Since the above was put in type I have made a seventh stop for oblique illumination, and which produces such excellent results with the condenser that I likewise had an engraving made of it. This stop works well with the $\frac{1}{8}$th.

The Histology *of the* Reproductive Organs *of the* Irid, Tigridia conchiflora; *with a* description *of the* Phenomena *of its* Impregnation. By P. Martin Duncan, M.B. Lond., Sec. Geol. Soc., &c.

Contents.

I.—Some years ago, when the great German structural botanists were investigating, and not with their usual calmness, the phenomena of the development of the embryo in flowering plants, I was led to follow in their path of research. Instead of examining the complicated phenomena of the impregnation of Dicotyledonous ovules, I laboured amongst Monocotyledons; and the following history of ovular development, of the growth and function of the pollen-tube, and of the impregnation of the embryo-sac, may be taken as a fair example of part of the philosophy of reproduction in that class.

The abstract of the original paper, which was read at the British Association, and published in the 'Transactions,' gave a fair analysis of the new matter. Since then the notion that the embryo was formed out of the end of the pollen-tube has been proved to be fallacious by its once very resolute supporters. It is a matter of satisfaction that the ideas of English botanists have passed safely through the ordeal, and that time has proved the correctness of the following observations.

The *Tigridia conchiflora* was chosen for the following reasons:

1st. The flower is very large, and therefore easily studied.

2nd. The organs of generation are very distinct, and there s no fear of impregnation taking place before the expansion of the perianth.*

3rd. The life of the flower is very short, and the passage of the pollen-tube down the long style very rapid.

4th. The ovary is large, the impregnation of one of each pair of associated ovules very certain, and the facilities for making transverse sections are very great.

5th. There are several flowers in each spathe; they bloom in succession, and the development of the ovule and the maturation of the seed may be studied in the same plant.

II.—The flowers blow in July and August, opening at about 8 o'clock a.m., and the perianth closes and decays long before sunset.

The stamens encircle the style for three inches and then become separate, and the style, suddenly losing its protecting tissue, issues forth to end in a triple termination. The anthers are large, and their opening is external. The ovary is large, inferior, and its apex is surmounted and surrounded by the origin of the combined stamens. The style, even at its entrance to the ovary, is thread-like, but is supported by the encircling filaments of the stamens. The tripartite stigma is covered with papillæ, and has an oleaginous secretion. The remote end of the style is continuous with the tissues composing the axis of the ovary which supports the ovules, and whose tissues are to be traversed by the pollen-tubes.

The ovary is divided into three cells; each cell has its rows of ovules, and placentæ, and is separated from its fellows by strong tissue.

A transverse section of the ovary shows two ovules, side by side, in each of the cells (Pl. I, fig. 1); the ovules are attached to the central axis by the continuity of their vessels and general structure, and the micropyle (fig. 1, *e*) is external and touches the placenta (fig. 1, *e*).

The placentary axis of the ovary is a very complicated affair; it has to give off vessels to three pairs of ovules, over and over again; moreover, it has to produce, under each micropyle, a papillary structure† (fig. 1, *c*), which is usually perforated by

* Some imagine that impregnation occurs only in the perfect flower, but this is a mistake, and that it is so may be well proved in the Leguminosæ.

† This papillary structure cannot be the homologue of even part of the placenta; it is perforated by the pollen-tubes, and has nothing to do with the nutrition of the ovule. The whole of the nomenclature of the sexual parts of flowers has been complicated by the attempt to recognise the

the pollen-tubes in their passage from the axis to the micropyle; neither the axis, the placentæ, nor the papillary structure, are hollow for the passage of the pollen-tubes; on the contrary, the tissues are remarkably cellular and well supplied with moisture.

The ovules, when ready for impregnation, are large, very cellular and transparent; and a very simple manipulation splits off the external coat from the long and narrow nucleus.

Each ovule is attached to the axis by its hilum, is a long oval in shape, and the orifice through which the pollen-tube has to pass is external to the hilum. Transverse sections show this orifice very well. The orifice of the micropyle is not at the extremity of the ovule, but is close to the hilum; the ovule is therefore "anatrope" in appearance, but not so in reality, for there is no reflection of the ovule during its development, but one half of it is, from the first, devoted to the vascular system, and the other to the formation of the coats and embryo-sac. There is no space between the ovule and the walls of the ovary until long after impregnation. The micropyle is very distinct, being situated in the long mammillary end of the nucleus, which projects considerably below the external coat (figs. 1, *b*, *e*; fig. 4, *c*).

