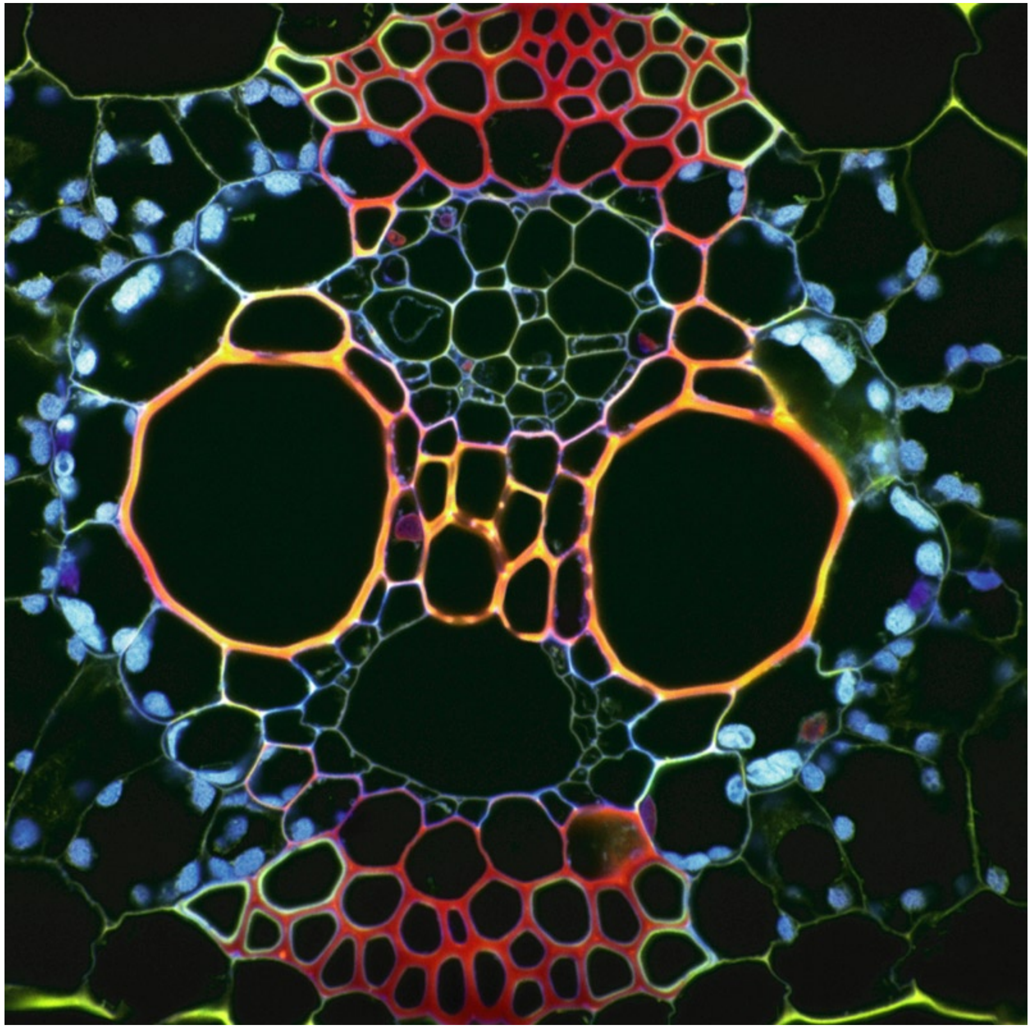
Plant Visions

100 years of plant imaging in Cambridge



Department of Plant Sciences
University of Cambridge

Plant Visions

100 year of plant imaging in Cambridge

The Department of Plant Sciences is one of the few remaining Departments of Plant Sciences in the UK, and is committed to research and teaching across a broad range of disciplines. This broad coverage of plant biology is based on a philosophy that plants should be studied for their intrinsic interest as much as for their potential exploitation as crops or sources of useful products.

