

## FLOWER    ADVANCED    VERSION

(NARRATION).		(REELS)
1. For most of us, flowers are a source of pleasure, with their variety of shapes and vast range of colours.	FLOWER VARIETY Pan along flower bed outside the Wintergarden  .	Reel 20:14:48 Marigolds, spider plants, cocks combs, loosestrife
2. They are used to brighten our homes and gardens.  And their bright blooms also bring colour to our city streets.	<u>Around the home:</u> Dale Harvey Home.  <u>In the city:</u> median planter Birkenhead shops: red petunias	Reel 20:06:05 or 06:28  Reel 20:10:07 to 25
3. But flowers are also the reproductive organs of the plant.  It is for this reason that scientists work with flowers to breed new, better and more valuable varieties of plants.	FLOWER FUNCTION Honey bee in blue Salvia  Keith Hammett With head band magnifiers on removing stamens. Adding purple pollen	Reel 20:07:13 to 21  Reel 20:02:24  20:00:55 to 01:10 20:02:43 to 02:54
4. A flower is therefore not just decorative, but plays an important part in plant reproduction.	FLOWER PARTS Rengarenga under dissecting scope.	07:08:43
5.		

NARRATION	THE STAMEN	
	IMAGES	REEL
***** 6a. The role the flower plays in reproduction is easier to see in the larger, simpler flowers of many monocotyledons	LOCATION. <i>Lilium</i> in government house garden. Renga in bush, growing on cliff face..	08:43:37-45  19:28:51
6b. The small number and large size of their flower parts allows us to easily illustrate their structure .  *****	FLOWER DETAIL. <i>Lilium</i> flower  Renga flower	08:50:53  07:02:42
7. Each flower has three <b>sepals</b> which overlap three <b>petals</b> .	<b>ANIMATION BEGINS: FLOWER</b> Flower to show sepals	
8. Inside the petals there are six <b>stamens</b> that produce pollen.	STAMENS Filaments have a pair of extensions with coloured hairs.	
9. Each stamen is attached to the flower by a <b>filament</b> .	FILAMENT Remove coloured extensions to just show the filament.	
10.. The enlarged sac at the tip of the filament is called the <b>anther</b> .	ANTHER: LOW POWER Move down filament to the anther.	
11.		
12. Inside the anther there are four <b>microsporangia</b> . .	ANTHER: INTERNAL X-ray view showing the four microsporangia with sporocyte cells visible.	
13. Each microsporangium is nourished by a layer of surrounding cells called the <b>tapetum</b> .	TAPETUM Fly inside the anther. Add tapetum covering around each microsporangium	
14.. A microsporangium consists of diploid <b>sporocyte</b> cells.	SPOROCYTE CELLS: Remove tapetum. Sporocyte cells visible again.	
15. The cellulose walls of these cells is soon replaced by a layer of <b>callose</b> .	SPOROCYTE: CALLOSE <u>Single cell</u> . Remove cream-yellow cell wall; interior of cell now visible. Cover this with callose so cell interior is not visible.	

