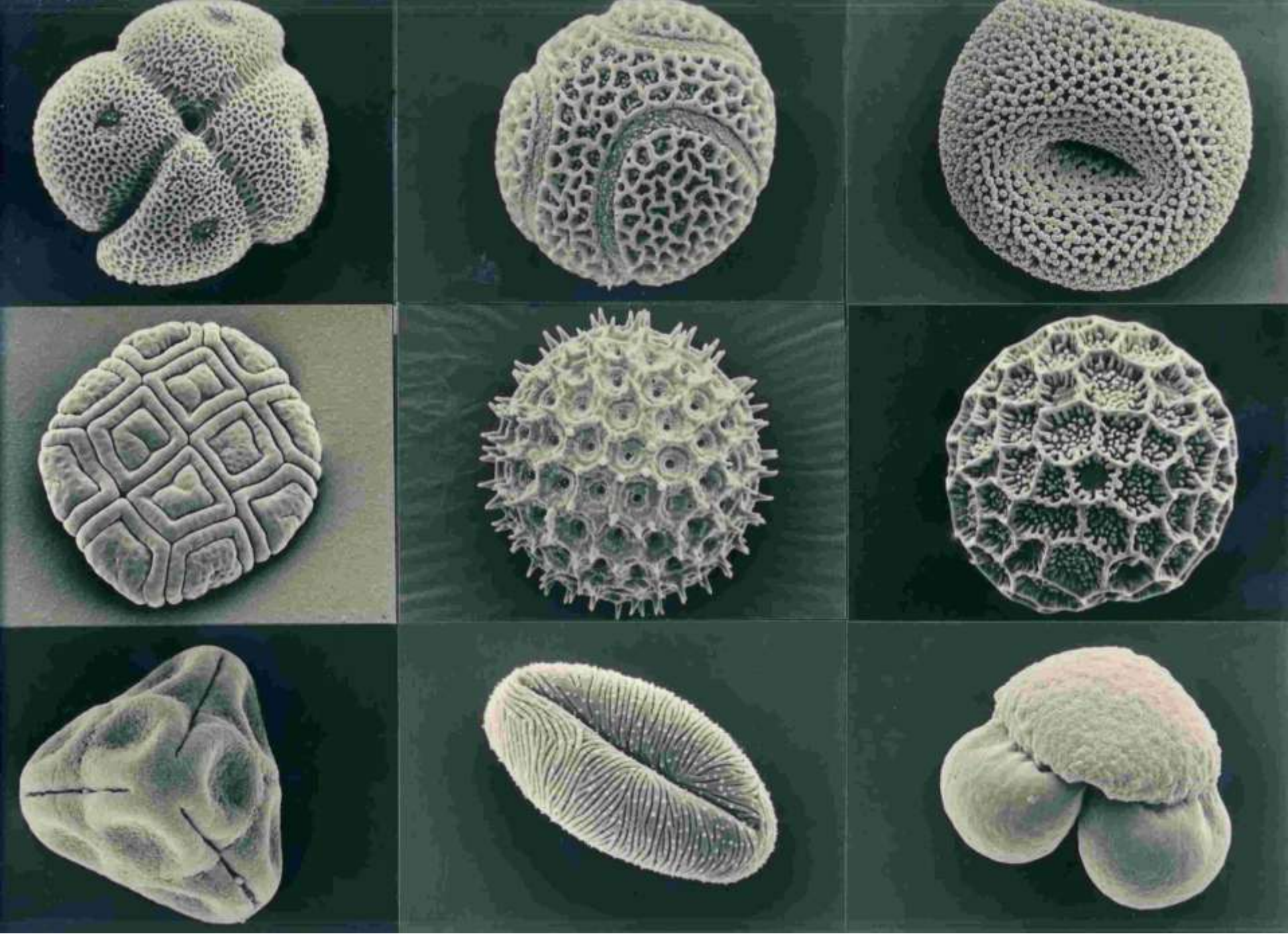
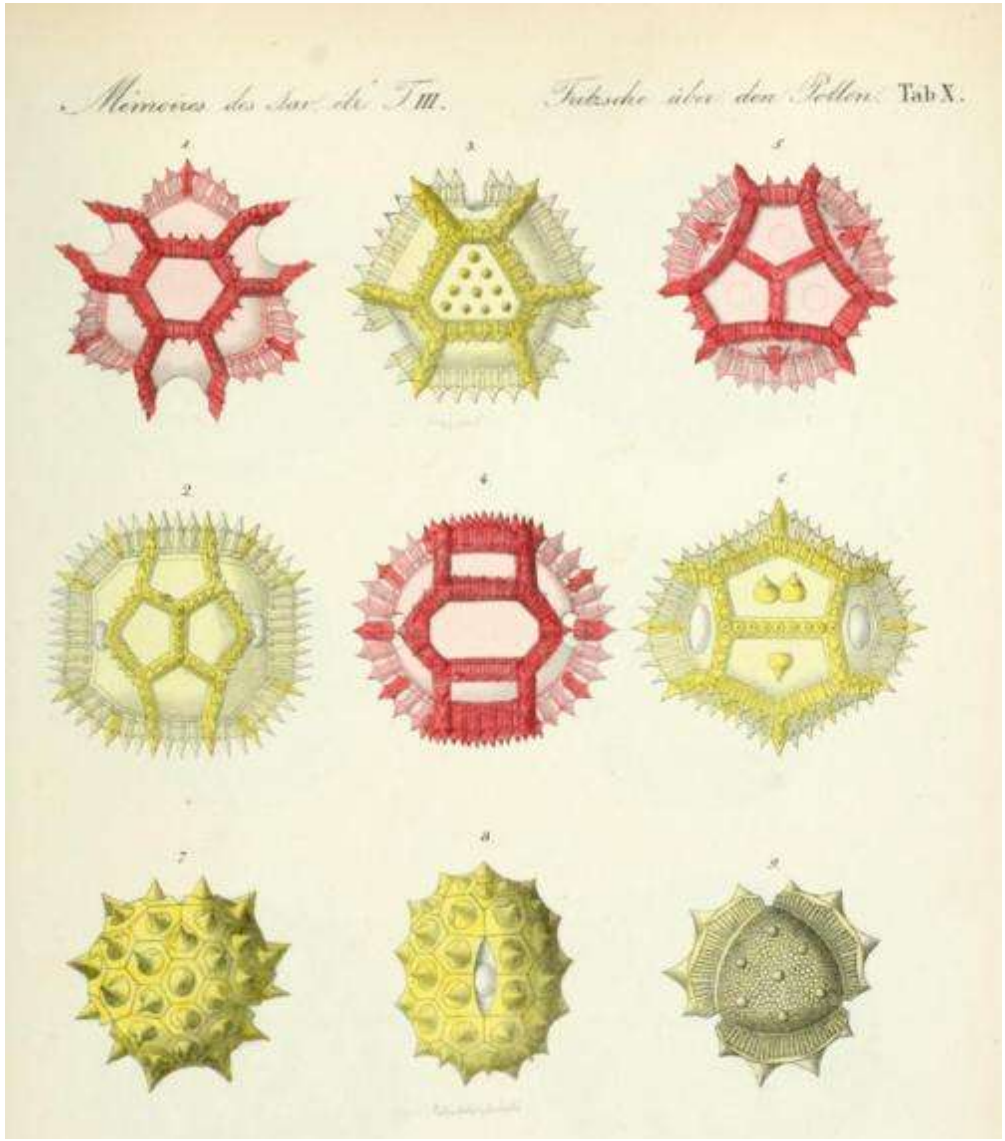
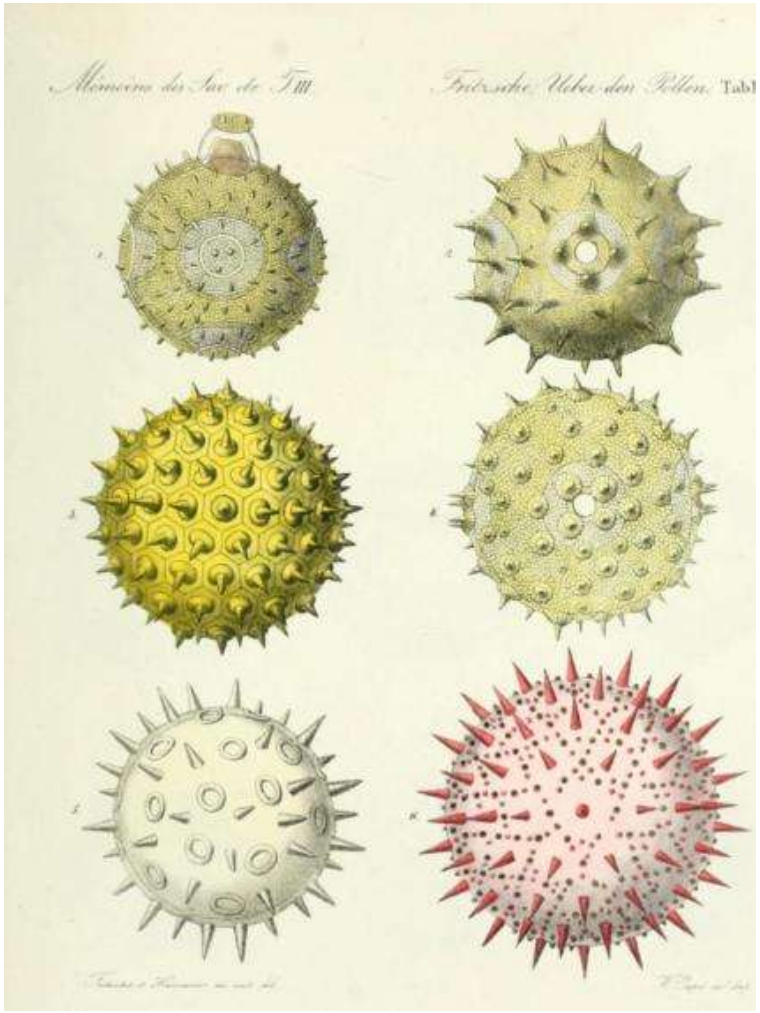
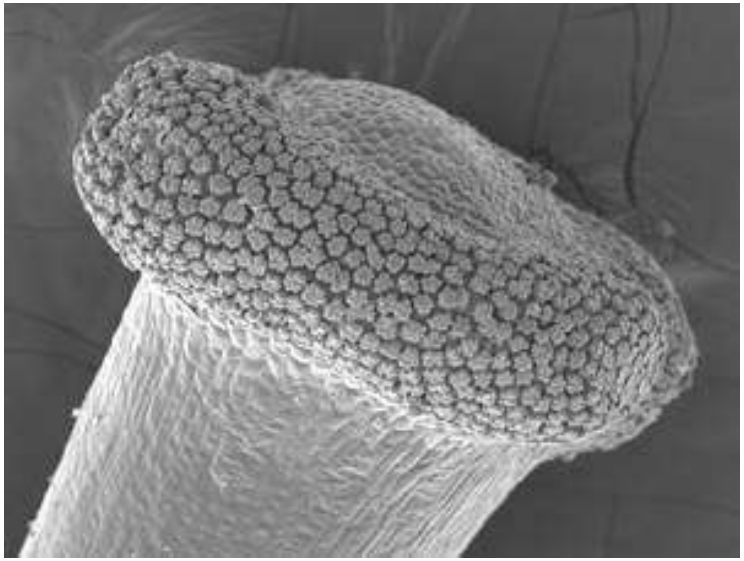