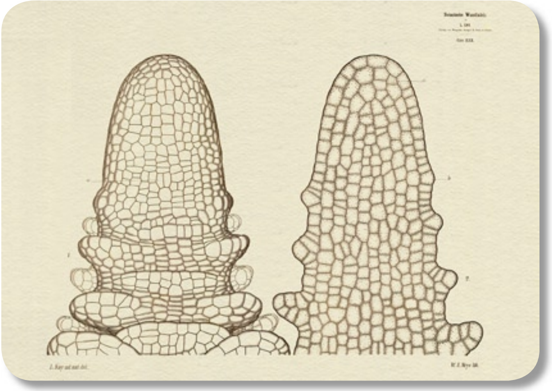
The building that houses the Department of Plant Sciences was first opened in 1904. The Plant Visions exhibition is one of a series of events to celebrate the contributions the Department has made to our understanding of biological processes over the last hundred years. This collection of past and contemporary images of plants is intended to represent the diversity of research interests that have been pursued in the Department.

Botanical teaching and research in Cambridge dates from the time of William Turner (who graduated in 1526). In these early days botanical imaging consisted almost entirely of sketching. As printing technologies improved, it became possible to produce colour engravings and sketches of plants, and many of these images are retained in the collections held by the Department Library. The development of optical microscopes led to an increase in the detail and quality of anatomical studies, and paved the way for the scanning electron and laser microscopy techniques which have been used to generate many of the more modern images in this collection.

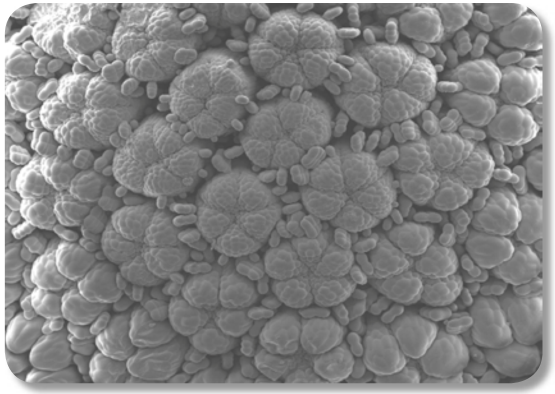
Dr. Beverley Glover & Dr. Jim Haseloff, Department of Plant Sciences.

Front cover: **Vascular bundle in a young leaf of Zea Mays (maize).** Laser scanning confocal micrograph of a transverse leaf section showing the organization of cells in the leaf. Cells are labelled due to fluorochrome staining and autofluorescence. Cells in the vascular system are responsible for the loading and unloading of water, minerals and sugars and their traffic between different organs of the plant. Botanical slide collection, Department of Plant Sciences; microscopy by Jim Haseloff, 2004.

1 Senecio pseudochina



2 Meristematic cells



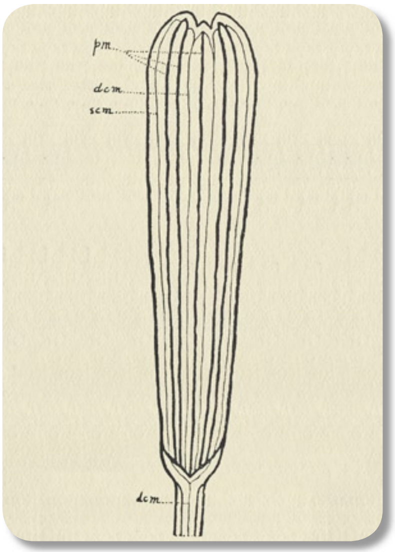
3 Chrysanthemum inflorescence meristem

1. ***Senecio pseudochina.*** This coloured engraving shows the leaves and flowers of this member of the family Compositae. All members of this family produce flower-like structures by clustering together many tiny flowers. Several of the tiny flowers are shown at the bottom of the picture. Andrews's Botanists Repository, 1803.

