by him, after five generations assumed all the characters of *purpurea*. He consequently rightly inferred that ~~this~~ *D. thapsi* was to be considered no other [^]than [^]a Spanish variety of the more common [^]of the species. If, again, it were possible for a true hybrid to be fertilized by the pollen of either of its parents, though it could produce no fertile pollen for itself, it would then [^]be in much the same condition as the female plant of any dioecious species, and its fertility might be secured by the instrumentality of insects, &c. In the present plant I repeatedly observed that the blossom always fell before the anthers on the shorter stamens had burst [^]and in order that this should not operate in diminishing the chance of impregnation, I touched some of the stigmas with pollen extracted from these anthers, but without any success. Possibly however the pollen was not sufficiently ripened, though ~~this did not seem to be the case~~. I also touched other stigmas with the pollen of *purpurea*, and others again with that of *lutea*. But all these experiments failed in fertilizing any of the ovules. Koe~~b~~reuter was equally unsuccessful in all his attempts to fertilize this hybrid. I must here record what has appeared to me a remarkable circumstance [^]brought before my notice during the prosecutions [^]of these enquiries. There were three or four plants of *lutea* in my garden which were quite deficient of pollen, and which nevertheless produced perfect seeds. I was unable to detect even a single grain of pollen either healthy or abortive in their anthers [^], though these [^]organs

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appeared to be well formed and perfected. The ovaria of these plants indeed contained plenty of ovules, most of which I afterwards observed had been fertilized, as their seeds ripened. These plants must therefore have been fertilized by the pollen of other specimens in their neighbourhood, according to all our present notions on this subject. But then the ovules of the hybrid were also similarly circumstanced with them, and if they had been capable of receiving the same influence from other plants, there is no apparent reason why they should not have proved fertile also.

^ Ovules. In the parent plants, the ovules begin to grow and develop themselves immediately after the fall of the corolla, whilst in the hybrid they soon wither away. It is remarkable however, that all signs of decay in the ovarium is strictly limited to the ovules themselves, for even the little protuberances upon which they are seated on the placenta continue succulent, as do the various parts of the pericarp, including even the base of the style, all which live and grow and attain their perfect dimensions, the sides alone slightly collapsing from the deficiency of the ovules, in the enlarged cells. Plate XVII. Fig. 4. But the stigmatic tissue dries up, and a cavity is thus left through the upper part of the dissepiment, forming an opening between the two cells, Fig. 5. c. The same effect sooner or later takes place also in the seed vessels of the parents.

Recapitulation. In reflecting upon the points of resemblance and of disagreement in the economy of these three plants, the most striking circumstance which we have hitherto noticed in their external characters, is the perfect identity in size and shape both of their pollen and of their ovules. As the respective organs which contain these bodies, viz. the anthers and the ovaria, are

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~~proportionately~~ proportionate to the different sizes of the three flowers themselves, it is evident that a flower, lutea must have much less pollen and many fewer ovules than one of purpurea, which in fact the most casual observation is sufficient to shew. The ovules of the hybrid also are about intermediate in number to those produced by the parents. It will be a subject worthy of future investigation, to determine whether ~~it be a~~ condition necessary for securing the hybridity of two species, ~~that~~ ^{one/ require/ 8/} their pollen and ovules ~~should~~ be of the same, or of nearly the same dimensions. *to/* There seems to be scarcely an other deviation in the external characters of the hybrid from that of a precisely intermediate condition, so to call it, in its various organs between those of its parents, excepting in the shape of the stigma, in which this organ differs very remarkably in the hybrid from the stigmas of either of the others. *insert below +* The chief physiological difference observable in the external economy of the organs of fructification seems to reside in the fall of the corolla, which in the parents does not take place till after the anthers have discharged their pollen and become perfectly withered, whereas in the hybrid the corolla falls before the anthers on the shorter stamens have burst, and when even those on the longer hair, although opened, have hardly parted with their pollen, and have not as yet become the least withered. *p/ in/* The style and stigma of all three appeared to comport themselves alike, that is to say, they all began to wither soon after the fall of the corolla.

Examination of the internal structure of the Organs of Fructification.

Before I begin the detail of this examination, I may at once state, that so far as I have hitherto been enabled to pursue it

B 2

+ Except in the above instances, & in the very peculiar shape of the stigma, all the other external characters of the hybrid appear to be precisely intermediate between those of its parents.