Pollen from ‘Ueber den Pollen’ by Julius Fritzsche Published 1837



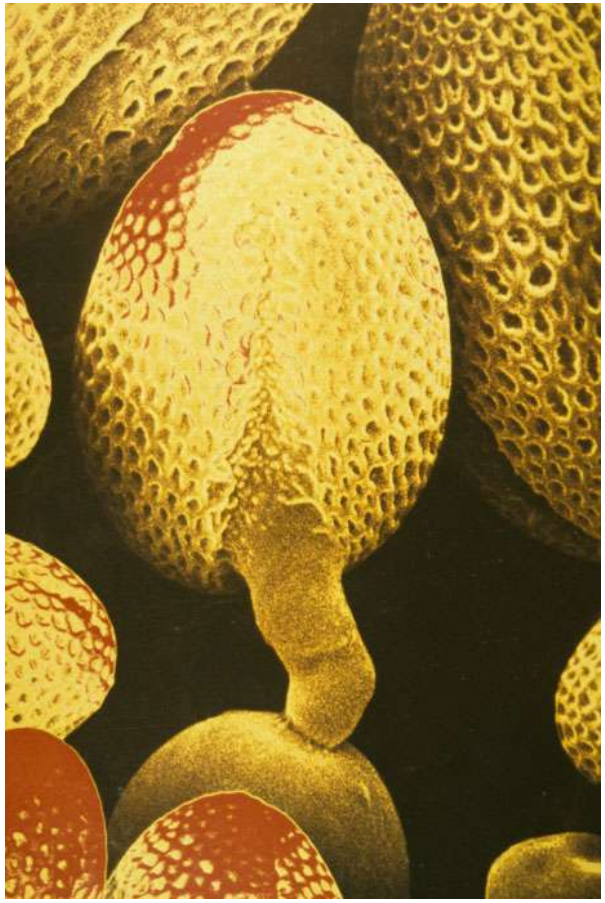


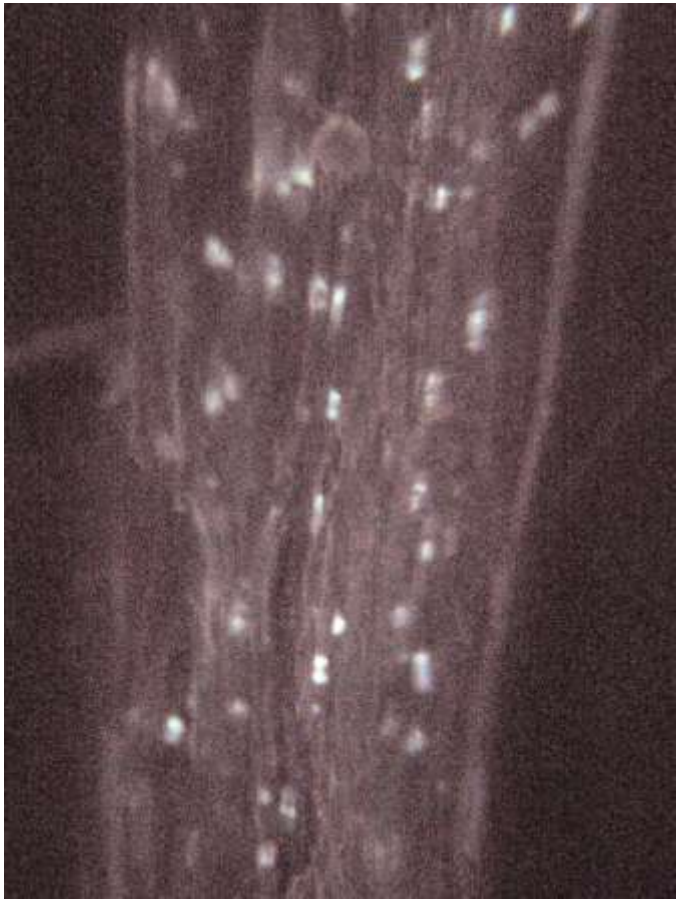



SCIENCEphotoLIBRARY


HV spot WD det HFW mag pressure 2 mm
10.00 kV 2.5 15.3 mm LFD 4.83 mm 62 x 24 Pa Amarylis pistil