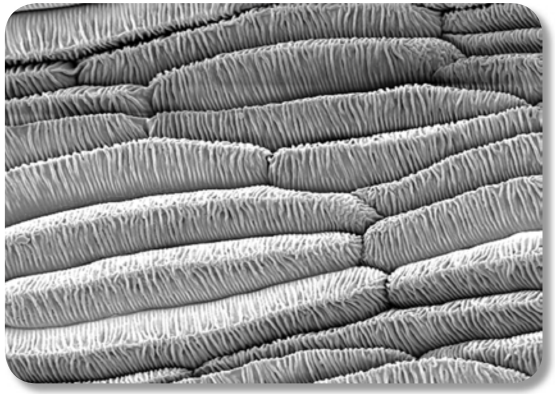
2. **Meristematic cells.** This sketch shows the structure of the growing tip of a plant, its meristem, and is taken from a collection of large posters used for teaching in the Department of Plant Sciences. W.A. Meyn. (1890)

3. **Chrysanthemum inflorescence meristem.** This scanning electron micrograph shows the growing tip of a Chrysanthemum, another member of the Compositae. The small clusters of cells will each develop into one of the tiny flowers. Beverley Glover, 2004.

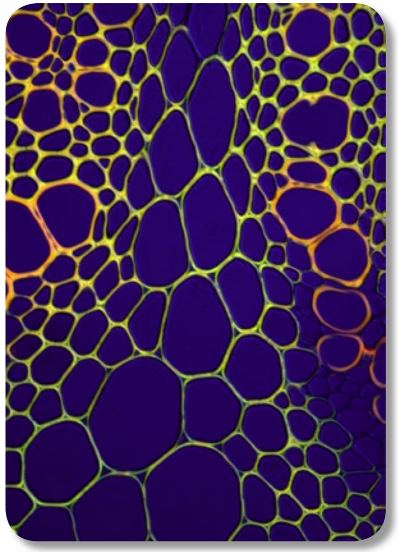
4. ***Senecio cruentus* ray floret.** This sketch of one of the tiny flowers of *Senecio cruentus*, another member of the Compositae, was made by Edith Saunders, a pioneering geneticist in the department from 1890-1940. E.R. Saunders's "Floral Morphology", 1939.



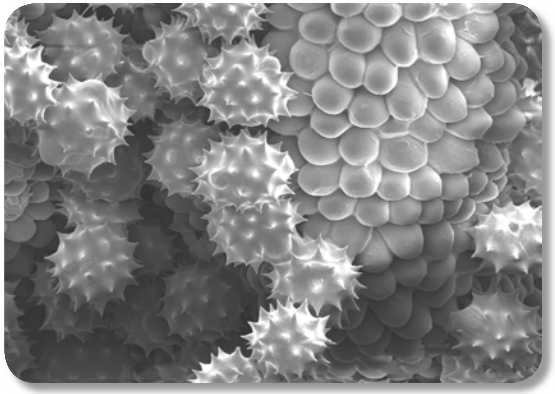
4 Senecio cruentus ray floret



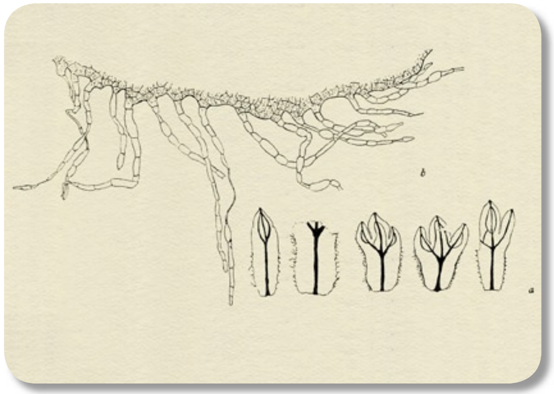
5 Gerbera petal



6 Senecio jacobaea stem



7 Chrysanthemum pollen grains



8 Fossil Saxifraga rosacea leaves

5. **Gerbera petal.** Scanning electron micrograph of the elongated petal cells of one of the tiny flowers of gerbera, another member of the Compositae. Beverley Glover, 2004.