<p>16. Each sporocyte now divides twice by meiosis.</p> <p>This creates four haploid microspore cells, each with one set of chromosomes.</p>	<p><b>SPOROCTE: MEIOSIS</b>  <u>1<sup>st</sup> Division</u>                  Look through callose: Wall-less cell with two nuclei.                  Add wall: walls form around nuclei.</p>
<p>17. This group of adhering microspores is known as a tetrad.</p>	<p><b>TETRAD: ADHERING MICROSPORES</b>  <u>2<sup>nd</sup> division</u>                  Tetrad showing walls.                  Return to exterior coating of callose.</p>
<p>18. Soon the callose is removed and <b>sporopollenin</b> begins to form on the surface of each cell.</p> <p>The surrounding tapetum now releases additional sporopollenin.</p> <p>One area of each wall, the <b>sulcus</b>, remains smooth, receiving very little sporopollenin.</p> <p>However, the rest of the wall is covered in a thick, ornate coating of this tough, resistant material.</p>	<p><b>MICROSOPORES: SPOROPOLLENIN</b>  <u>Tetrad</u>                  Callose shrinks and disappears.                  Faint yellow texture to walls..  <u>Sporangium cross section</u>                  Particles travelling from the tapetum to the surface of the microspores.  <u>Single pollen grain rotating</u>                  Sulcus coming into view                   Grain rotates to show exine pattern.</p>
<p>19. Each microspore nucleus now divides by mitosis. The lower <b>Generative Cell</b> separates from the wall and moves into the cytoplasm of the larger <b>Tube Cell</b>.</p> <p>This is the immature male and is known as a <b>pollen grain</b>.</p>	<p><b>MICROSPORE DIVISION</b>  <u>Stop rotation , dissolve wall</u>                  Nucleus divides                  Wall forms around generative cell as it moves inside the tube cell.</p>
<p>20.</p>	
<p>21. Before it is released, the pollen grain accumulates nutrient reserves.</p>	<p><b>POLLEN: ADDITION OF NUTRIENTS</b>  <u>Return wall and rotation</u>                  Food particles entering sulcus.</p>
<p>22. Finally, most of the water is lost and the pollen grain enters into a resting state.</p>	<p><b>POLLEN: LOSS OF WATER</b>                  1-very small, blue water molecules leaving from the sulcus                  2-wall pulling into the sulcus which becomes concave.</p>
<p>22a. Before the anther releases the pollen, the cells beneath the epidermis develop thickened walls. This is called the <b>endothecium</b>.</p>	<p><b>OPTIONAL: ENDOTHECIUM</b>                  Fly out of anther.                  Show external surface of anther.                  Remove external surface                  Show endothecium beneath.</p>
<p>23. When the pollen and the anther mature and dry out, the endothecium shrinks. This tears open the anther between each pair of microsporangia, allowing the pollen to escape.</p>	<p><b>ANTHER DEHISCENCE</b>  <u>External of anther</u>                  Opening along the stomium.  <u>Internal of anther</u>                  (Note: authentic models of pollen grains yet to be added here.)</p>
<p>24.</p>	<p><b>FLOWER</b>                  Fly out to flower</p>



<b>THE OVARY</b>	
25. At the centre of the flower there are three <b>carpels</b> .	<p><b>FLOWER MODEL</b>            Fade away all parts, leaving the compound gynoecium.</p> <p>Pull apart to show <u>one</u> carpel with stigma, style and ovary.</p>
26. At the base of each carpel there is an enlarged <b>ovary</b> .	<p><b>OVARY</b>            Enlarged basal portion is highlighted.</p>
27. A slender <b>style</b> extends from the ovary and.....	<p><b>STYLE</b>            Pull back to view the style</p>
28. ....at the tip of the style there is a <b>stigma</b> . The three carpels are fused together, forming one stigma and a style with a central canal. The base of the canal leads into each of the three ovaries.	<p><b>STIGMAS</b>            Zoom in on the stigma lobes            Now put carpels back together.</p> <p>Move down canal towards the ovary.            Remove ovary wall to show three compartments.</p>
29. In the young carpel, small outgrowths appear on the ovary wall. Each of these is a <b>megasporangium</b> .	<p><b>YOUNG OVARY: MEGASPORANGIUM</b>  <u>Interior</u>: Bumps appear on carpel locule wall.  <b>NOTE</b>: bumps appear and then enlarge??</p>
30.	
31. Two layers of cells, the <b>integuments</b> , grow over the megasporangium,.  A small pore, the <b>micropyle</b> , is the only area that remains uncovered by the integuments. This entire structure is called an <b>ovule</b> .	<p><b>INTEGUMENTS FORMING</b>            Two layers gradually growing up from the base of the ovule.</p> <p>Micropyle becomes smaller and smaller until only a fine pore.</p>
32. Inside the sporangium there is a single diploid <b>sporocyte</b> cell.	<p><b>SPOROCYTE</b>            Fade into interior to show one large sporocyte cell.</p>
33. The diploid sporocyte divides by <b>meiosis</b> to form four haploid nuclei, each with one set of chromosomes.  33a. In some plants such as Lillium walls are not formed around these nuclei.....	<p><b>MEIOSIS</b>            Sporocyte divides to produce four nuclei lying within the enlarged sporangium.</p>
34. but in the majority of flowering plants, walls are formed around each nucleus resulting in four <b>megaspore cells</b> .	<p><b>COMMON EMBRYO SAC PATHWAY:</b>  <b>MEGASPORE WALLS</b>            Walls form around megaspore nuclei.</p>