I have not perceived the slightest difference between the internal structures of the three plants, and as their organization is somewhat different from any of the cases selected by Mons. A Brogniart to illustrate his paper on the formation and developement of the Embryo, the present attempt may not be without some general interest to the physiologist, independent of the objects connected with the particular enquiry for which it has been undertaken. The method which I pursued was always to examine first the various parts, in *purpurea*, and then to compare them with the like parts in *hybrida*, and *lutea*. Though it is possible therefore that I may accidentally have overlooked some defect and dissimilarity in the internal structure of the hybrid during this common and simultaneous examination of all the three, and may have represented in the drawings some appearance or other strictly belonging only to the anatomy of *purpurea*, yet I do not think such an error could very probably have occurred. As the main object in view was the direct comparison of the three plants, any striking difference at least would have been noticed, and the subject have been submitted to a rigorous re-examination.

Vessels of the Pistil. Plate xvii. Fig. 1. represents a longitudinal section of the ovarium perpendicular to the dissepiment, and consequently passing through both the cells; and Fig. 2. is another longitudinal, at right angles to the last section, and through the plane of the dissepiment, or rather, it represents the surface obtained by tearing the ovarium asunder down the thickness of the dissepiment, which is composed of two skins with parenchymatous matter between them. The threads of vascular tissue arranged in a circle round the axis of the pedicel (*a*), after giving off veins to the calyx and corolla (*b*), and again to the pericarp (*c*).

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sected specimens of

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diverge on either side into the placenta (*d*), a little above its lowest point, and then ramify or subdivide through its substance into separate fibres (*d*) which proceed directly to the bases of the ovules. Fig. 3. represents a transverse section of the upper part of the ovarium with the lower part of the style; that position of the valve which is nearest the spectator being removed, as also are all its ovules. The smaller veins (*c*), of which more than twenty are seen rising through the pericarp, all terminate in the base of the style, but the two larger ones (*c*) which run along the line of junction of the dissepiment with the pericarp rise through the whole length of the style. The stigmatic tissue (*e*), (Fig. 1. 2. 3.) descends down the middle of the style till it comes into contact with the summit of the placenta. When the appearances here represented are examined with the highest magnifiers, their more intimate structure is exposed, as in Plate XVIII. where Fig. 1. and 2. are two transverse sections of the pistil, the former corresponding to one quarter of the circumference of the ovarium represented in the lower part of Fig. 3. Plate XVII. the latter agreeing with the section through the style in the upper part of the same figure. Plate XVIII. Fig. 3. and 4. are longitudinal sections of the same organ, the former through the stigma, the latter through the summit of the ovarium where the stigmatic tissue (*e*) descends to the placenta, as in Fig. 1. Plate XVII. In these highly magnified sections all the corresponding parts are designated by the same letters as ~~those~~ in the former figures. The veins (*c*) (*d*) are in all cases composed of tracheæ, ~~which are united into bundles~~ and which in the larger veins (*c*) are very numerous. I have counted sometimes between thirty and fifty combined in the constitution of a single vein (*c*), a fact which would not be ~~perceived~~ upon a casual observation, but which

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becomes evident by digesting the style in nitric acid, when these elementary parts are easily separated. Their terminations are in the form of ~~elongated~~ cones, and they all end together a short distance below the stigma. The other elementary parts of these veins are certain extremely delicate tubes which invest the bundle of tracheæ, and give it the appearance of being surrounded by a mucous or glutinous substance, but which under the highest powers of the microscope may be separated into these tubular vessels, whether subdivided or not by transverse diaphragms, I was unable to satisfy myself. This very delicate tissue has the same general appearance as the stigmatic tissue, which in these plants descends down the centre of the style, to the summit of the placenta. Where this latter tissue joins the stigma it is evidently composed of distinct cells, separable from each other ~~at their extremities~~ by nitric acid, Plate XVIII. Fig. 3. (m). Lower down however the cells are more elongated (n), and lower still, where this tissue meets the placenta, I could neither detect any transverse diaphragms in it, nor even detach its cells (if they were such) from each other at their extremities, by the action of nitric acid, though they were easily separated longitudinally into long filamentous strings. In this part of its course therefore the stigmatic tissue appears rather to be tubular than cellular in its structure. After this tissue has become divided into two bands penetrating on either side through the dissepiment into the two cells, it seemed to me, upon a most careful examination, to coat over the whole *surface* of the placenta. It is very difficult however to be quite certain of this fact, and I may be wrong, but after numerous dissections made upon the three plants, I found I could generally raise, with the point of a very fine needle, a thin gelatinous film of a delicate fibrous structure from between

the ovules (ϵ')^A which film seemed to be similarly constituted, and also continuous with the stigmatic tissue.