6. ***Senecio jacobaea* (ragwort) stem.** Transverse section through lignified cells in a stem from *Senecio jacobaea* (ragwort). Laser scanning confocal micrograph of stained and autofluorescent cells, overlaid on a differential interference contrast image. Botanical slide collection, Department of Plant Sciences; microscopy by Jim Haseloff, 2004.

7. **Chrysanthemum pollen grains.** In this scanning electron micrograph pollen grains of Chrysanthemum are seen resting on a background of stigmatic tissue, part of the female reproductive structure of the flower. Beverley Glover, 2004.

8. **Fossil *Saxifraga rosacea* leaves.** Sir Harry Godwin was a member of the Department between 1923-1968, and was Professor of Botany. He established the field of quaternary botany in Cambridge, producing drawings such as this of the surface detail of fossilised plants. Godwin's "History of the British Flora", 1956.

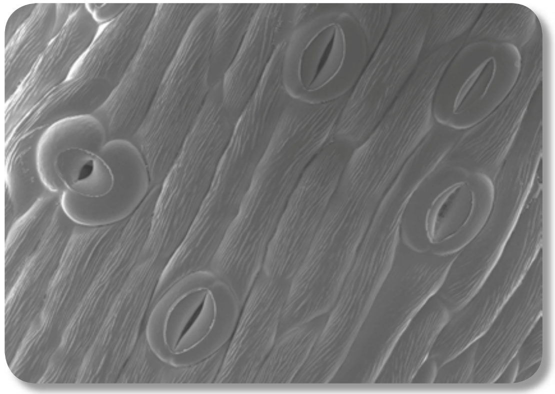
9 Saxifrage rosette

9. **Saxifrage rosette.**
This scanning electron micrograph shows the waxy surface of a rosette of Saxifrage leaves. Beverley Glover, 2004.

10. **Lily plants in flower.**
In this colour drawing two different species of *Lilium* are shown in flower. “Flora and Sylva”, 1905.

11. **Lily pollen germination.**
This sketch of lily pollen grains landing and germinating on stigmatic tissue was made by F.T. Brooks, a member of the Department between 1905-1917 and 1919-1948 and Professor of Botany. D.H. Scott and F.T. Brooks “Flowering Plants”, 1937.

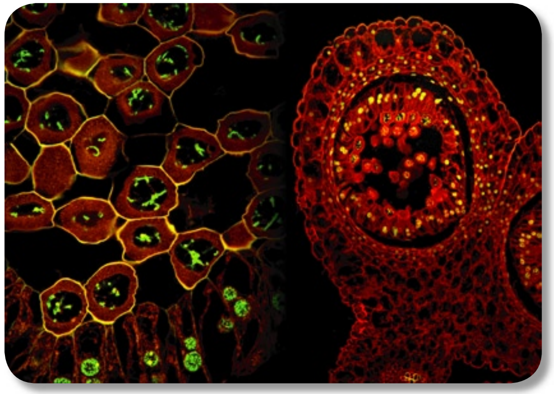
12. **Lily anther with stomata.**
Pollen is produced by anthers, which are photosynthetic organs. The stomata are necessary for gas exchange. When the guard cells surrounding them are turgid, the pore is open, but when the guard cells lose water the pore closes. Beverley Glover, 2004.