For all the purposes of the study of its impregnation, the ovule may be first examined in the rudimentary flower, whose anthers are as yet uncovered by the perianth; secondly, when the anthers are covered; and thirdly, immediately before impregnation, or when the flower is in bloom.

1. A transverse section (through the axis) exhibits the ovules adherent by their cellular and vascular tissue to the axis (at the placenta), shows the projection of the nucleus cropping out of the external cellular coat, and presents to the eye the situation of the upper and globular part of the nucleus, covered now by the external coat, distinguishing it by a track of transparent tissue. By gently removing one of the ovules, and placing a piece of thin glass over it, and pressing the glass gradually with the handle of the knife, the nucleus may, in the majority of instances, be slipped out of its external cellular coat.* Then the nucleus is proved to be cylindrical, rounded at one end, and tubular, with the micropyle at the other (fig. 2). It is very tender, and consists of two parts—a body and a neck. The neck is

homologies of the sexual apparatus in animals. The anatomist may well be perplexed at a placenta inside an ovary, and part of it perforated by the male element.

* This external coat is cellular, the cells being square in their outline; it leaves more than two thirds of the neck of the nucleus uncovered.

the part which projects, and which is tubular and nearest the hilum of the ovule; it is open at its free extremity—the micropyle—and is traversed by a canal, leading from this open extremity to the body of the nucleus—the canal of the micropyle. Its structure is cellular, the cells being long ovals, their long axes being parallel to the canal. The orifice is formed by a circular series of these cells (fig. 4, *c*; fig. 2, c^x). The body of the nucleus is joined to the neck, and at the point of junction the canal ceases. The rounded end of the body is imbedded in the cell structure of the ovule, and at this early stage is barely cellular; but nearer the neck, square cells (fig. 2, d^x), with a cell-nucleus in each, are seen. The contents of the body of the nucleus at this period are fluid; there are neither granules nor cells in it, and the canal of the micropyle is in existence, but barely patent.

2. At this period the external coat has covered all but the free third of the neck of the nucleus; the canal of the micropyle is recognised by a dark line in the axis of the neck, and the micropyle is more open and better rounded (fig. 2, *a*, *b*, *c*.) The same plan of manipulation as in 1, sets free the nucleus, whose body is now seen to be perfectly cellular outside, and filled with more than a simple plasma or fluid. Proceed now as follows:—Having obtained several nuclei free from their external cell-coats, take a fine-pointed knife and operate, under the $1\frac{1}{2}$-inch object-glass. Glycerine and water, plain water, and olive oil, are good media, and should be tried separately. Pierce the nucleus at its round extremity, and place it under a piece of thin glass; use the handle of the knife as before, and with a little jerking pressure a delicate globular-looking film will escape through the rent in the nucleus. This is the early embryo-sac; it is of tolerable distinctness, being composed of a very fine layer of cells, forming a membrane and enclosing a quantity of fluid. The embryo-sac nearly fills the body of the nucleus, and its contents are *not* granular, *neither is there any trace of cell growth in them.* The membrane of the sac is so delicate that the edges of its cells are barely distinguishable, but their position may be inferred from the presence of cell-nuclei (fig. 2, *e*). It requires an object-glass of $\frac{1}{8}$-inch focus to determine the structure of the embryo-sac, but one of $\frac{1}{4}$-inch focus is sufficient for the examination of the nucleus; but in all cases, the lowest power must precede the employment of the higher.

The anterior extremity of the embryo-sac, when it is within the nucleus, is in contact with the canal of the micropyle; and the effect of the cylindrical shape of the nucleus at this spot is to make this extremity of the sac rather angular in outline.

A dark line shows the margin of the embryo-sac when the nucleus is examined by transmitted light, and the globular shape and refractile contents of the sac throw the sides of the nucleus in shade, and its centre in high light (fig. 2).

The cells of the nucleus are more perfect.