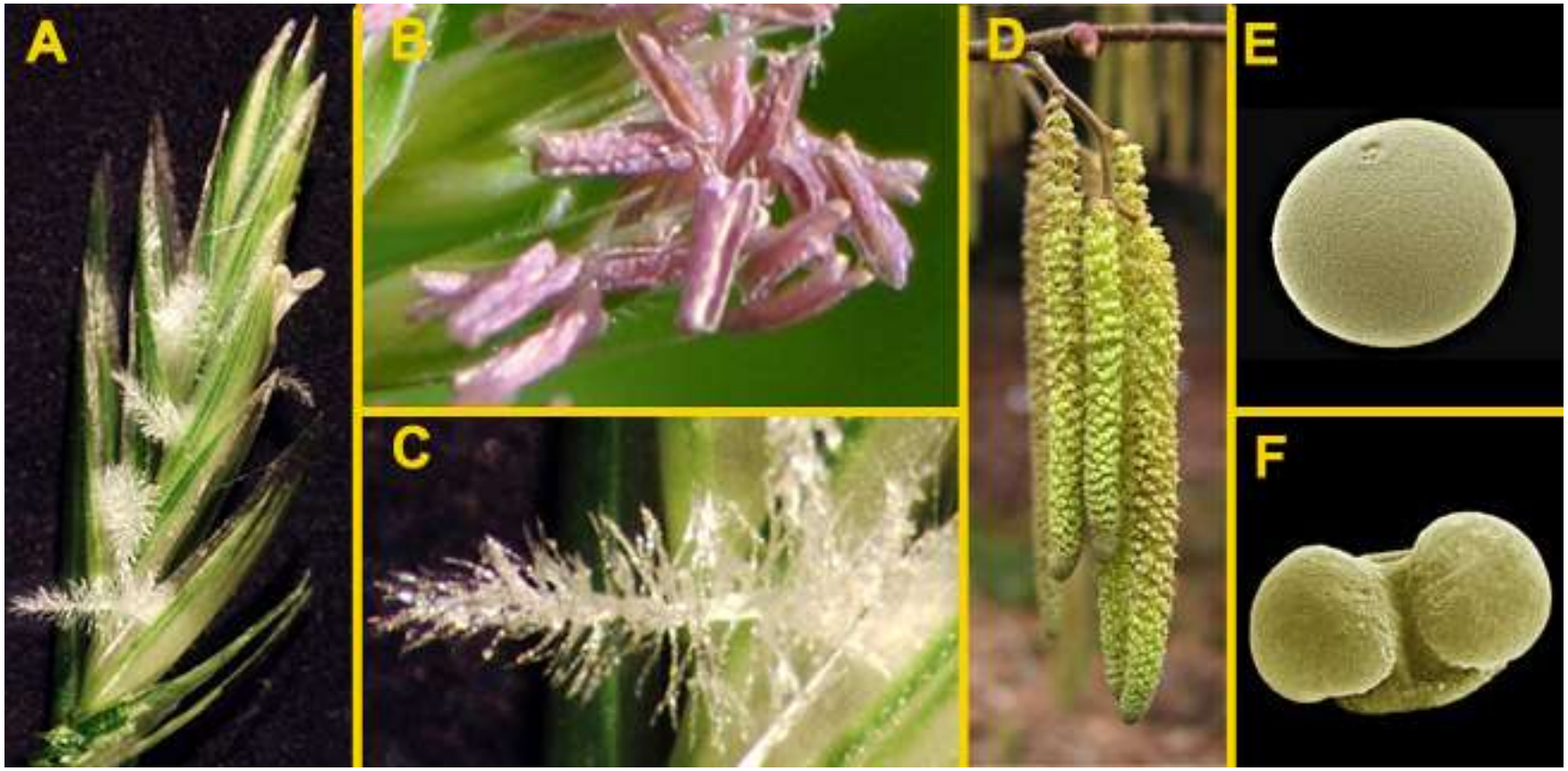
Pollen tube growth



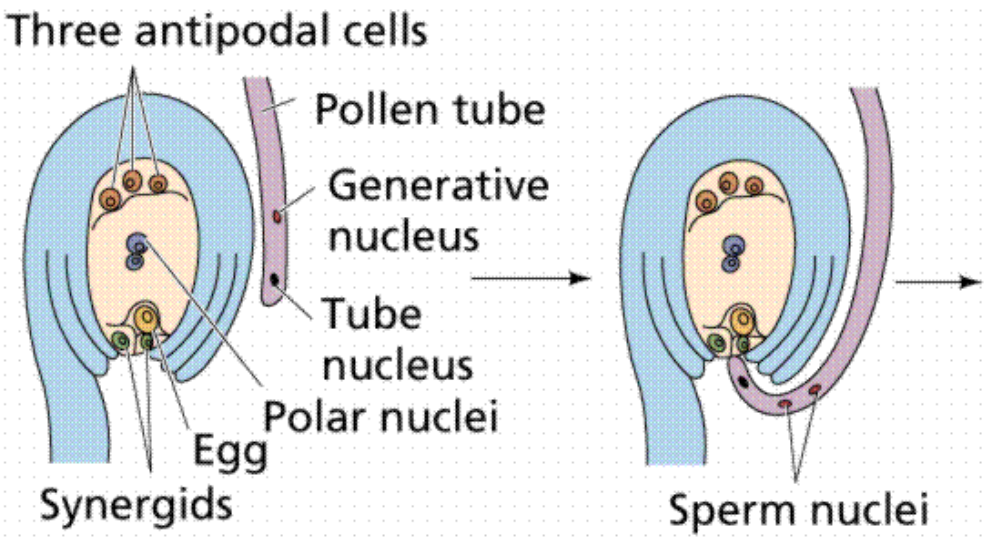


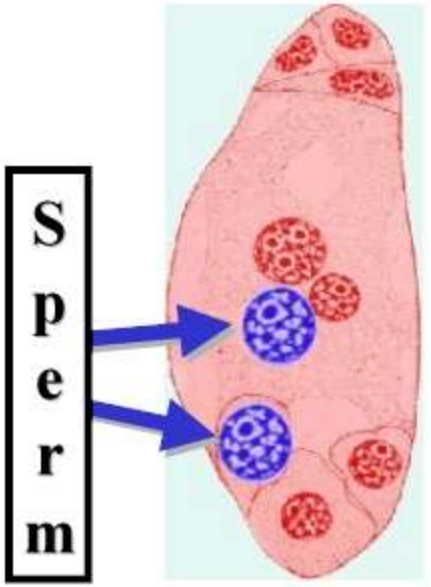
Animal Pollination - Zoophily

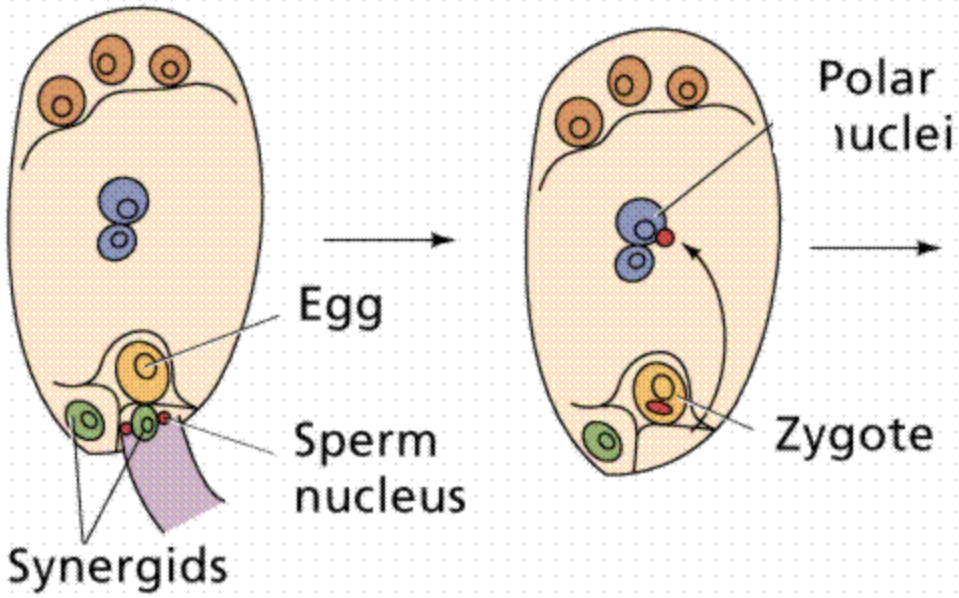
Wind Pollination - Anemophily