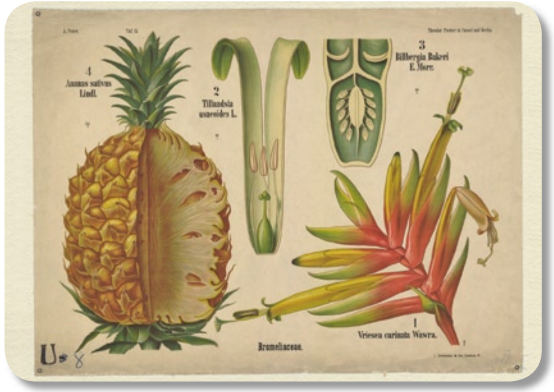
12 Lily anther with stomata

10 Lily plants in flower

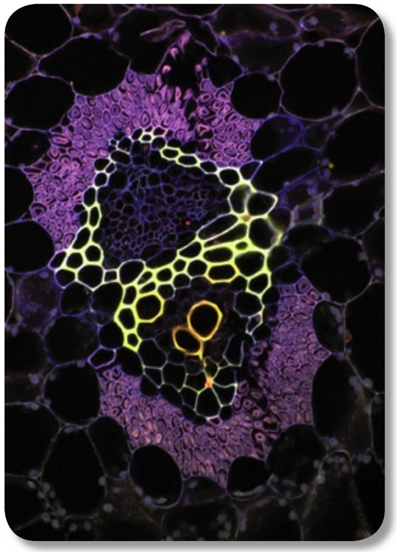
11 Lily pollen germination



13 Pollen development in Lily anthers



14 Flowers and fruit of Bromeliads



15 Pineapple leaf

16 Pineapple in flower

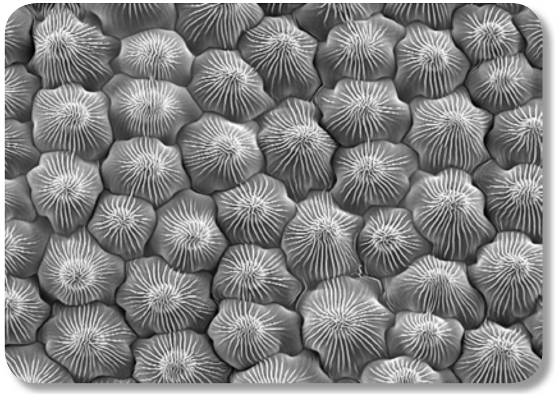
13. **Pollen development in Lily anthers.** Transverse section of an anther from *Lilium* (lily). Maturing pollen grains are seen inside the anther undergoing meiosis (diplotene stage); DNA is stained green in these laser scanning confocal micrographs. Botanical slide collection, Department of Plant Sciences; microscopy by Jim Haseloff, 2004.

14. **Flowers and fruit of Bromeliads.** This drawing shows the flowers and fruits of several species of Bromeliad, including pineapple. Teaching aid from the Department of Plant Sciences. Newmann and Co., London.

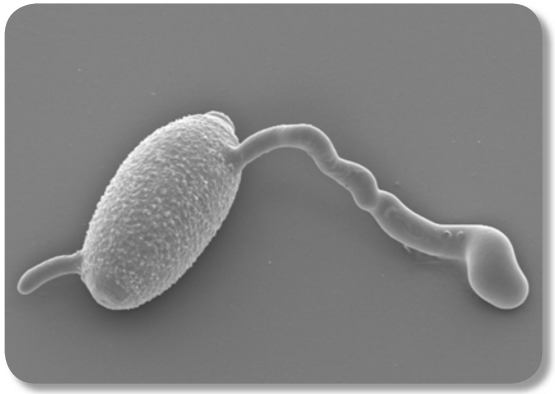
15. **Pineapple leaf.** Transverse section of a young leaf of *Ananas comosus* (pineapple), showing detail around a vascular bundle. Laser scanning confocal micrograph of stained and autofluorescent cells. Botanical slide collection, Department of Plant Sciences; microscopy by Jim Haseloff, 2004.

16. **Pineapple plant in flower.** Pineapple fruits are produced from a number of flowers, as seen in this photograph taken at the University Botanic Garden. Kate Maxwell, 2003.