Cellular tissue of the Pistil. These cells are for the most part compressed into tolerably regular rhomboidal dodecahedrons, excepting in the placenta, where, as the ovarium increases the ~~cells~~ assume that irregular character so well described and represented by Mons. A. Brogniart in the parenchyma of the leaf, (Ann. des Sc. Vol. \wedge) and they have the same sort of interstices filled with air between them as occur in that organ. When the style is digested in nitric acid, the separate vesicles of its cellular tissue become cylindric-oval, Fig. 5. β : and I have represented an appearance (γ) which was noticed several times upon some of these vesicles, ~~which~~ had a faintly marked band running down one side.—Further examination may perhaps throw some additional light upon this circumstance, but at present I know not to what cause it may be ascribed.

Epidermis of the Floral Organs. Plate XVII. Fig. 6, 7.

The flattened cells are of the same size in the three plants, their diameter being somewhat more than the thousandth of an inch. They vary in shape from hexagonal to quadrangular prisms bordered by straight, or wavy sides. This membrane is irregularly supplied with stomata (f). When digested in nitric acid, the cells assume an appearance, represented in Fig. 7., ~~as though each were composed of a double membrane, or as though the granular matter they contained~~ were coagulated into a nucleus or else enclosed in a separate ^A vesicle. Whether this appearance originate in any optical deception, I could not sufficiently satisfy myself, though I think it does not, and if so, the fact must have

Fig. 4 / ✓

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been hitherto overlooked from the difficulty of detecting the true plane of junction between contiguous cells, owing to the great transparency of their membrane.—Thus, in Fig. 6, where this epidermis is less magnified, the cells appear to be separated from each other by anastomizing veins or canals, whilst in Fig. 7. it is shewn that their true planes of junction run along the middle part of these canals. I am however quite positive upon another point which has been a subject of dispute among physiologists. I mean the existence of a delicate homogeneous membrane investing this epidermis. Such a membrane may be distinctly separated by the action of nitric acid, from the epidermis of the corolla, filament, and style. It is faintly marked by parallel longitudinal striæ (g), and appears to coat over the whole surface of these organs, but whether it is perforated by a fissure opposite to each stoma I did not ascertain.

Structure of the Filament. Plate xvii. Fig. 8. 9.

The cellular tissue of this organ consists of elongated rhomboidal dodecahedrons, as the elongated hexagons seen in its longitudinal section sufficiently explain (Fig. 9.). A single bundle of tracheæ runs up the middle of it, invested by the peculiarly delicate fibrous tissue already noticed.

Structure of the Anthers. Plate xvii. Fig. 10—12.

The fibrous cells* composing the inner coat of the Anther appeared to me as distinct and perfect in the hybrid as in the parent. Nor did I observe the slightest difference in the formation and condition of the whole organ in either of the three plants. In general, a transverse section shewed the fibrous cells to be arranged in a triple tier (Fig. 10.). These curious vessels seemed to be arranged, as it were, upon the sides and edges of void dodecahedral spaces, as though certain original cells of that shape had disappeared and left this frame-work of their structure alone standing. The triple tier is not distinguishable upon looking directly down upon the inner surface of the anther (Fig. 11.), but

* See Purkinje "De cellulis antherarum fibrosis, &c. 4to. Vratislaviae 1830."

some of the cells may be seen standing upon the edges of the cells of the epidermis, where ~~the~~ this membrane has been partially cleaned of the inner coating composed of them. Fig. 12. (h) is the appearance which they assume when ~~disembodied~~ by digestion in nitric acid (k) being the cells of the epidermis, (l) ~~a~~ grain of pollen recalling somewhat of the character of the grain figured at X. Plate xvi. Fig. 3.