3. The ovule, when ready for impregnation, is larger than in the imperfect flower, the neck of the nucleus is more covered by the external coat, and the micropyle is close to and touches the "papillary structure. The same method of manipulation suffices to show that the canal of the micropyle is open, that the *cell-coat of the embryo-sac is perfect*, and that its anterior extremity blocks up the end of the canal. The embryo-sac is now of considerable size; its contents are *not* granular, however, but consist of simply colourless fluid. The appearance of the membrane of the sac is now *distinctly cellular*, the cells being delicate, and, generally speaking, they overlap each other at the edges (fig. 3, *c*).

The cells of the external coat of the nucleus are larger, more perfect, and firmer. The ovule is now ready for the pollen-tube.

I have never found any cells in the embryo-sac, and it is evident that the cells of the membrane of the sac, when seen through, cause many illusive appearances in the fluid below them.

III.—The pollen-tube issues from the pollen-grain, insinuates itself between the papillæ of the stigma, passes into the central tissue, and descends the style. The base of the style is traversed, and the tube enters the axis of the ovary; the ovules are then only separated from the pollen-tube by the tissue of the axis and the "papillary structure" opposite and touching the micropyle. The tube has to deviate from its course and pass at right angles to gain the base or attachment of the "papillary structure" to the axis, and this deviation is determined by the direction of the vascular bundles, which pass from the axis at right angles to reach the hilum of the ovules. The pollen-tube cannot traverse the dense tissue of the vessels, but is turned outwards and runs along them to the base of the placenta, and the "papillary structure," whose cellular structure is easily pierced, the cells making way for and *nourishing* the tube in its marvellous course. Arrived at the margin of the "papillary structure," the micropyle, being open and pressing against the papillæ, is speedily gained; the tube now passes along the canal of the micropyle and abuts against the anterior and convex end of the embryo-sac. I propose to describe the pollen-tube in various parts of its course, to state the results of experiments performed by Dr. Maclean* and myself, upon the independence of the tube of the pollen-grain after it has once passed into the style, and to explain the change which occurs in the tube at its contact with the embryo-sac.

The pollen-grain of Tigridia is large, oval, and contains in its external coat much oil; it is barely visible to the naked eye, yet it is the originator of a tube which passes along at least four inches of stigma, style and axis, in less than twenty-four hours; this tube perforates the stigma, insinuates itself between the cells of this organ, and reaches the so-called conducting tissue of the style. This tissue ought, for reasons presently to be given, to be called nourishing tissue.

The fact is that the life of the pollen-tube is very short, and the period which elapses between the application of the pollen-grain and the entrance of the tube into the ovule must be found out before the phenomena of impregnation in the plant in question can be determined with any accuracy.

The received idea is as follows:—That upon the stimulus of the secretion of the stigma upon the pollen-grain a tubular prolongation of its internal membrane is ejected and thrust between the papillæ and superficial cells of the stigma; that this tube reaches the central tissue, and finally gains the ovule—and all along the course the tube acts as the pipe through which the granular fovilla, spermatic fluid, and its granules, pass from the pollen-grain to the ovule; whether the theory that in the ovular end of the pollen-tube the future embryo is developed holds good or not, the theory of the descent of the contents of the pollen-grain has always been inferred.

I wish to be understood that I am now about to speak of Tigridia alone, and that I believe that the following processes occur in all Monocotyledonous plants, with long styles.† The experimenter must remember, before he follows the path of these investigations, that water influences the pollen-tube in the following manner—it swells out the tube between the denser and solid parts in the axis of the tube and the tube-wall; it moreover puts an end, generally speaking, to the movement of the granules, but oil or glycerine will give a good idea of the normal size of the tube.

The mechanical ideas of the primary formation of the pollen-tube must be abandoned; it is essentially a vital process, and

* Allan Maclean, M.D., of Colchester, one of the greatest raisers of hybrids and a most careful observer.

† The phenomena can be readily traced in the Crocus.

is not dependent upon endosmosis and exosmosis; it is a growth of the cell-wall of that layer of the pollen-grain which contains the granules and fluid usually termed protoplasma. The growth is peculiar to the perfect pollen-grain, and occurs at a certain period when the viscid secretion of the papillæ of the stigma is strong enough to hold the pollen-grain in perfect apposition, and to resist the effects of the pressure exercised by the end of the pollen-tube upon the tissue of the stigma before entering. Were this viscidity insufficient, the gentle force of perforation could not take place; and when the viscidity is sufficient the growing tube, with its conical tip, is held forcibly against the cell-structures of the stigma: the force to cause these to diverge and to admit the tube between them is "growth." The amount of force employed may be roughly estimated by adding water to the viscid secretion, some hours after perforation has taken place; the pollen-grain is released from its durance vile and jumps away from the stigma; its restraining fluid having been rendered inefficient.