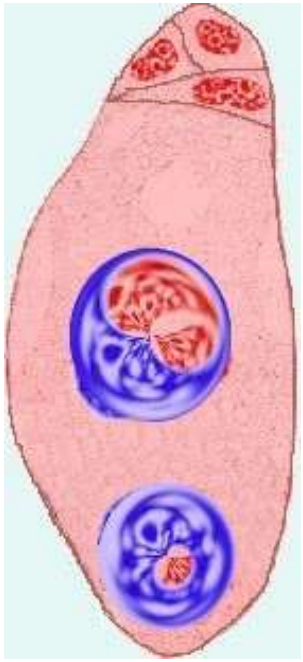


Double Fertilization

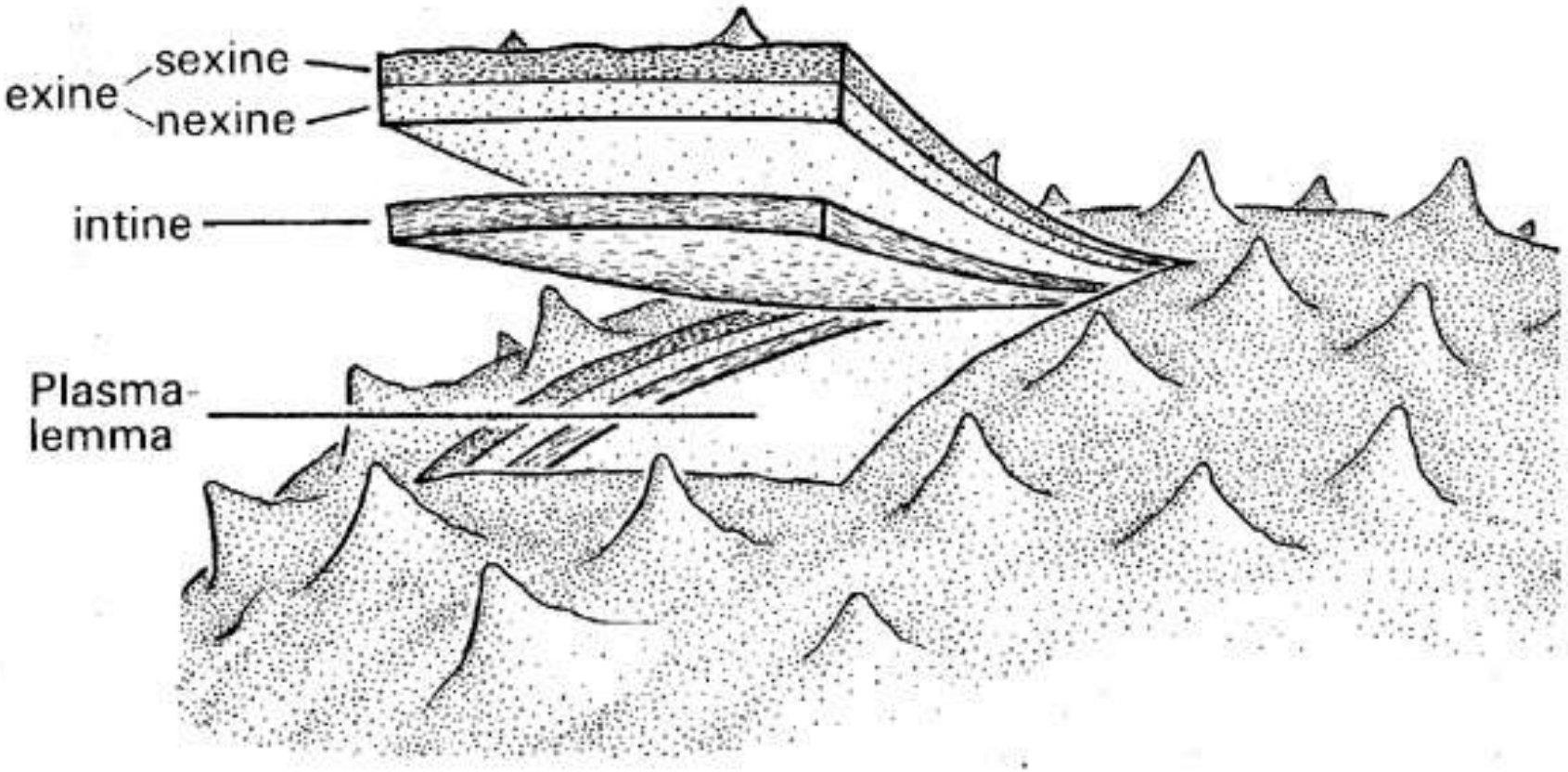


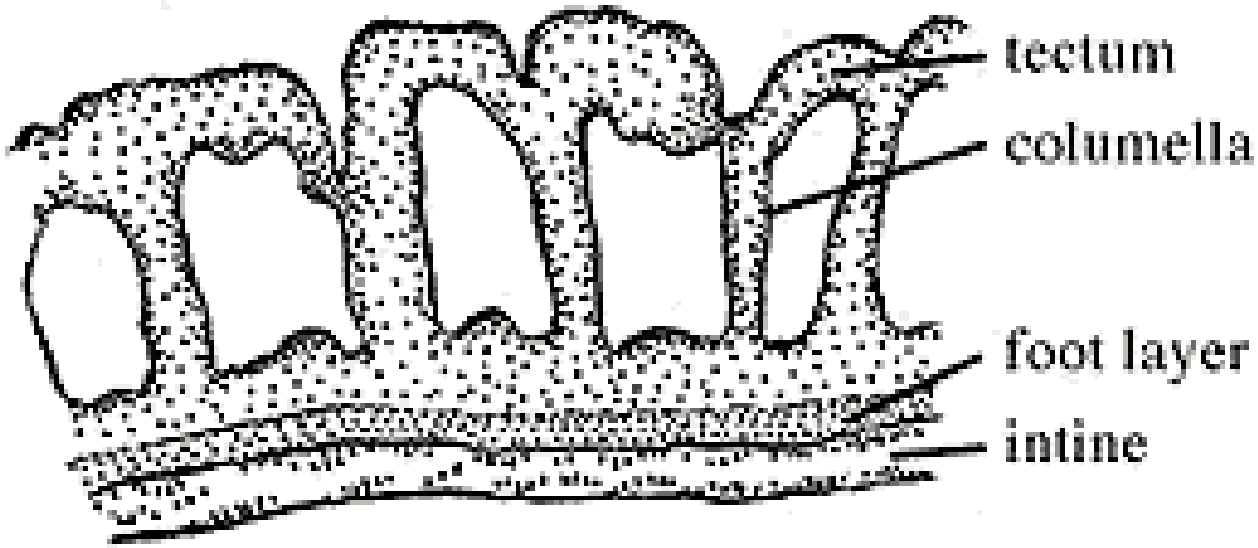




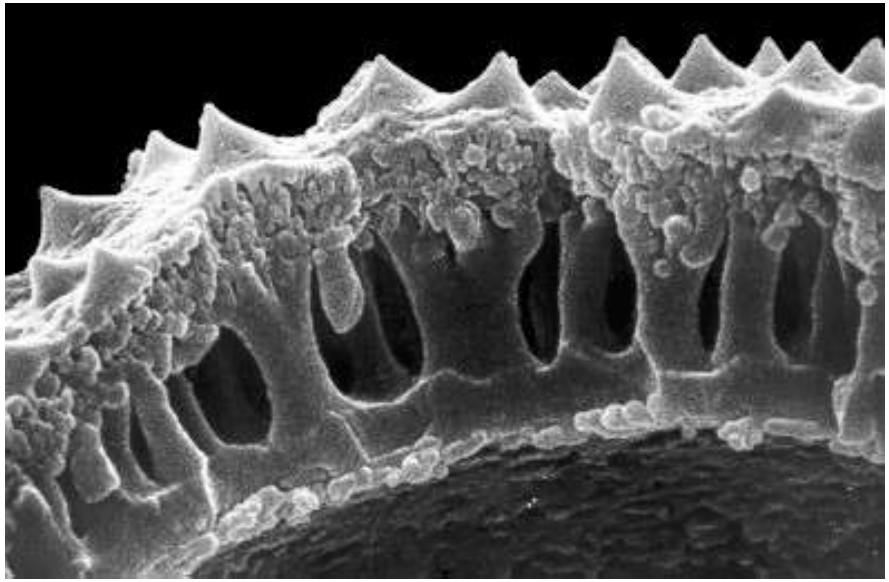


Pollen Wall