35. Three of these then degenerate.	MEGASPORE DEGENERATION Three megaspores fade away. Remaining one enlarges.
36. The surviving spore enlarges and the nucleus divides three times yielding eight haploid nuclei.	MEGASPORE DIVISION Remaining spore enlarges and nucleus within divides three times producing eight nuclei arranged in two groups of four.
37. Two of these nuclei move towards the centre.  These are known as the <b>polar nuclei</b> .  Seven cells now form.	NUCLEAR MOVEMENT, WALL FORMATION Two nuclei move into the centre. Walls form.
38. At the micropylar end, there is an <b>egg cell</b> and two <b>synergid cells</b> .	EGG CELL One larger egg cell and to each side, a pair of slightly smaller synergid cells.
39. In the middle, there is a <b>central cell</b> containing the two polar nuclei.	CENTRAL CELL Large cell in the middle.
40. Above this, the remaining nuclei form three <b>antipodal</b> cells.	ANTIPODAL CELLS Highlight the three antipodal cells.
41. This is the <b>female gametophyte</b> , also known as the <b>embryo sac</b> .	NORMAL FEMALE GAMETOPHYTE Pull back to show the entire 7 celled, eight-nucleate female.
42. This is contained within the <u>megasporangium.....</u>	PULLBACK: sporangium placed around embryo sac.
43. ... which is covered by the integuments of the ovule.	PULLBACK: integuments placed around sporangium.
44. The ovule, in turn, is surrounded by the carpel	PULLBACK: carpel placed around ovules. Flower parts added around carpels.

	<b>POLLINATION AND FERTILISATION</b>
46. . The transfer of pollen to the receptive surface of the stigma is called <b>pollination</b> . This happens by various means such as wind, insects and other animals.	LILY/RENGARENGA FLOWER Entire flower, then flower with perianth removed to show the ovary.
47.	STIGMAS Move in close to stigmas <b>BEGIN ANIMATION</b> Pollen grains sitting on the stigma. (must avoid having to show an insect!)

<p>48. The pollen grain now absorbs water and begins to swell. A pollen tube soon emerges containing .....the tube nucleus .....and the generative cell.</p>	<p><b>STIGMA</b> <u>External:</u> Stigma surface with finger like cells, moist at their surfaces. Water molecules leaving stigma and moving into pollen grain. Pollen begins to swell and the sulcus changes from concave to convex.</p>
<p>49.</p>	<p><b>POLLEN TUBE</b> <u>Exterior:</u> Tubular growth emerges from the sulcus and grows along the surface of a stigma papilla. <u>Interior:</u> Tube cell in pollen tube with tube nucleus and attached generative cell.</p>
<p>50. The generative cell divides to form two <b>sperm</b> cells.</p>	<p><b>POLLEN TUBE: SPERM CELLS</b> <u>Interior:</u> Generative cell attached to tube nucleus. Gen.cell dividing.</p>
<p>***** 50a. In order to reach the ovaries, the pollen tube must now carry the sperm down the full length of the canal.</p>	<p>Wide shot of the canal cut away</p>
<p>51. It does this by first growing down through the stigma to reach the surface of the canal directly below. *****</p>	<p><b>POLLEN TUBE IN STIGMA</b> <u>Exterior:</u> growth of tube down to the base of the stigma papillae. Suggest a low power view.</p>
<p>52. Here it grows along the moist <b>transmitting tissue</b> which serves as a path to the ovary.</p>	<p><b>POLLEN TUBE IN STYLE</b> <u>Interior:</u> Pollen tube finding the canal and beginning to grow along its moist surface.</p>
<p>53a .Pollen tubes have a very fast rate of growth often several micrometers per minute. This growth is localised at its tip.</p>	
<p>53b. Vesicles containing wall material accumulate at the tip where they are required for wall growth.</p>	<p><b>OPTIONAL: GROWING TIP</b> <u>Exterior:</u> close up of tip portion growing along transmitting tissue.</p>
<p>53c. Behind this, the cytoplasm flows around the cell in regular streams.  This known as <b>cytoplasmic streaming</b>.  The two sperm cells and tube nucleus continually move forward as the cell grows.</p>	<p><b>OPTIONAL: CYTOPLASMIC STREAMING</b> <u>Interior:</u> same as above, but inside the p.tube to show streaming of cytoplasm and particles in it including vesicles.</p>
<p>54. Plugs of wall material called <b>callose</b> form which keep the cytoplasm close to the growing tip.</p>	<p><b>CALLOSE PLUGS</b> <u>Exterior:</u> X-ray view of pollen tube to show a plugs forming as the tube progresses down the style. Cytoplasm shown as being between the most recent plug and the growing pollen tube tip.</p>
<p>54a. When the pollen tube reaches the base of the style, it grows into one of the three ovaries.</p>	