Structure of the Ovules. Plate xvii. Fig. 13. When the corolla is expanded, the ovules are entirely composed of a congeries of large vesicles, and their surface has a very remarkable and granulated appearance. At this period of their existence I was unable to detect any thing very precise respecting the distinction and distribution of their ~~separate~~ parts. The foramen (m) however was evidently seated near the hilum, and a darker spot indicated the chalaze (n) to be at the opposite extremity (see also Plate xviii. Figs. 1. and 4.) ~~In~~ In the ovules of *purpurea* and *lutea*, there is no difficulty in tracing the separate parts of ordinary structure, if they be examined shortly after their impregnation; but before their fertility is secured I have not hitherto been able to detect in these plants, more than in the hybrid, any thing but a homogeneous mass of cellular tissue. ~~It~~ Possibly I have not given this part of the investigation sufficient attention. ~~When~~ When the ovules are digested in nitric acid, the detached cells assume an oval shape, Fig. 15. X, and are yellowish. ~~But~~ But among them I several times observed a larger cell (p) which was more transparent and whiter, and which I fancied might be the embryonic sack. These component parts are best exhibited by crushing the ovule between two flat pieces of glass. Fig. 14. represents a monstrosity in which an ovule was observed to stand upon a sort of pedicel.

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Recapitulation. So far then as these researches have hitherto proceeded in comparing the internal structure of the floral organs of the hybrid with those of its parents, no appreciable difference has been detected. The elementary vesicles of which their cellular tissue is constructed seem to be all of the same size, and consequently it is evident that fewer of these vesicles must be employed in the conformation of any of the parts of hybrida, and still fewer in those of lutea, than in completing the corresponding parts of purpurea. But there appears to be nothing actually defective in any part of these organs in the hybrid, nothing wanting of what is to be found in those of the two parents. The nutritive apparatus more especially, so far as w e have examined it, seems to be quite perfect, and as the functions performed by it in all three plants are precisely the same up to the period when the flower falls, there seems to be no reason for suspecting the hybrid to differ in any particular from its parents in the perfection of A its conservative organs. Since however the functions of the reproductive apparatus appear to cease in the hybrid before they do in the parents, it should seem that there must be some Y deficiency in this part of its organization, though it has not yet been noticed. Should the Society consider the details of this examination worthy their attention, I propose to myself the further satisfaction of prosecuting the enquiry next summer, if another opportunity should be permitted me.

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sider the details of this examination worthy their attention, I propose to myself the further satisfaction of prosecuting ~~the en-~~ ^{it} ~~quiry~~ ^{apert} next summer, if another opportunity should be permitted me. Indeed I ought to add, that in the present state

of this enquiry, so little additional light has been thrown upon the great questions connected with the phenomena of hybridity, that I should hardly have felt myself justified in presenting these ~~present~~ remarks to their notice, ~~where~~ ^{that} were it not in the hope ^{that} they ~~might~~ ^{might} ~~save~~ ^{save} some time & trouble to whomsoever may be inclined to take up the subject, & propose the means of carrying ^{on} the investigation ^{if it} still further.

DESCRIPTION OF THE PLATES.

PLATE XV.

THE raceme (Fig. 1.) and radical leaf (Fig. 2.) of the Hybrid.

PLATE XVI.

The various parts of the floral organs in the three plants contrasted together. The details are at pages 4 and 5.

As the same parts in the three columns are marked by corresponding letters in three alphabets, viz. in Roman capital, small Italic, and Greek characters, it will be unnecessary to refer to more than the figures in one compartment for the purpose of explaining those in the others.

1. *Calyx*. A. sepals separated and spread open: B. their marginal hairs magnified: c. with supernumerary sepal: d. to l., arrangement of the sepals during inflorescence, ~~taken at their base~~. N.B. These sections do not refer to the

of the sepals in activation, which by some neglect I have omitted to

2. *Corolla*.

β. with supernumerary petal: γ ditto blended with the tube and forming a notched lower lip.

3. *Male Organs*. A. is of the natural size; the rest are more or less magnified.

A. Position of the stamens in the tube of the corolla: B. a front, and C. a back view of the anthers: D. dry, and E. moistened grains of pollen, lying on squares representing the $\frac{1}{1000}$ of an inch: F. a grain exploding upon the application of moisture: G. grains taken from off the surface of a withering stigma, with their tubes (*boyaux*) exerted: H. a grain with three lighter blotches on the surface.

4. *Female Organs*. A. is of the natural size; the rest are more or less magnified.

A. pistil: B. stigma: C. transverse section of the ovarium: D. an ovule at the period of the flowers expansion, placed on a micrometer divided to the $\frac{1}{300}$ of an inch.

PLATE XVII.

Anatomy of the parts of fructification. All the figures excepting Fig. 4, are more or less magnified. The same letter is always employed to designate the same parts in the different figures.