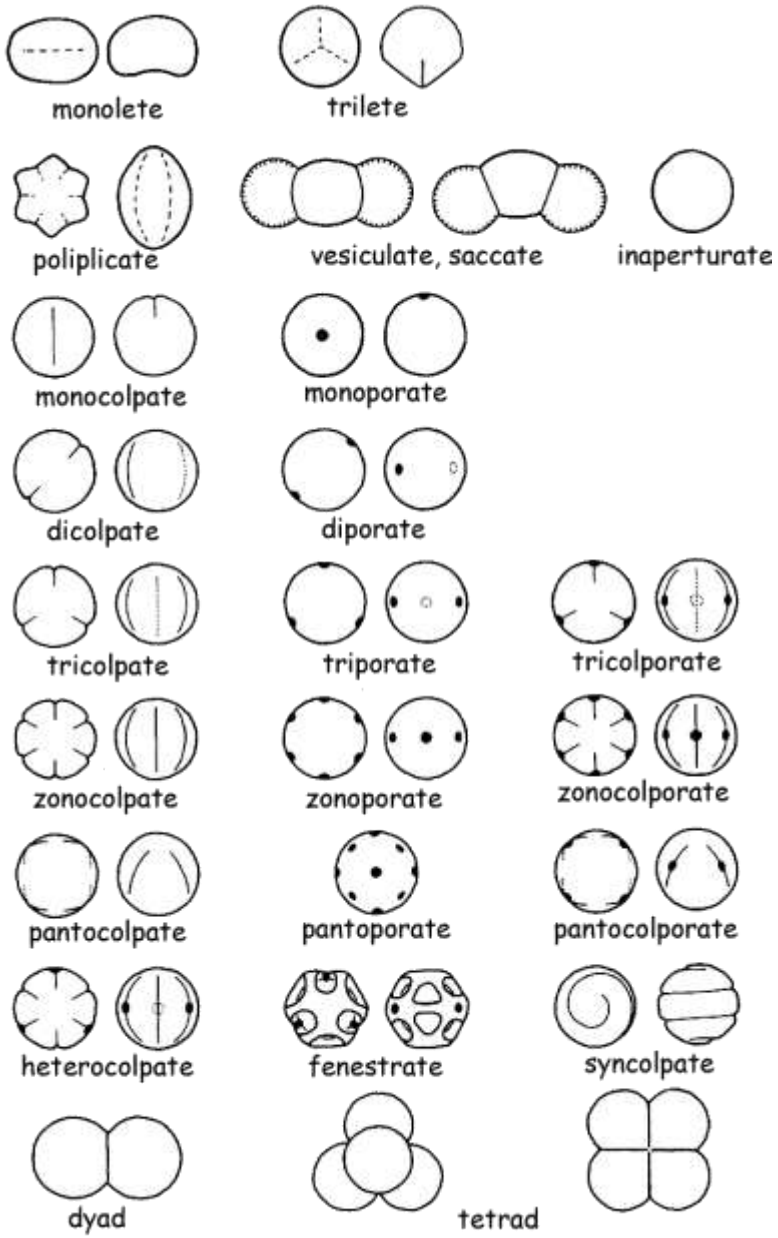


Tectate-collumellate wall (exine) typical of angiosperm pollen.

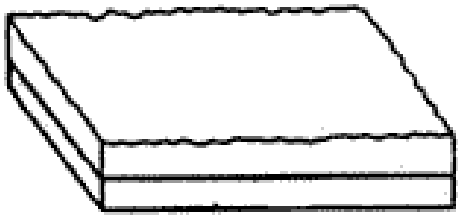


Artemisia

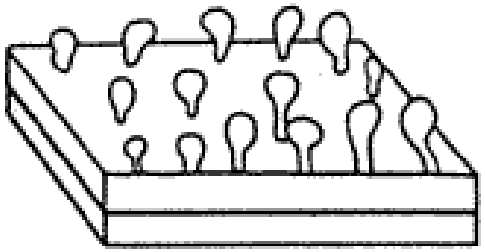
Entire spectrum of possible pollen types



