

FLOWER INTERMEDIATE VERSION

		(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 role in plant reproduction.	FLOWER PARTS Rengarenga under dissecting scope.	07:08:43

NARRATION	THE STAMEN	
	IMAGES	REEL
6a. There are many types of lilies, some are cultivated in our gardens, and others are found growing in the wild.	LOCATION. <i>Lilium</i> in government house garden. Renga in bush, growing on cliff face..	08:43:37-45 19:28:51

6b. The parts of the lily flower are large and easy to see and can be used to illustrate the structure and function of the flower.	FLOWER DETAIL. <i>Lilium</i> flower	08:50:53
	Renga flower	07:02:42
7. Each flower has three sepals which overlap three petals.	ANIMATION BEGINS: FLOWER Flower to show sepals	
8. Inside the petals there are six stamens that produce pollen. (Their function is to produce male cells- ??? repeated info?)	STAMENS Filaments have a pair of extensions with coloured hairs.	
9. Each stamen is attached to the flower by a stalk called a filament.	FILAMENT Remove coloured extensions to just show the filament.	
10. The enlarged sac at the tip of the filament is called the anther.	ANTHER: LOW POWER Move down filament to the anther.	

11.		
12. Inside the anther there are four spore cases.	ANTHER: INTERNAL X-ray view showing the four microsporangia.	
13. Each is nourished by a layer of surrounding jacket cells.	TAPETUM Fly inside the anther Add tapetum covering around each microsporangium..	
14. A spore case contains a large number of diploid spore-producing cells.	SPOROCTE CELLS: Remove tapetum. Sporocyte cells visible..	
15. A coating of wall material forms around the outside of each cell.	SPOROCTE: CALLOSE .Remove wall; interior of cell with nucleus clearly visible. Cover with callose.	
16. Each now divides twice by meiosis. This creates four haploid spores, each with one set of chromosomes	SPOROCTE: MEIOSIS <u>1st Division</u> Look through callose: wall-less cell with two nuclei. Wall forming around two cells	

17.	TETRAD: ADHERING MICROSPORES <u>2nd Division</u> Tetrad showing walls. Return to exterior coating of callose..
18. The surrounding wall material is now removed, releasing the four spores. The jacket cells around the spore case now begin to release a tough, resistant wall material This covers the surface of each spore.	MICROSPORES: SPOROPOLLENIN <u>Tetrad</u> Callose shrinks and disappears. Faint yellow texture to walls. <u>0Sporangium cross section</u> Particles travelling from the tapetum to the surface of the microspores. <u>1Single pollen grain rotating</u> Sulcus comes into view.
19. Each spore soon divides by mitosis to form two male cells.	MICROSPORE DIVISION <u>Stop rotation, dissolve wall</u> Nucleus divides. Wall forms around generative cell as it moves inside the tube cell.
20. This male tissue with its surrounding wall is now called the pollen grain	
21. Nutrients now accumulate inside the pollen grain.	POLLEN: ADDITION OF NUTRIENTS <u>Return wall and rotate</u> Food particles entering sulcus..
22. Finally, most of the water is lost and the pollen grain enters into a resting state..	POLLEN: LOSS OF WATER \\ 1-very small, blue water molecules leaving from the sulcus. 2-wall pulling into the sulcus which becomes concave.
22a. Before the anther releases pollen, the outer cells develop thickened walls.	ENDOTHECIUM Fly out of anther. Show external surface of anther. Remove external surface. Show endothecium.
23. When the anther dries out, the thickened cells shrink and tear open the anther between each pair of spore cases, allowing the pollen to escape..	ADJACENT SPORANGIA MERGE <u>External:</u> Opening along the stomium <u>Internal</u> Pollen visible.
24..	FLOWER Fly out of flower.