Once entered between the cells of the stigma, the pollen-tube, consisting of a cell-wall enclosing the spermatic materials, closed by a conical end, and continuous with the pollen-grain, begins to elongate with extraordinary rapidity (fig. 5, *a*, *b*). The following are the results of experiments by Dr. Maclean and myself:

1. *Four hours* after the application of pollen to the stigma the pollen-tubes were detected one inch down the style; day fine, and good sun.
2. *Eighteen hours* after application, the pollen tubes were detected at the base of the style, three and a half inches from the end of the stigma.
3. *Twenty-four hours* after application, the pollen-tubes were seen in the micropyles of several ovules.
4. *Thirty hours*, impregnation is complete, and the pollen-tubes are wasting in the micropyle.

Series II.—*Experiments by Dr. Maclean and myself.*

1st. Tigridia fertilised with pollen-grains by twelve o'clock in the day (not much sun).

The perianth closed as usual about five o'clock, and at nine o'clock two inches of the style were removed with the stigma, and the rest of the flower placed in water.

In these two inches of style, hundreds of pollen-tubes existed, and the diameter of the style was considerably increased by their presence. *They were cellular, and the cells of the* *pollen-tubes were long and very distinct* (fig. 5, *a*, *b*), some being filled with granules, others containing but few, and those near the end of the cells.

At twenty-four hours after the application of the pollen-grains, the rest of the style and the ovary were examined. Pollen-tubes were found in both, and many of the ovules contained pollen-tubes in their micropyle-canals (fig. 6 *e*, *f*, *g*, *h*; fig. 7, *a*, *b*).

2nd. Tigridia fertilised with the last. At the same hour in the evening all the style but one inch was removed. Ovary examined at the same time as the other, viz., twenty-four hours after the application of the pollen-grain, and multitudes of pollen-tubes were in the cells of the ovary and in the ovules.

3rd. These experiments repeated, with same results.

4th. Two inches of the style and stigma were removed four hours after fertilisation, and in the removed portion, the pollen-tubes were seen in abundance.

5th. Dr. Maclean endeavoured in vain to prevent the plants seeding, by removing the style from the axis before the perianth had fallen.

From these experiments it is proved that the impregnation is perfected in a little more than twenty-four hours; that the pollen-grain produces a tube-cell, which grows according to the manner of cells, which passes through stigma, style, and to the remotest ovule in the ovary—a space oftentimes of five inches—in twenty-four hours; that, taking the average length of the tissue to be perforated to be four inches, the pollen-tube grows at the rate of one inch in six hours; that before the pollen-tubes are half way down the style, if their connection with the pollen-grain be destroyed, they still grow and impregnate; that after the pollen-tube has fairly entered the style it is independent, both as regards its subsequent growth and impregnating properties, of the pollen-grain; and that the varying conditions of the atmosphere influence the rapidity of the growth of the pollen-tube, and consequently impregnation.

Tearing the style with needles suffices to show the long pollen-tubes, and it is as well always to examine a non-impregnated style with the impregnated. No one can mistake the one for the other; the abundance of very long cellular tubes, where all divisions are at right angles to the cell-walls, and which are to be traced several times across the field of the microscope, indicates the fertilised style.

It is evident that a *force* of *some* kind is requisite to propel the conical end of the pollen-tube at the rate of an inch in six hours, at the rate of an inch in four hours, and sometimes at even double that rate, through cellular tissue whose formation is very much adapted for the transition. It is demonstrable, from repeated experiments, that this force is exercised most efficiently when the direct sunlight and heat are accompanied by a warm and humid atmosphere, and most inefficiently when there is no sun. In fact, the greatest stimuli to vegetable growth are those which strengthen all the powers of the pollen-tube.

From the above experiments it is to be proved that the *force* just spoken of is exercised when the pollen-grain, and even one half of the pollen-tube, are removed.