Fig. 1, 2. *Ovarium*, longitudinally divided; in the first case perpendicular to, and in the second down the plane of the dissepiment.

a. The pedicel with its circle of vascular bundles surrounding the axis: *b*, branches of this circle given off to the calyx and corolla: *c*, two larger bundles which run up the pericarp, where the dissepiment meets it, and rise through the whole length of the style: *d*, separation of the vascular bundles into two bands which enter the two lobes of the placenta near their base, and rising through their substance *d'*, again separate and subdivide, giving off single vessels to the bases of the ovules: *e*, the stigmatic tissue descending through the style to the summit of the placenta.

Fig. 3. A transverse section through the summit of the ovarium, and again through the base of the style. The letters designate the same parts as in the last Figure, with the additions of *c'*, small vascular bundles rising through the pericarp, all of them terminating in the base of the style.

along the future line of its dehiscence,

The valves and ovules of one cell are removed.

Fig. 4. Ripened pericarp of the Hybrid, of the natural size.

Fig. 5. The same magnified, with one valve removed—exhibiting the dissepiment, and one lobe of the placenta, which is still fleshy, covered by abortive ovules: *e* a cavity left by the drying up of the stigmatic tissue.

and/

Fig. 6. *Epidermis* of the corolla, with a glandular hair and two stomata (*f*).

Fig. 7. The same digested in nitric acid and more highly magnified *g*, being the investing pellicle faintly but very regularly striated.

3/

Fig. 8, 9. *Filament*, transverse and longitudinal sections.

3/

Fig. 10. *Anther*, a section perpendicular to coats exhibiting the triple tier of its fibrous cells.

3/ its/3/

Fig. 11. A fragment of the coats of the anther viewed on the inside perpendicularly to its surface, which is partly divested of the fibrous cells.

-/

Fig. 12. Details of the anther after it has been digested in nitric acid; *h*, fibrous cells; *k*, vesicles of the epidermis; *l*, a grain of pollen peculiarly marked.

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Digitalis hybrida
(*purpureo-lutea*)

Fig. 1.