SUMMARY bs01 <ul style="list-style-type: none"> At the tip of a stamen there is an anther that contains four spore sacs. 	ANTHER: Surface removed, showing four microsporangia
bs02 <ul style="list-style-type: none"> Spore sacs contain fertile tissue that divides by meiosis to form spores. 	MEIOSIS One to four ball sequence, ending in spore walls going on.
bs03 <ul style="list-style-type: none"> Each spore cell develops into a pollen grain, containing two male cells inside a tough protective wall. 	MATURE POLLEN GRAIN Division of spore nucleus, two cells then external of wall.
bs04 <ul style="list-style-type: none"> Pollen grains are released when the spore sacs are torn apart. 	ANTHER OPENING External view?
<h2>THE OVARY</h2>	
25. At the centre of the flower there are three large chambers called carpels. Their function is to produce female tissue.	FLOWER MODEL Fade away all parts, leaving the compound gynoecium. Pull apart to show <u>one</u> carpel with stigma, style and ovary.
26. At the base of each, there is an enlarged region called the ovary.	OVARY Enlarged basal portion is highlighted.
27. A slender stalk called the style, extends from the ovary and ...	STYLE Pull back to view the style leading down to the ovary.
28. At the tip of the style there is an enlarged stigma. The three carpels are joined together to form a central canal that leads into each ovary.	STIGMA Zoom in on stigma lobes. Now put carpels back together. Move down canal towards the ovary. Remove ovary wall to show three compartments.
29. Small spore cases form on the wall of the young ovary.	YOUNG OVARY: MEGASPORANGIUM <u>Interior:</u> Bumps appear on carpel locule wall.
30	

31. A protective jacket soon covers each spore case, leaving only a small pore extending to the inside. This entire structure is known as an ovule.	INTEGUMENTS FORMING Two layers gradually growing up from the base of the ovule. Micropyle becomes smaller and smaller until only a fine pore.
32. Inside the spore case, there is a single, diploid cell.	SPOROCYTE Fade into interior to show one large sporocyte cell.
33. This divides by meiosis to form four haploid nuclei, each with one set of chromosomes.	MEIOSIS Sporocyte divides to produce four nuclei lying within the enlarged sporangium.
34. In most flowering plants, walls are formed around each nucleus resulting in four spore cells.	COMMON EMBRYO SAC PATHWAY: MEGASPORE WALLS Walls form around megaspore nuclei.
35. Three spores then degenerate.	MEGASPORE DEGENERATION Three megaspores fade away. Remaining one begins to enlarge.
36. The remaining spore enlarges and the nucleus divides three times.	MEGASPORE DIVISION Remaining spore enlarges and nucleus within divides three times producing eight nuclei arranged in two groups of four.
37. Two nuclei move into the centre . Seven cells now form.	NUCLEAR MOVEMENT, WALL FORMATION Two nuclei move into the centre
38. Three of these lie at one end of the ovule. One is the fertile egg cell. .. and the other two are sterile cells.	EGG CELL, SYNERGID CELLS One large egg cell and at each side, a pair of slightly smaller synergid cells.
39. There are two nuclei in the center of the cell that fills the center of the ovule.	CENTRAL CELL
40. At the far end of the ovule there are three sterile cells	ANTIPODAL CELLS Highlight the three antipodal cells.
41. These seven cells represent the mature female tissue.	NORMAL FEMALE GAMETOPHYTE Pull back to show the entire 7 celled, eight-nucleate female.
42. This is contained within the spore case.	PULLBACK: Sporangium placed around the embryo sac.
43. Which is covered by the protective jacket. .	PULLBACK: Integuments placed around the sporangium.

44. The Ovule in turn is contained inside the carpel	PULLBACK: Carpel placed around ovules. Flower parts added around carpels.
SUMMARY cs01 <ul style="list-style-type: none"> In lily flowers, there are three carpels. Each consists of an ovary, a style and a stigma. 	FLOWER MODEL Three carpels together; then show a single carpel with ovary
cs02 <ul style="list-style-type: none"> In the ovary, spore cases are surrounded by a protective jacket. These are called ovules. 	OVULE: Ovule showing the integuments creeping up, leaving the micropyle at the top.
cs03 <ul style="list-style-type: none"> The fertile cell divides by meiosis to form four spores but only one survives 	MEIOSIS One to four balls again with spore walls forming.
cd04 <ul style="list-style-type: none"> This spore cell divides repeatedly to form the female tissue 	EMBRYO SAC Formation of the embryo sac.

	POLLINATION AND FERTILISATION
46. Pollen is transferred to the receptive surface of the stigma. This is called pollination.	LILY/RENGARENGA FLOWER Entire flower, then flower with perianth removed to show ovary-style-stigma.
47.	STIGMAS Move in close to stigmas BEGIN ANIMATION Pollen grains sitting on the stigma. (must avoid having to show an insect!)
48. The pollen grain now absorbs water and begins to swell. It then grows a pollen tube containing the tube nucleus and a male cell.	STIGMA <u>External:</u> Stigma surface Water molecules enter Pollen Pollen begins to swell
49.	POLLEN TUBE Tube emerges; tube nucleus and generative cell appear..