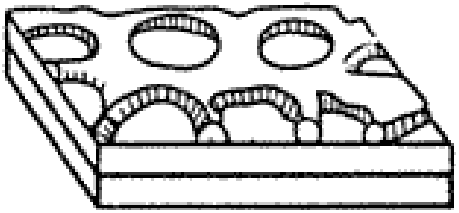
Exine Ornamentation



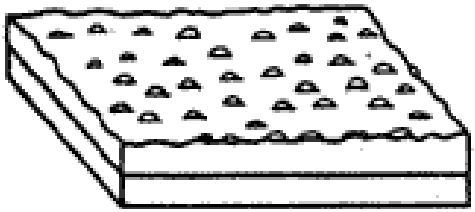
psilate



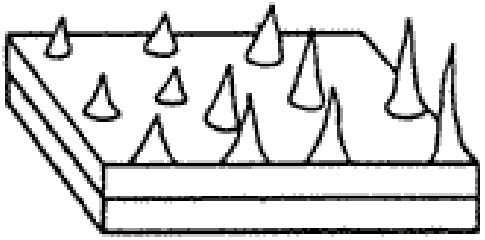
clavate



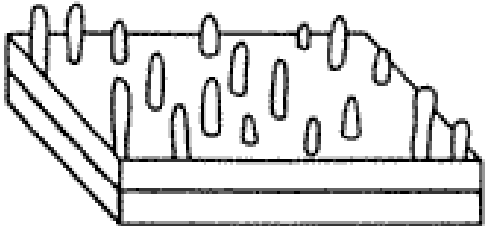
reticulate



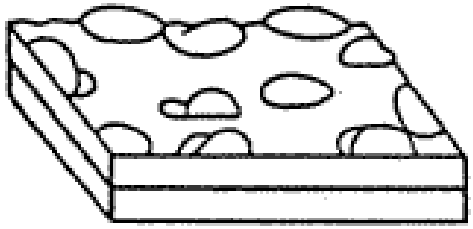
scabrate



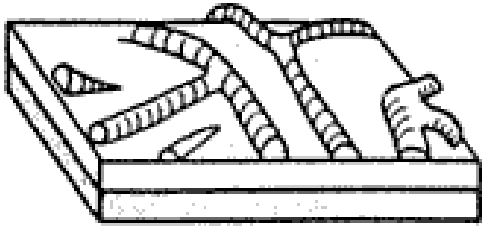
echinate



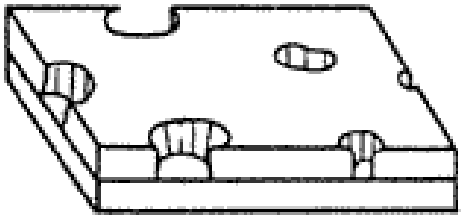
baculate



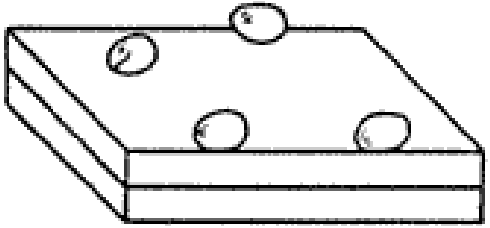
verrucate



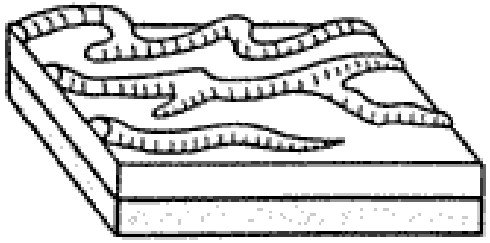
rugulate



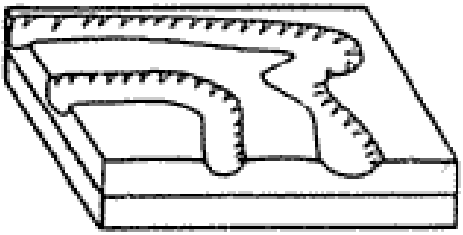
foveolate



gemmate

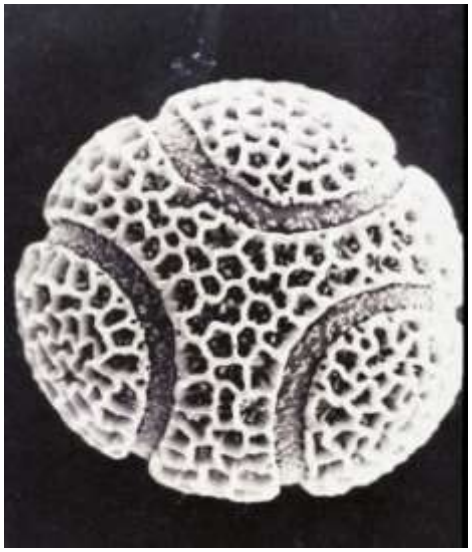


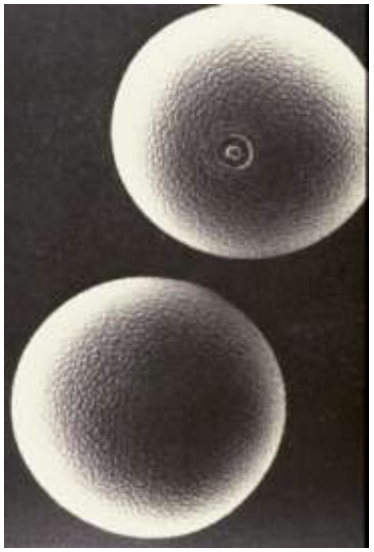
striate

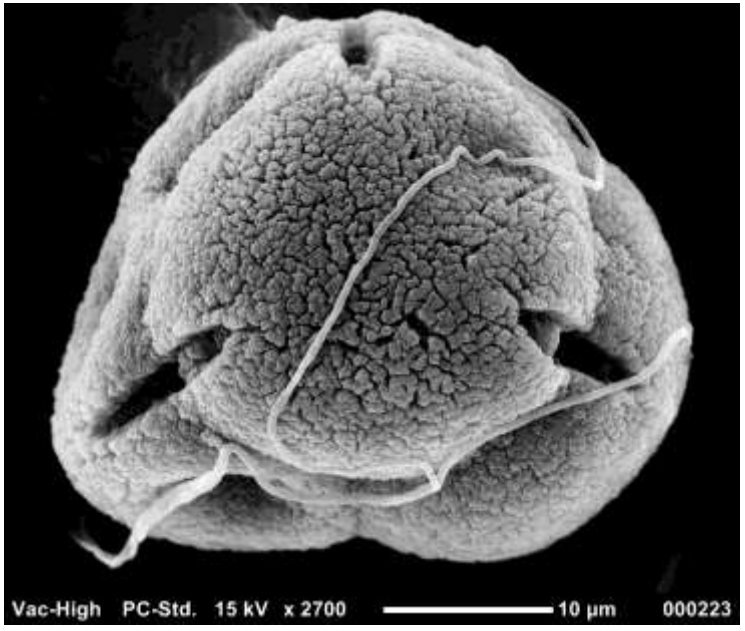


frustillate

Pollen

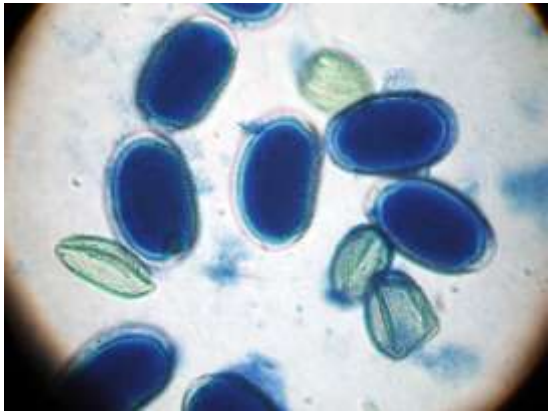






Pollen Techniques

Pollen Traps
Surface sampling
Fresh Pollen
Dry Pollen
Pollen Mounting
Hydration
Dehydration
Acetolysis
HMDS
SEM preparation
TEM
Sediments
Core samples
Pollen Viability
Bee Wash
Pollen tube growth



Pollen Technique - Acetolysis

Method was introduced by Erdtman, with help from his chemist brother.

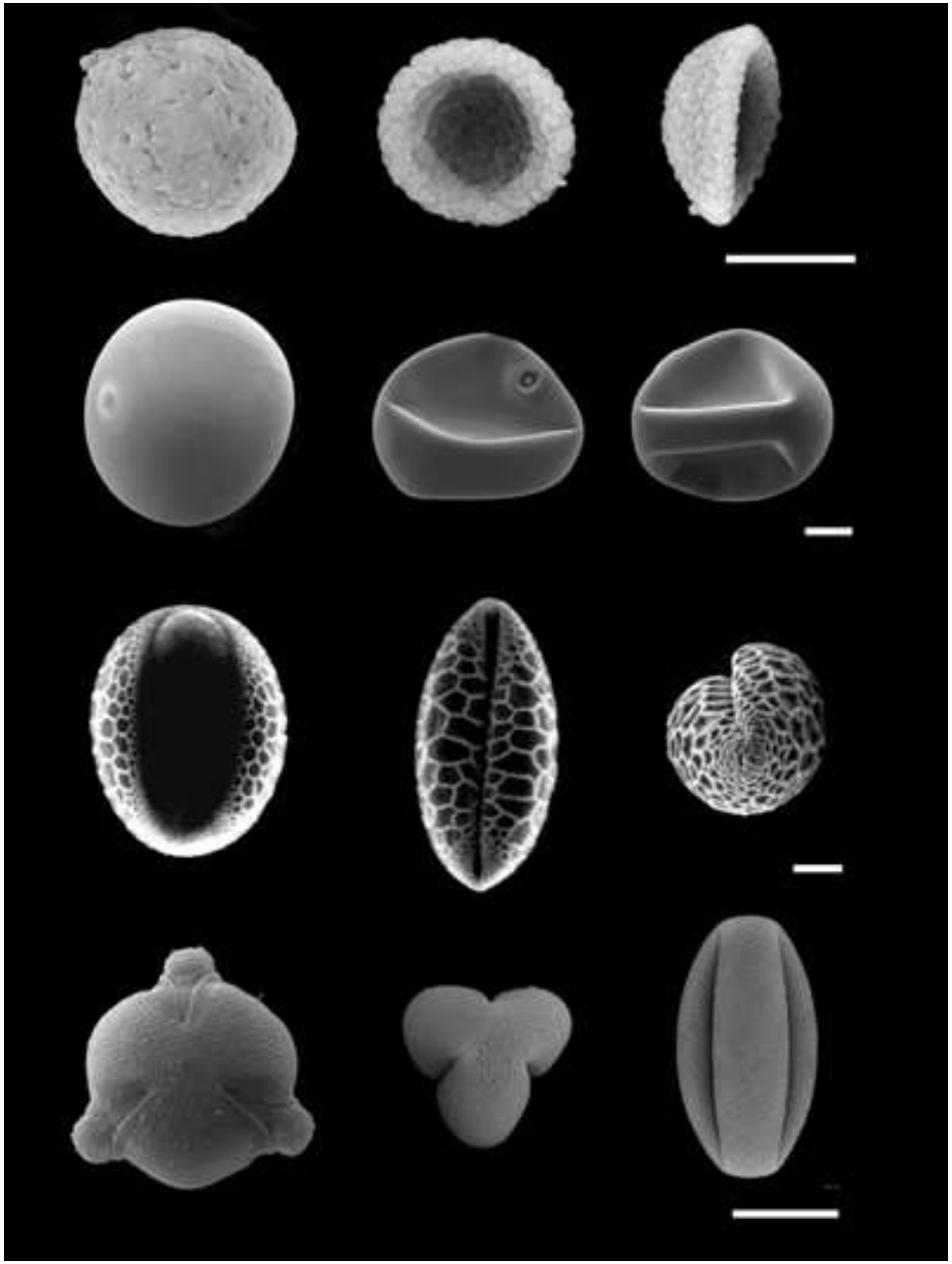
Nine parts acetic anhydride plus one part concentrated sulfuric acid.