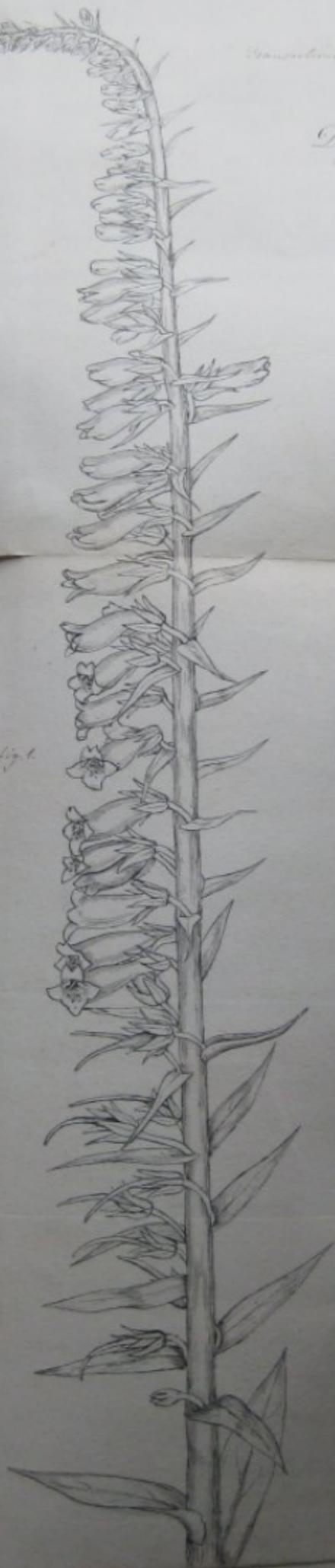
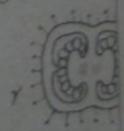
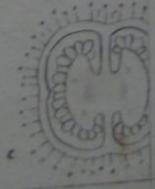
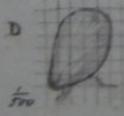
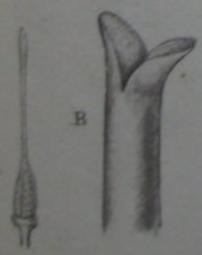
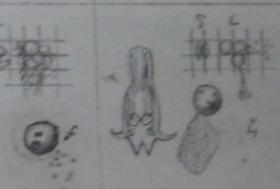
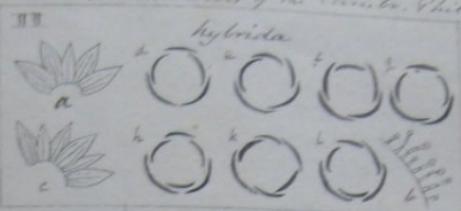
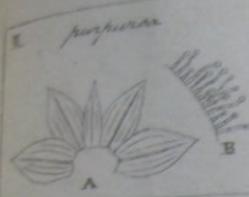
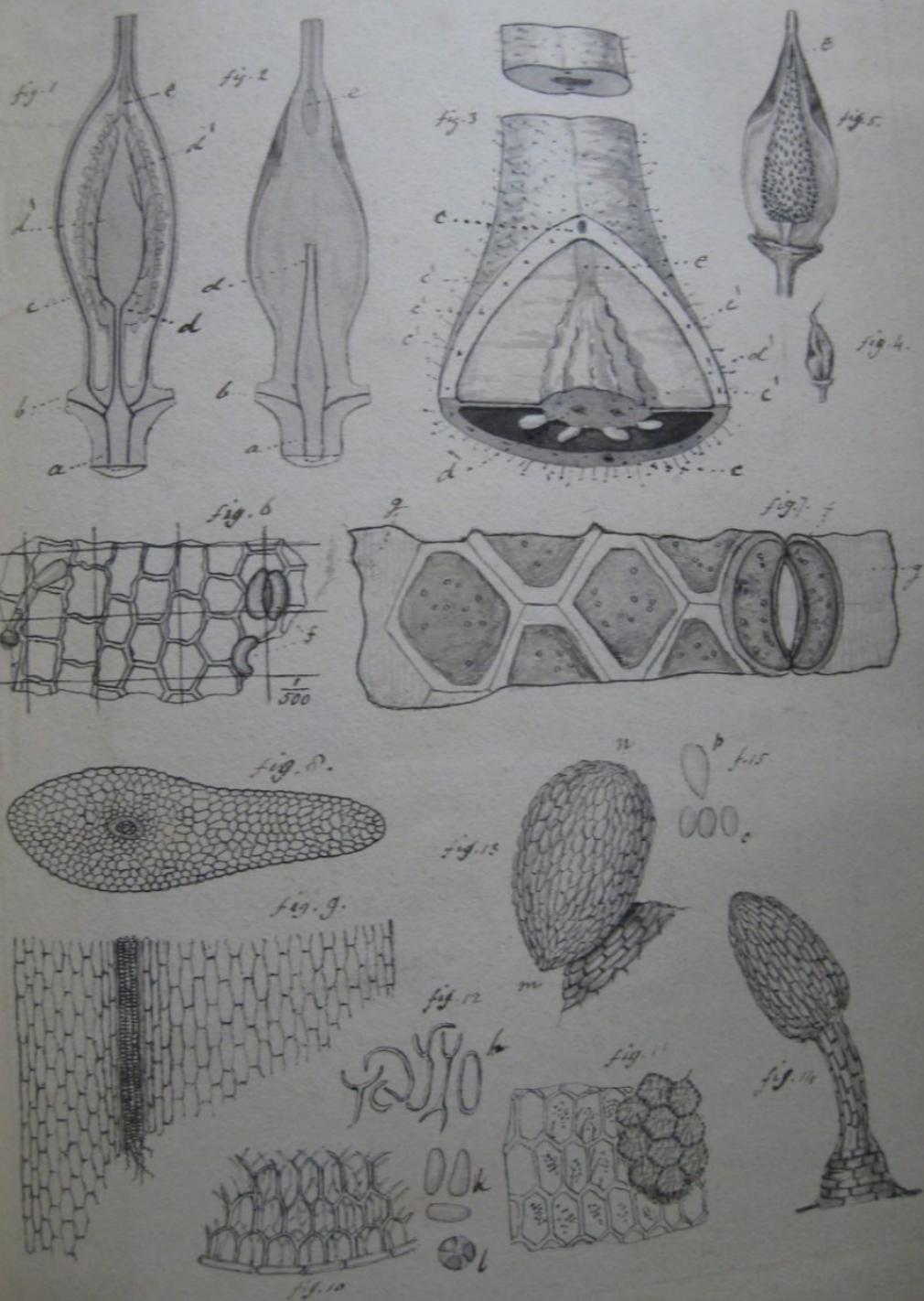