50. The male cell divides to form two sperm cells..	POLLEN TUBE: SPERM CELLS <u>Interior:</u> Generative cell moves into pollen tube and then divides.
51. The pollen tube grows through the stigma and into the canal inside the style.	POLLEN TUBE IN STIGMA <u>Exterior:</u> growth of tube down to the base of the stigma papillae. Suggest a low power view.
52. Here it grows along the moist surface toward the ovaries.	POLLEN TUBE IN STYLE <u>Interior:</u> Pollen tube finding the canal and beginning to grow along its moist surface.
53a. Pollen tubes have a very fast rate of growth. This growth is localised at its tip.	POLLEN TIP Pollen tube up close growing along the surface of the style canal.
53b. Vesicles containing wall material accumulate at the tip where they are required for wall growth.	TIP: WALL VESICLES Inside, at the very tip of the cell.
53c. Behind this, the cytoplasm flows around the cell in regular streams. The two sperm cells and tube nucleus move forward as the cell grows.	TIP: CYTOPLASMIC STREAMING Interior:
54. Plugs of wall material periodically form which keep the cytoplasm close to the growing tip.	CALLOSE PLUGS <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.
54a.. When the pollen tube reaches the base of the style, it enters one of the ovaries.	POLLEN TUBE AT OVARY Pull back to show style and ovary with pollen tube growing into ovary, along its placental tissue, and up a funiculus.
55. Inside the ovary, the tube locates the rows of ovules.	
56. Approaching an ovule, the pollen tube grows into the pore and penetrates the spore case.	POLLEN TUBE INTO MICROPYLE Tube grows over surface of ovule and locates the micropyle.
57. It then grows into the female tissue and releases the two sperm cells.	POLLEN TUBE INTO EMBRYO SAC Pollen tube at base of micropyle, growing into the embryo sac.
58.	RELEASE OF MALE CELLS Tube tip rupturing to release the tube nucleus and two sperm cells.

59. One sperm fertilises the egg, forming a cell with two sets of chromosomes. This is called a zygote.	FIRST FERTILISATION One sperm moving across to the egg cell and the two nuclei fusing.
60. The second sperm fertilises the central cell, forming a cell with three sets of chromosomes. This is called the endosperm cell.	SECOND FERTILISATION The remaining sperm moves into the central cell, with its nucleus joining the two nuclei already there.
61. The fertilisation of <u>two</u> female cells is characteristic of all flowering plants.	DOUBLE FERTILISATION REVIEW 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.	INSIDE OVARY WITH ROWS OF OVULES VISIBLE.
62b. The style supports the growth of a large number of pollen tubes.... These grow down the style and enter the each of the three ovaries.	STYLE WITH POLLEN TUBES CHARGING DOWN
62c. When the pollen tubes enter an ovary, they each locate and fertilise an ovule.	INSIDE OVARY: TUBES LOCATING MICROPYLES
62d. Each ovary now has many fertilised ovules....which will now develop into seeds.	POLLEN TUBES MOVING ALONG ROW OF OVULES.
SUMMARY ds01 <ul style="list-style-type: none"> Pollen absorbs water from the stigma and forms a tube. ds02 <ul style="list-style-type: none"> One male cell divides to form two sperm cells. 	STIGMA: POLLEN Stigma surface with pollen grain and tube. Division of generative cell.
ds03 <ul style="list-style-type: none"> The pollen tube carries the sperm to an ovule 	POLLEN TUBE Pollen tube growing down style Pollen growing into micropyle.
ds04 <ul style="list-style-type: none"> One sperm cell fertilises the egg, forming a zygote with two sets of chromosomes. 	FERTILISATION: EGG Sperm joining egg cell
ds05 <ul style="list-style-type: none"> The other sperm cell fertilises the central cell, forming an endosperm cell with three sets of chromosomes. 	FERTILISATION: CENTRAL CELL Sperm joining the central cell.