$(C_6H_{10}O_3) + 3(CH_3CO)_2O \xrightarrow{\text{sulfuric acid}} (C_6H_7O_5)(CH_3CO)_3 + 3CH_3COOH$

Cellulose — acetic anhydride — cellulose triacetate — acetic acid

Passiflora

Pollen Folding - Harmomegathy



Aristolochia gigantea

Zea mays

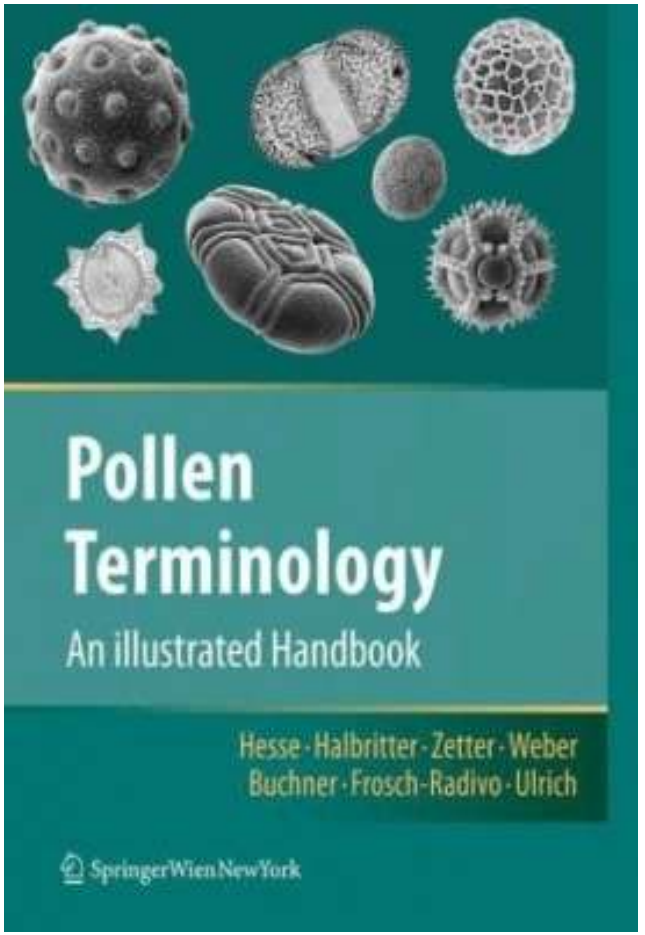
Lilium longiflorum

Euphorbia milii

Pollen for SEM - Halbritter 1997

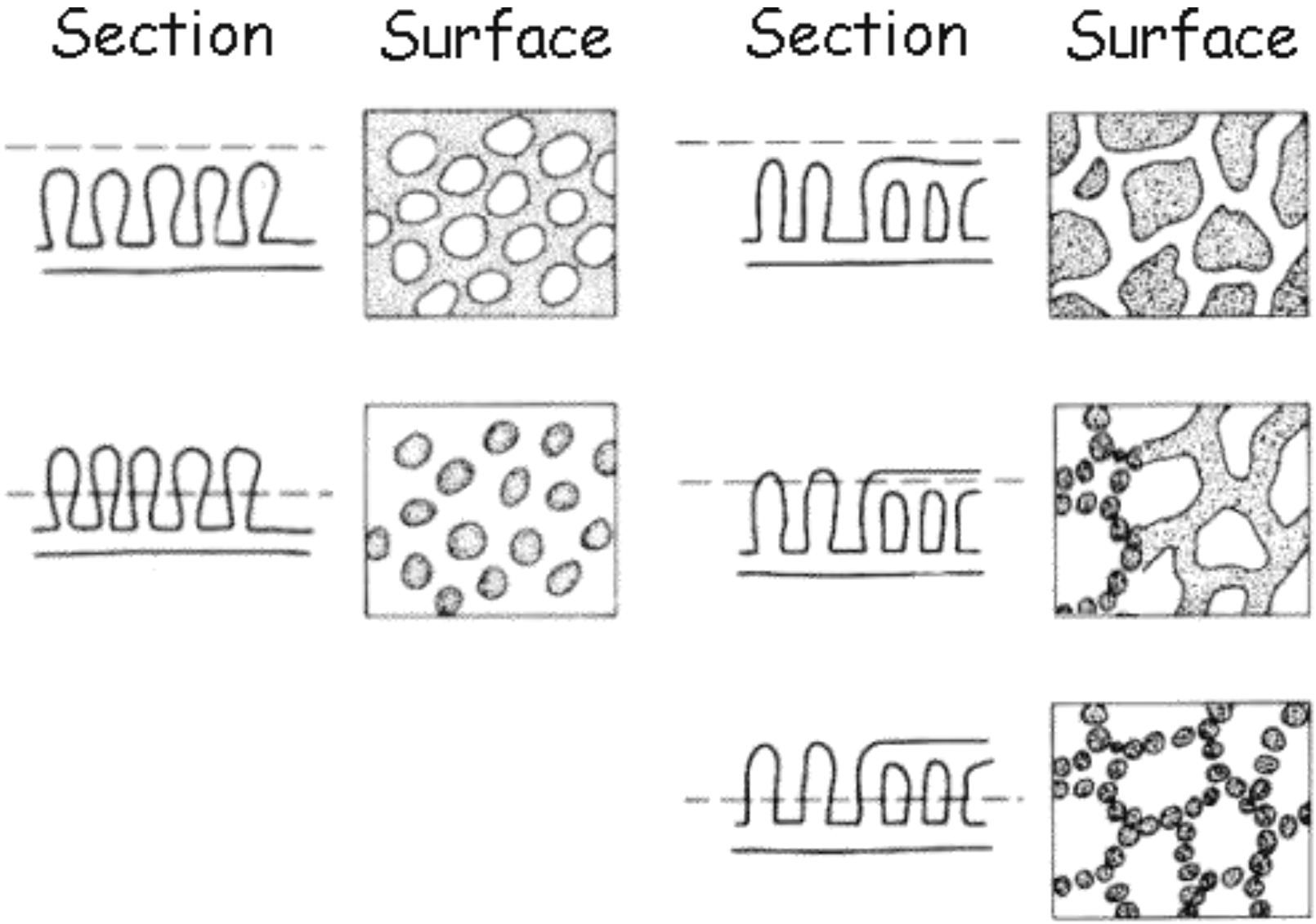
Place fresh pollen in envelope
Place envelopes in 2,2 dimethoxypropane
Dehydrate
Critical Point Dry
Acetone as transitional fluid
Spread on stub
Sputter coat