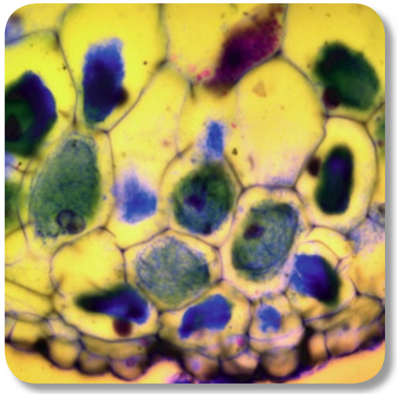
17 Orchid in flower



18 Orchid petal cells



20 Fungal spore germination



19 Orchid root

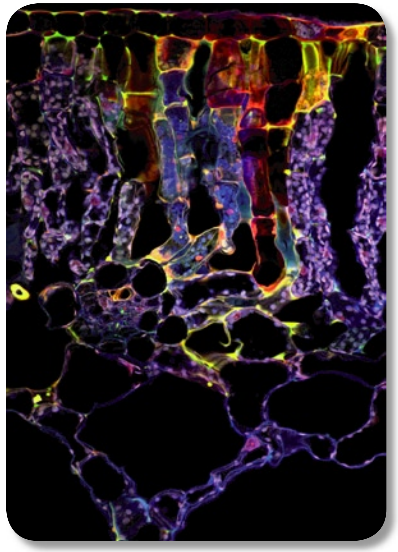
17. **Orchid in flower.** The complex floral structure of an orchid is shown in this colour drawing. “Flora and Sylva”, 1905.

18. **Orchid petal cells.** This scanning electron micrograph shows the detail of the petal cells in an orchid flower. The sculpting of the cuticle on each cell influences light reflection and enhances petal colour. Beverley Glover, 2004.

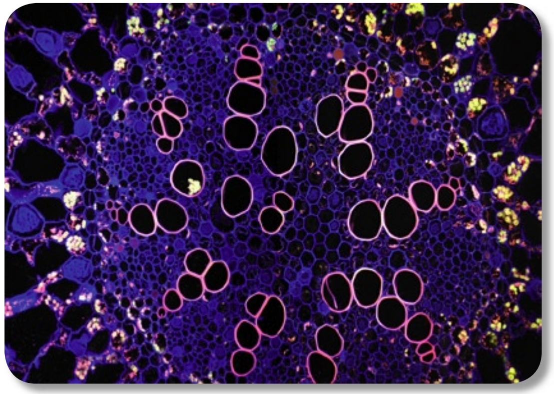
19. **Orchid root.** Transverse section of a root from *Neottia nidus-avis* (bird’s nest orchid). Like other orchids, the roots of the plant form a close mycorrhizal association with a soil fungus. Fungal hyphae penetrate the root cells of this plant, and can be seen in this laser scanning confocal micrograph. Botanical slide collection, Department of Plant Sciences; microscopy by Jim Haseloff, 2004.

20. **Fungal spore germination.** When fungal spores land on plant tissue they germinate to produce hyphae, as seen in this scanning electron micrograph. Patrick Echlin.

21 Iris



22 Floating leaf of Water Lily



23 Water Lily root

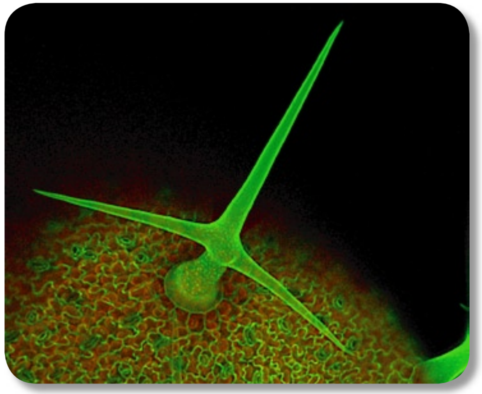
21. **Iris.** The Iris is one of a number of plant species that live in wet habitats. “Flora and Sylva”, 1905.

22. **Floating leaf of water lily.** Transverse section through a floating leaf of *Nymphaea alba* (white water lily). Large air spaces are found under the top section of the leaf in this laser scanning confocal micrograph. Botanical slide collection, Department of Plant Sciences; microscopy by Jim Haseloff, 2004.

23. **Water lily root.** Transverse section through the root of *Nymphaea alba* (white water lily). The central bundle of vascular tissue is shown in this laser scanning confocal micrograph. Botanical slide collection, Department of Plant Sciences; microscopy by Jim Haseloff, 2004.