55. Inside the ovary, the tube locates the two rows of ovules.	
	<b>POLLEN TUBE AT OVARY</b> Pull back to show style and ovary with pollen tube growing into ovary, along its placental tissue, and up a funiculus.
56. Approaching an ovule, the pollen tube grows into the micropyle where it penetrates the megasporangium..	<b>POLLEN TUBE INTO MICROPYLE</b> Tube grows over surface of ovule and locates the micropyle.
57. It then grows into one of the synergid cells, releasing the two sperm.	<b>POLLEN TUBE INTO EMBRYO SAC</b> Pollen tube at base of micropyle, growing into the embryo sac.
58.	<b>RELEASE OF MALE CELLS</b> Tube tip rupturing. Tube nucleus fades away. Keep two sperm cells.
59. One sperm fertilises the egg cell forming a diploid <b>zygote cell</b> .	<b>FIRST FERTILISATION</b> One sperm moving across to the egg cell and the two nuclei fusing.
60. The second sperm fuses with the two polar nuclei forming a <b>primary endosperm cell</b> .	<b>SECOND FERTILISATION</b> The remaining sperm moves into the central cell, with its nucleus joining the two nuclei already there. Fade away the other cells.
61. This <b>double fertilisation</b> is characteristic of all angiosperms.	<b>DOUBLE FERTILISATION REVIEW</b> Pull back and show entire embryo sac with both cells receiving nuclei at the same time. Remaining cells of the female gametophyte then degenerate
62a. The ovary contains hundreds of ovules and each requires a pollen tube to be fertilised.	<b>INSIDE OVARY WITH ROWS OF OVULES</b>
***** 62b To accomplish this, The style supports the growth of a large number of pollen tubes.... These grow down the style and enter each of the three ovaries. *****	<b>STYLE WITH POLLEN TUBES CHARGING DOWN</b>
62c. When the pollen tubes enter an ovary, they each locate and fertilise an ovule	<b>INSIDE OVARY: TUBES LOCATING MICROPYLES</b>
62d. Each ovary now has many fertilised ovules .....which will develop into seeds.	<b>POLLEN TUBES MOVING ALONG ROW OF OVULES.</b>

	<b>SEED and FRUIT</b>
<p>62 After the ovules are fertilised, the flower undergoes several changes.</p>	<p>REAL FLOWER: RENGARENGA Flower in full bloom</p>
<p>63. Many parts begin to wither..</p>	<p><b>ANIMATION BEGINS:</b> Flower model: Petals, sepals move in.</p>
<p>64. Eventually these parts are shed.</p>	<p>RENGARENGA:EXTERNAL Perianth and stamens dropping off.</p>
<p>65. Only the ovary remains healthy and firmly attached to the stem.</p>	<p>OVARY: EXTERNAL, THEN CUT-AWAY AND INSIDE External: Ovary green and healthy. Withering of style, stigma Previous ovary cut-away and move into ovary to ovules. Show old pollen tubes etc.</p>
<p>66. Inside the ovary, the ovules are now about to undergo many changes.</p> <p>Each ovule contains two fertilised cells.</p> <p>The nucleus of the primary endosperm cell begins to divide to form <b>endosperm</b> tissue with no cell walls.</p>	<p>OVULE: SECTIONAL VIEW Primary endosperm nucleus dividing to form many nuclei within the embryo sac . Do this like we did the pine female gametophyte.</p> <p>(walls form later in the monocots)</p>
<p>67. The zygote divides, forming a large basal cell and a small apical cell.</p> <p>The basal cell produces a chain of cells called a <b>suspensor....</b></p>	<p>SUSPENSOR AND PROEMBRYO Zygote forming large basal and small, apical cell. Basal cell divides to form chain of cells..</p>