	Seed and Fruit
62 After the ovules are fertilised , the flower undergoes several changes.	REAL FLOWER: RENGARENGA Flower in full bloom
63. Many parts begin to wither..	ANIMATION BEGINS: Flower model: Petals, sepals move in.
64. Eventually these parts are shed.	RENGARENGA:EXTERNAL Perianth and stamens dropping off.
65. Only the ovary remains healthy and firmly attached to the stem.	OVARY: EXTERNAL, THEN CUT-AWAY AND INSIDE External: Ovary green and healthy. Withering of style, stigma
66. Inside the ovary, the ovules now undergo many changes. Each ovule contains two fertilised cells. The nucleus of the fertilised central cell begins to divide to form new tissue called endosperm.	OVULE: SECTIONAL VIEW Primary endosperm nucleus dividing to form many nuclei within the embryo sac .
67. This stimulates the zygote to divide. As a result, a chain of cells is formed that pushes a small growing embryo deep inside the ovule.	SUSPENSOR AND PROEMBRYO Zygote forming large basal and small, apical cell. Basal cell divides to form chain of cells..
68. As it enlarges, the embryo receives nutrients from the surrounding endosperm.	
68a. In lilies, the embryo forms a single seed leaf or cotyledon.	SMALL EMBRYO: Apical area enlarging. Food particles moving into suspensor and into embryo
69. A tiny shoot tip forms on one side of the embryo.	APPEARANCE OF SHOOT TIP
70. Below this there is a stem.....and a root....covered by a root cap.	SMALL EMBRYO: HYPOCOTYL Cotyledon enlarging a little. A stem-root axis matures.
71.	
75. With the completion of embryo growth, nutrients are now stored in the surrounding endosperm tissue.	NUTRIENTS ACCUMULATE Particles moving into endosperm

76. Water is then removed and the embryo enters a state of dormancy.	WATER LEAVING Blue particles leaving embryo and endosperm
77 . As these events take place, the ovule jacket develops into a tough, protective seed coat. The ovule is now called a seed.	OVULE: EXTERNAL Put lid on and show it turning black.
78 . At the same time that the ovule is growing into a seed, hormones are released by the developing embryo	YOUNG FRUIT: EXTERNAL
79... These stimulate the ovary to expand and make room for the enlarging ovules..	ENLARGING FRUIT
80. In this way, the ovary wall expands and is changed into a fruit.	LARGE, BROWN FRUIT
81. In most lilies, the fruit is a tough, dry capsule that tears open to release the seeds.	OPENING FRUIT
82. The seeds are soon dispersed and will germinate to form new plants, thus completing the life cycle.	

SUMMARY	
es01 • The fertilised central cell forms endosperm tissue.	FORMING ENDOSPERM Dividing nuclei , then nuclei around the zygote or embryo.
es02 • The fertilised egg {or zygote} forms an embryo with one seed leaf es03 • The embryo is nourished by the surrounding endosperm	FORMING EMBRYO Embryo being pushed into ovule as the cotyledon forms. Food going into embryo from endosperm
es04 • The ovule is transformed into a seed, containing an embryo.	MATURE EMBRYO Cross section showing mature embryo and endosperm..
es05 • The ovary enlarges to form a fruit that opens to release the seeds.	OVARY AND FRUIT Enlarging ovary Opening fruit
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GRAND (NARRATION)	FINALE (IMAGE)	(REEL)
We have seen that flowers capture pollen and ensure the success of fertilisation and seed formation.. No other structure in the plant world performs this task so efficiently	HARVEY'S GARDEN Garden, then zoom in to bee in purple <i>Salvia</i> flower	<u>Reel 20</u> :07:08 to 07:22
It is therefore not surprising that a great variety of flowering plants dominates the landscape.	BOTANIC GARDENS Flowers with bee, then pull back to lake and trees etc.	<u>Reel 21</u> 01:35:14 to 25
Many of these attain a great size. But others are tiny and almost microscopic.	VARIETY of FORMS Palm tree Duckweed	<u>Reel21</u> 01:38:58 19:14:33
Some flourish in places where water is scarce;	CACTI dramatic shot of large, erect cacti	20:34:24
Others thrive in ponds and lakes.	WATER LILIES	20:26:24 distance 20:27:57 Up close, pan back 20:31:12 Waterfall, pan out to lake
And from this variety we have, by careful selection, developed all those plants which provide us with food, including many types of fruits..	CROPS Vineyard shots Bunches of grapes to pair of apples.	20:17:47 20:22:52-56 20:21:38
Without the great variety of flowering plants, the world in which we live would indeed be a very different place!	PLANTS & PEOPLE <u>Albert Park</u> : Flowers, students	<u>Reel21</u> ,01: 37:21-33