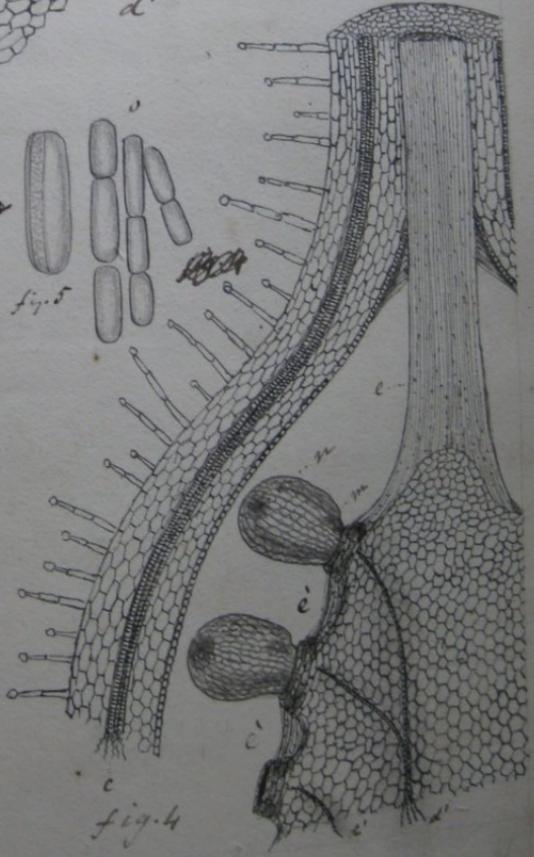
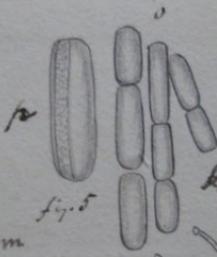
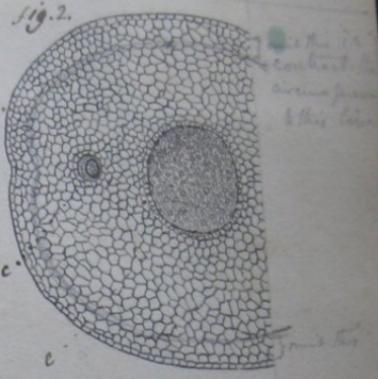
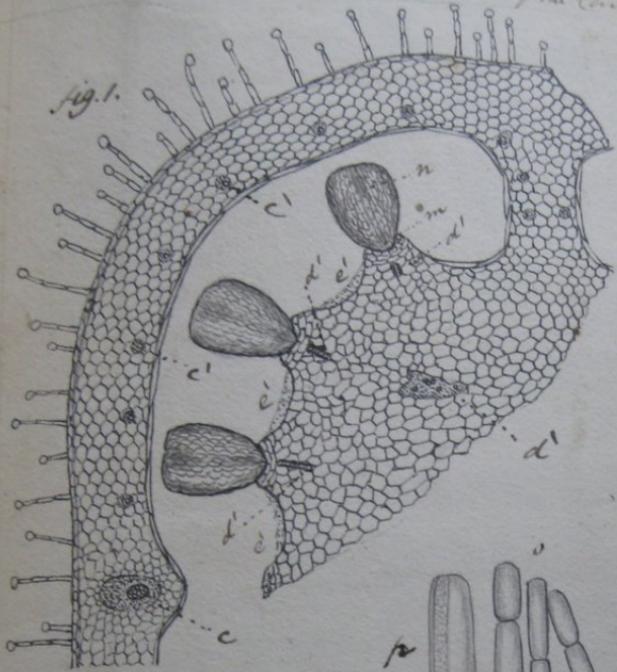
Fig. 2.



L. J. Andrews del.







Hyphale hybridus
(*Guarano-hybridus*)

Hyphale hybridus
(*Guarano-hybridus*)