It is manifestly no *force* arising from the pollen-grain as a fixed point. The whole secret is contained in the pollen-tube itself; and in *Tigridia*, if by careful manipulation in making longitudinal sections of the style and tearing with the needle a few tolerably lengthy pollen-tubes are exposed, it will be noticed that the pollen-tube *is not one continuous elongation of the cell-wall of the pollen-grain, but that it is* CELLULAR (fig. 5, *a*, *b*). Transverse inflections of the tubular cell-wall exist every now and then, and the pollen-tube is really a tube formed by elongated cells. These cells resemble, in a most singular manner, those of the Conjugateæ, when their spiral contents are removed; the cell-wall is beautifully definable by the highest powers, and it is evident that the cylindrical shape of the tube is often lost when, passing between the long cells of the style, no great space can be obtained. I have found the cells of the pollen-tube in all parts of the style, and also within the canal of the micropyle. The force of the progression of the pollen-tube is then cell growth; the cells, in their passage through the style and axis, are nourished *by the juices of the cells of the style-tissue contiguous to them*; and each cell, by its elongation upwards and downwards, tends to produce a force which thrusts the free end of the pollen-tube along. It may be observed that the pollen-tube is in intimate contact with cells throughout the whole of its course, and that these cells are as delicate in structure as it is. The stimuli to cell growth affect the nutrition of the cells of the style, and these contribute, under most favorable circumstances, to the most rapid nutrition and consequent elongation of the cells of the pollen-tube. The contrary is equally true. The cutting off the pollen-grain, and the bisection of the pollen-tube, before its free end has even reached half an inch below the line of incision, prove the independence of the remaining part of the tube to depend upon its cellular character. Each cell is independent of the one above it, that is to say, of the one nearer the pollen-grain. The influence of the female organ in thus nourishing the male "spermatic tube" is very interesting, and is seen in the animal kingdom in the effects of the vaginal and uterine mucus upon the spermatozoa.

The length of the cells of the pollen-tube varies; and it appears to me that whenever any difficulty in the passage has to be overcome by a little exertion of fresh force the cells are nearer together, and that when the passage is free the cell is found very long.

The contents of the pollen-tube, the fertilising agents, are granules; these often contain—more especially in the terminal cell (Schact noticed this years ago in *Pedicularis silvestris*)—small highly refractile globules, larger masses of filmy looking stuff, and the fluid of the tube. This fluid is certainly denser than water, for the application of this swells the space between the fluid of the cell and the cell-wall. This liquor seminis is secreted by the cell-wall of the pollen-tube, after the formation of the first cell in the tube; and its individuality and specific male properties are not influenced by any length or any amount of subdivision into cells.

In many spots the cell-contents are very scanty, and the tube is ribbon-shaped, but the free end of the tube, and especially where it passes from the papillose placenta into the canal of the micropyle, is cylindrical, very turgid, and filled with granular masses and cell-fluid (fig. 5, *c*). I have already noticed that at the time of impregnation the open micropyle is in contact with the papillary structure close to the placenta, and it will be as well to observe that there is an indubitable vital attraction between the end of the pollen-tube and the micropyle of the ovule, quite as great as there is in many plants between the anthers and the stigma.

Once within the canal of the micropyle, the pollen-tube is nourished by *the contiguous cells of the nucleus*; and here a cell is usually added to the pollen-tube, and oftentimes two. The free end, completely filling the canal of the micropyle (fig. 7, *a*, *b*), passes onwards, and as the nutrition of the cells of the nucleus is active, so is its progress rapid; it impinges, at last, against the anterior convex cellular wall of the embryo-sac. The progressive force still continues, and the terminal cell of the pollen-tube presses the embryo-sac, at the point of contact, backwards, until, at last, the end of the pollen-tube-cell is hidden by the wall of the embryo-sac.*

* This was well shown by Schleiden, but he mistook the bulbous end for the embryo.

According to the previous turgidity of the terminal cell of the pollen-tube, so is the amount of pushing inwards which the embryo-sac-wall suffers, and the more rounded does the end of the pollen-tube become (fig. 6, *a*, *y*).

It must be distinctly understood that *no* perforation of the embryo-sac occurs; that the pollen-tube presses the sac inwards, and produces, as the finger does upon a bladder, a concave depression; and that the pollen-tube swells out from a *vis a tergo*, and fills the whole of this artificial depression. If the pollen-tube be pulled out of the canal of the micropyle its very shortness will tend to disprove the idea that it perforates the embryo-sac.