<p>68. ....and the apical cell gives rise to an embryo.</p> <p>68ab. The suspensor now begins to transport nutrients into the young embryo.</p> <p>68aaa. In monocotyledons, a single seed leaf or <b>cotyledon</b> forms.</p> <p>68d. As it enlarges the embryo also receives nutrients directly from the surrounding endosperm.</p> <p>68ba. During this time, walls slowly form within the endosperm tissue.</p>	<p>SMALL EMBRYO: Apical area enlarging.</p> <p>Food particles moving into suspensor and into embryo.</p> <p>Cotyledon forms and grows up</p> <p>NOURISHMENT Food particles leave endosperm and enter cotyledon.</p>
<p>69. A tiny <b>shoot tip</b> forms on one side of the embryo.</p>	<p>SMALL EMBRYO: Appearance of shoot tip. Appearance of the small shoot tip.</p>
<p>70. Below this there is a stem, called the <b>hypocotyl</b>.</p>	<p>SMALL EMBRYO: HYPOCOTYL Cotyledon enlarging a little. A stem-root axis matures.</p>
<p>71. At the base of the hypocotyl there is a root. This is covered by a protective <b>root cap</b>.</p>	<p>SMALL EMBRYO: ROOT, ROOT CAP Show the root tip and then cover this with the root cap.</p>
<p>75. In most monocotyledons, nutrients now begin to accumulate within the endosperm.</p>	<p>NUTRIENTS ACCUMULATE Particles moving into endosperm</p>
<p>77. When nutrient accumulation is complete, much of the water is removed and the embryo enters a state of dormancy.</p>	<p>WATER LEAVING Blue particles leaving embryo and endosperm</p>
<p>76. However, a different sequence of events takes place in the ovules <u>of most dicotyledons</u>.</p> <p>In these ovules the growing <u>seed leaves</u> accumulate nutrients and absorb <u>all</u> of the endosperm.</p>	<p>OVULE: SECTIONAL VIEW All parts of the embryo enlarge.</p> <p>Endosperm disappearing. Cotyledons enlarging. Food particles entering cotyledons.</p>
<p>78. As both types of ovules mature, the integuments develop into a tough, protective <b>seed coat</b>. The ovule is now a <b>seed</b>.</p>	<p>OVULE: EXTERNAL Put lid on and show it turning black.</p>
<p>73. At the same time that the ovule is changing into a seed, the developing embryo is releasing hormones.</p>	<p>YOUNG FRUIT: EXTERNAL</p>
<p>73a. These stimulate the ovary to expand and make room for the enlarging ovules</p>	<p>ENLARGING FRUIT</p>
<p>80. In this way, the ovary wall expands and is transformed into a <b>fruit</b>.</p>	<p>LARGE, BROWN FRUIT</p>
<p>79. In most lilies, the fruit is a tough, dry capsule that tears open to release the seeds. The seeds are soon dispersed and will germinate to form new plants thus completing the life cycle.</p>	<p>OPEN FRUIT: REAL VIDEO FOOTAGE?? OR..... ANIMATE FRUIT OPENING??</p>

<b>GRAND (NARRATION)</b>	<b>FINALE (IMAGE)</b>	<b>(REEL)</b>
<p>1. We have seen that flowers capture pollen and ensure the success of fertilisation and seed formation..</p> <p>In the plant world reproduction by flowers is the most efficient.</p>	<p>HARVEY'S GARDEN Garden, then zoom in to bee in purple <i>Salvia</i> flower</p>	<p><u>Reel 20</u>:07:08 to 07:22</p>
<p>2. It is therefore not surprising that a great variety of flowering plants dominate the landscape.</p>	<p>BOTANIC GARDENS Flowers with bee, then pull back to lake and trees etc.</p>	<p><u>Reel 21</u> 01:35:14 to 25</p>
<p>3. Many of these attain a great size.</p> <p>But others are tiny and almost microscopic.</p>	<p>VARIETY of FORMS Palm tree</p> <p>Duckweed</p>	<p><u>Reel21</u> 01:38:58</p> <p>19:14:33</p>
<p>4.. Some flourish in places where water is scarce;</p>	<p>CACTI dramatic shot of large, erect cacti</p>	<p>20:34:24</p>
<p>5. Others thrive in ponds and lakes.</p>	<p>WATER LILIES</p>	<p>20:26:24 distance 20:27:57 Up close, pan back 20:31:12 Waterfall, pan out to lake</p>
<p>6. And from this vast variety we have, by careful breeding, developed all those plants which provide us with food, including many types of fruits..</p>	<p>CROPS Vineyard shots</p> <p>Bunches of grapes</p> <p>to pair of apples.</p>	<p>20:17:47</p> <p>20:22:52-56</p> <p>20:21:38</p>
<p>7. With the great variety of flowering plants, the world in which we live is indeed a very colourful place!</p>	<p>PLANTS &amp; PEOPLE <u>Albert Park</u>: Flowers, students</p>	<p><u>Reel21</u>,01: 37:21-33</p>