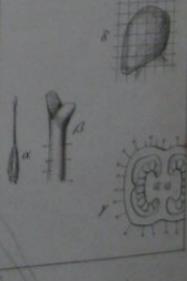
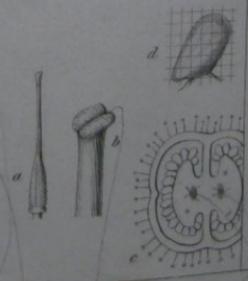
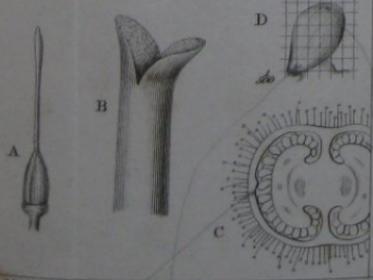
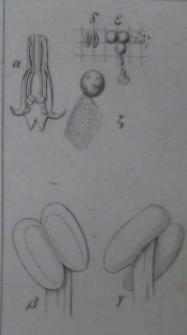
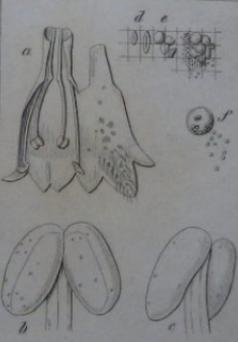
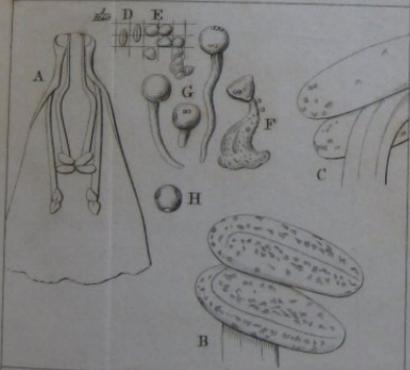
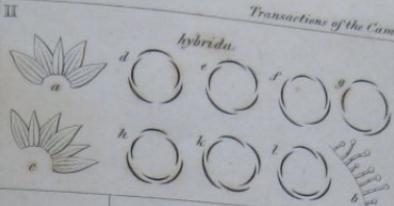
This plate should be
above the apex of the

Fig. 1

Fig. 2

This is returned
merely to show
how it must be
folded

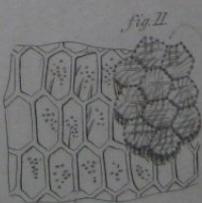
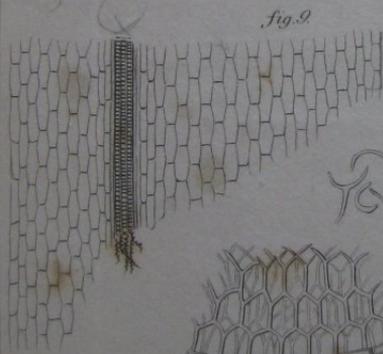
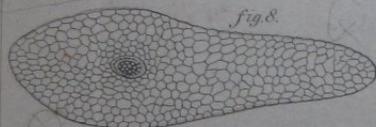
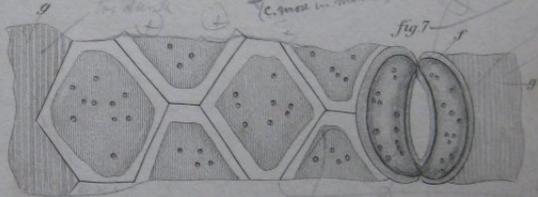
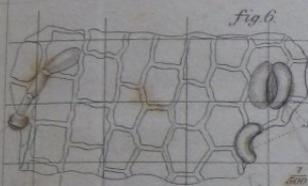
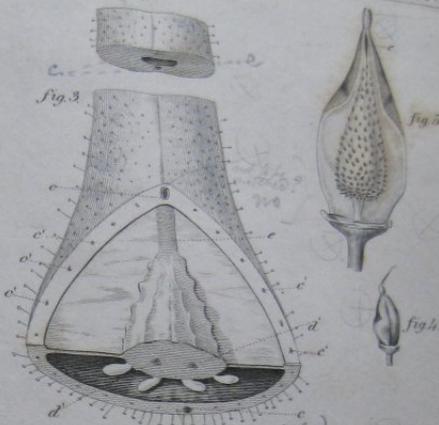
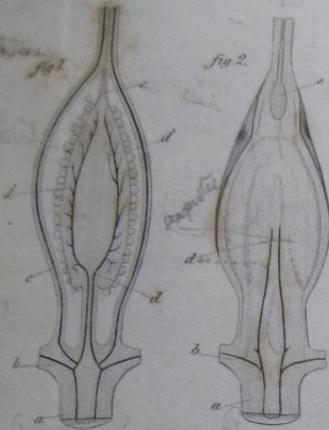




Sketches taken from original

Sketches taken from original

Sketches taken from original



These parts were to be counted from the middle of the stalk... because I could not find the middle of the stalk... rather common