24 Water Lily

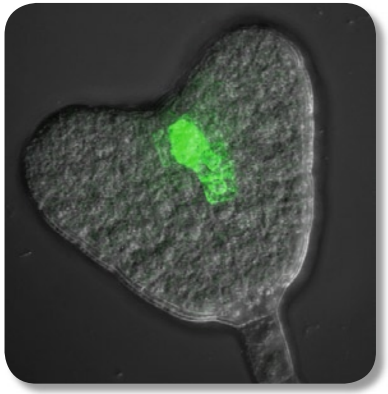
24. **Water-lily.** This engraving shows the detail of the flower of the water lily *Nymphea colossea*. “Flora and Sylva”, 1905.



25 Arabidopsis thaliana leaf hair

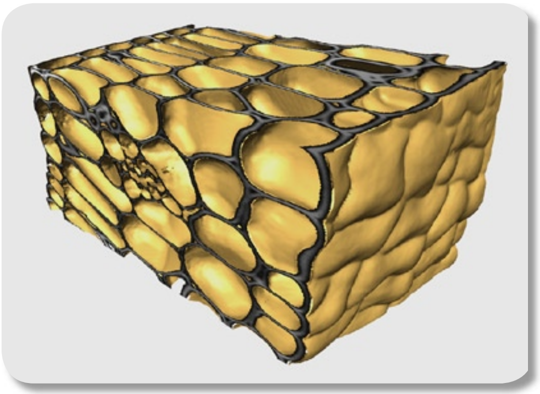
25. **Arabidopsis thaliana leaf hair.** The trident-shaped hairs on the leaves of the model genetic plant Arabidopsis thaliana defend the leaves against herbivorous insects. Kit Wilkins and John Runions, 2002.

26 Arabidopsis thaliana plants



27 Arabidopsis embryo

26. ***Arabidopsis thaliana* plants.** This weed is the most studied plant and arguably best understood plant species on Earth, and is widely used as a model for the study of many aspects of plant biology.

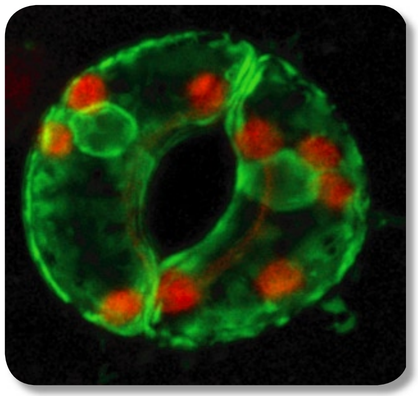


29 3D reconstruction of Arabidopsis cells

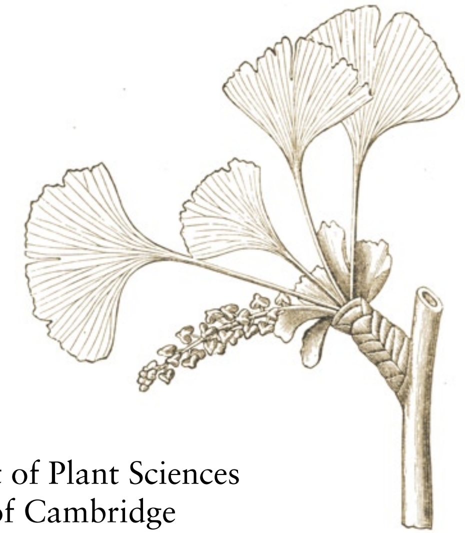
27. ***Arabidopsis* embryo.** Naturally fluorescent proteins from jellyfish or coral can be expressed in trangenic plants to “paint” living cells. Here, cells in the developing apex of an *Arabidopsis* embryo are expressing green fluorescent protein (GFP). Elizabeth Truernit, 2003.

28. ***Arabidopsis* leaf pore.** Expression of GFP was used to decorate the guard cells that make up leaf pores in Arabidopsis leaves. Andrew Baker and Alex Webb, 2002.

29. **3D reconstruction of Arabidopsis cells.** Laser scanning confocal microscopy allows serial optical sectioning of intact plant tissues and 3D computer visualisation of cell arrangements. Jim Haseloff, 2004.



28 Arabidopsis leaf pore



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