Twenty-four hours after impregnation, and forty-eight hours after the application of the pollen-grain to the stigma, the terminal cell of the pollen-tube—*i. e.* that in contact with the embryo-sac—is found to be nearly empty. The anterior surface of the embryo-sac, which was in contact with the end of the pollen-tube, is perfectly identical, in its overlapping cell structure, with the rest of the sac; but within the sac, in its former cell-less, granule-less contents, a change has occurred. After this time the pollen-tube decays.

IV.—The appearances of the embryo-sac and the non-granular plasma within it, in the flower whilst in bloom, but before impregnation, have been noticed; the overlapping, circular, or ovoid cells of the sac, each with a distinct nucleus, are most delicate, and the simplest pressure will cause them to take on various forms or to rend. After the contact of the cell-wall of the pollen-tube, the cells of the embryo-sac being pressed in upon the fluid contents of the sac, and yet not ruptured, suffer great flattening, and this must also be the case with the end of the pollen-tube. The transmission of the contents of the last or ultimate pollen-tube-cell—its fluid plasma and granules—from the interior of the tube-cell to the interior of the embryo-sac, is effected very shortly after the contact of the end of the tube-cell with the small cells of the embryo-sac; and in a few hours the contents of the embryo-sac have become granular, whilst the pollen-tube's last is empty cell (fig. 9, *e*). If the pollen-tube be forced out of the canal of the micropyle forty-eight hours after the pollen has been added to the stigma, and the nucleus, with its large embryo-sac, submitted to the compressorium, under the lowest power of the microscope, and then the anterior part of the embryo-sac examined with the highest powers, it will be seen to be intact, to have retained a somewhat concave form, but the small cells are overlapping, and present no symptom of violence (fig. 9, *a*, *b*).

On the third day after the impregnation of the ovule, the granular contents of the impregnated embryo-sac have collected together in a more or less elongated form, the anterior extremity being in contact with the inner surface of that spot of the embryo-sac where the contact with the pollen-tube occurred. The anterior end receives a sort of concave edge from the still existing depression in the anterior part of the embryo-sac. Ten days elapse, and the ovules, greatly increased in size, have a tough external coat, and the embryo-sac is very remote from the micropyle; the presence of *cells* is now evident *within* the sac, whose simple overlapping cells are becoming thick and hard.

V.—There is no difficulty in the manipulation necessary for these investigations; the ordinary flat knives and needles will suffice as instruments, and water, glycerine, and the usual reagents, are necessary. The impregnation of the ovule differs as regards the time it occupies in most species; moreover, temperature and moisture determine its rapidity. The stigmas of some plants are impregnated before the flower is perfectly open; others remain virgin for a long period. It will then happen that, unless the nature of the efflorescence, the duration of the flower, and the time of the increase of the diameter of the style be noticed, the microscopist may look in vain for any trace of pollen-tubes. The rapidity with which some ovules in plants with very short styles are impregnated can be well imagined after what has been brought forward in reference to the rate of pollen growth in *Tigridia*.

Immediately after the impregnation, changes commence in the pollen-tube, as well as in the whole of the female organs. The tubes become flaccid, all granular movement ceases, and they lose their tenseness. The style is swollen by the descent, through cell-growth, of the numerous pollen-tubes; the nutrition of its central cell system is at its height, and this vital activity is kept up until the tubes pass into the axis of the ovary. Then the stigma and upper part of the style droop, and the perianth begins to lose its brightness, to become flabby, and to fold. The ovules are not yet impregnated. After a few hours the pollen-tubes passing down the axis, nourished by its juices, are turned off laterally by the barriers formed by tough vascular tissue which passes off to each ovule; the tubes pass through the papillary structure near the placenta, and reach the micropyle. The nutritive processes of the upper part of the axis are vastly increased in activity, the tissue swells, and the nutrition of the perianth, the style, and the filaments of the stamens, is interfered with by a pressure from within outwards, which diminishes the calibre of their cells and vessels. The ruin of the flower is clearly produced, in part, by the increase in calibre of the lower part of the style and the upper part of the axis. The balance between the rapidity of the pollen-tube growth and the development of the micropyle of the embryo-sac is, of course, exact when the impregnation is being perfected, and it is the chance of this balance being incomplete which renders fertilisation by strange pollen generally so difficult. The influence of the female organ in nourishing the male element is very suggestive.