Heidemarie Halbritter



Asteraceae Pollen

LO-Analysis (Lux Obscuritas) – focus changes



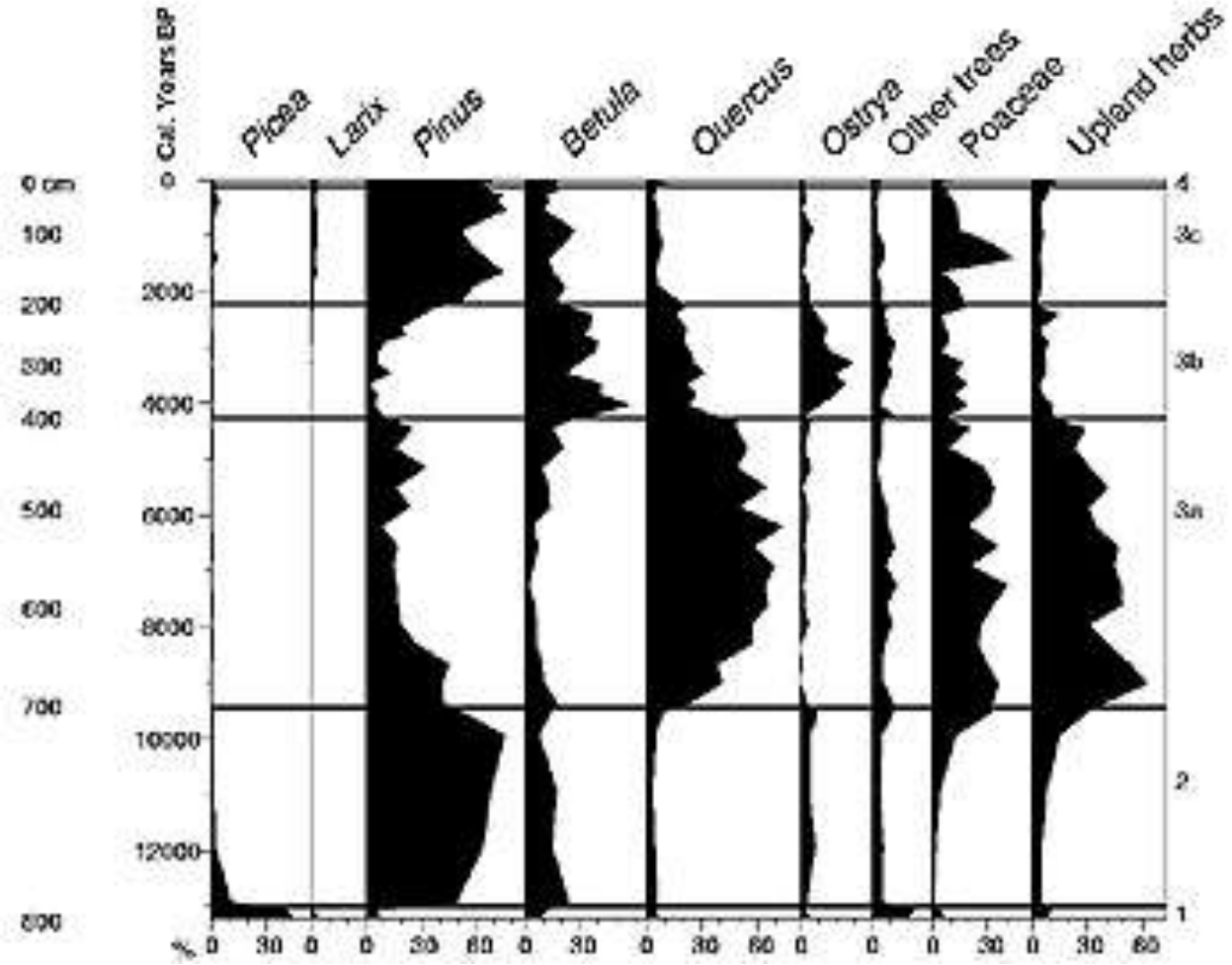
Pollen analysis was initially confined to Nordic countries because many early publications were in Nordic languages

Roger Philip Wodehouse – 1889 -1978 Canadian
1935, 1959. *Pollen grains*.

Gunnar Erdtman - 1897–1973 Swedish
1933 Developed acetolysis technique
1943 *An Introduction to Pollen Analysis*
1952 *Pollen Morphology and Plant Taxonomy. I . Angiosperms.*
Popularized fossil pollen analysis in the 1920s and 1930s through both his English language publications and a lecture-collecting tour in North America

Knut Fægri - 1909 – 2001 Norwegian
Text-Book of Modern Pollen Analysis (4 editions 1950-1989
The Principles of Pollination Ecology (1966, with L. van der Pijl)

Erdtman 1931



Bog D Pond pollen diagram, located about 70 m south of Erdtman's Muskeg core, redrawn from McAndrews (1966). Pollen sum is tree pollen. Sediment is gyttja with a buried soil at the base. Four 14C dates and the surface provide a chronology. The Poaceae peak in Zone 3c is from wild rice.

RECONSTRUCTING PAST CLIMATES

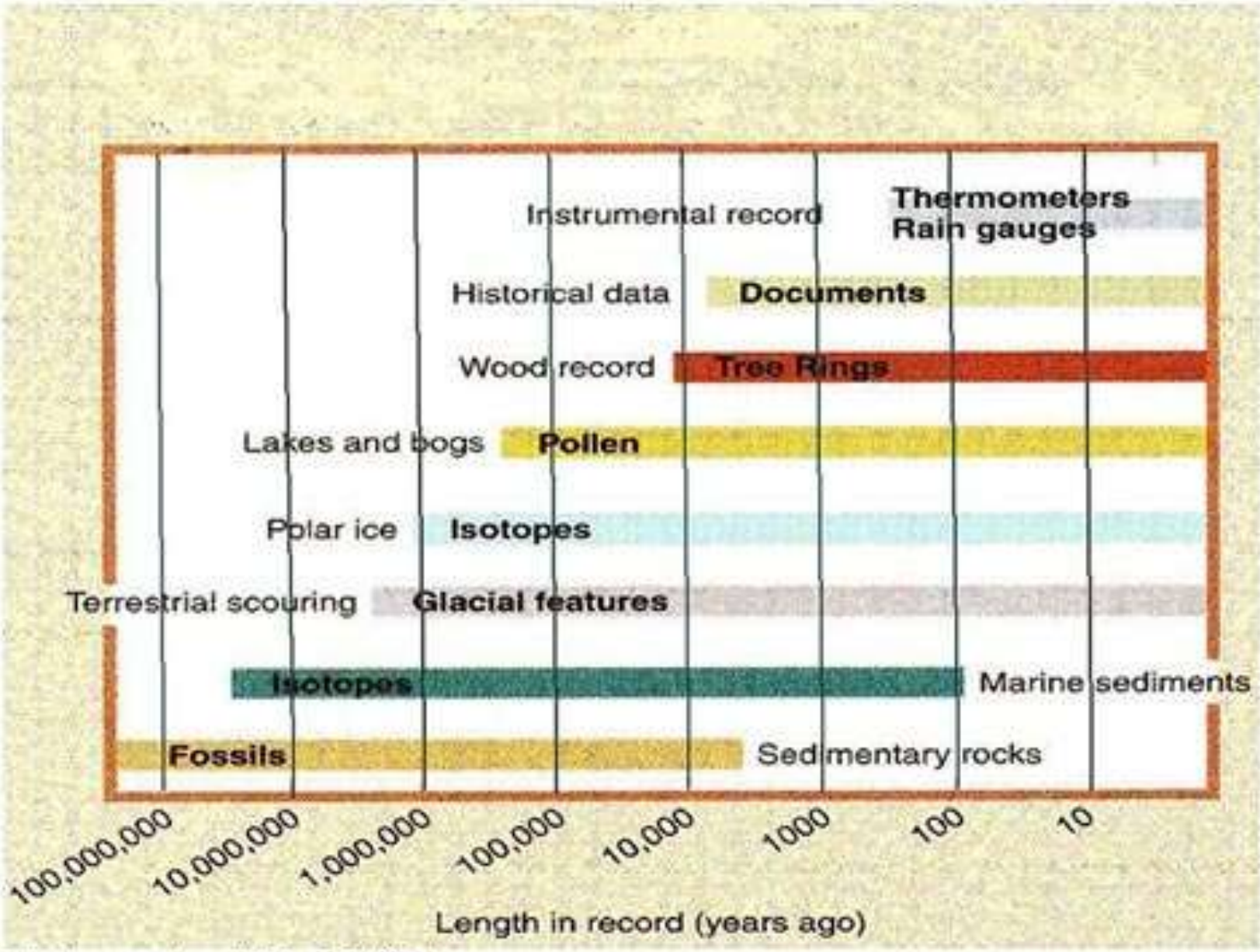


Photo courtesy Friend of Science

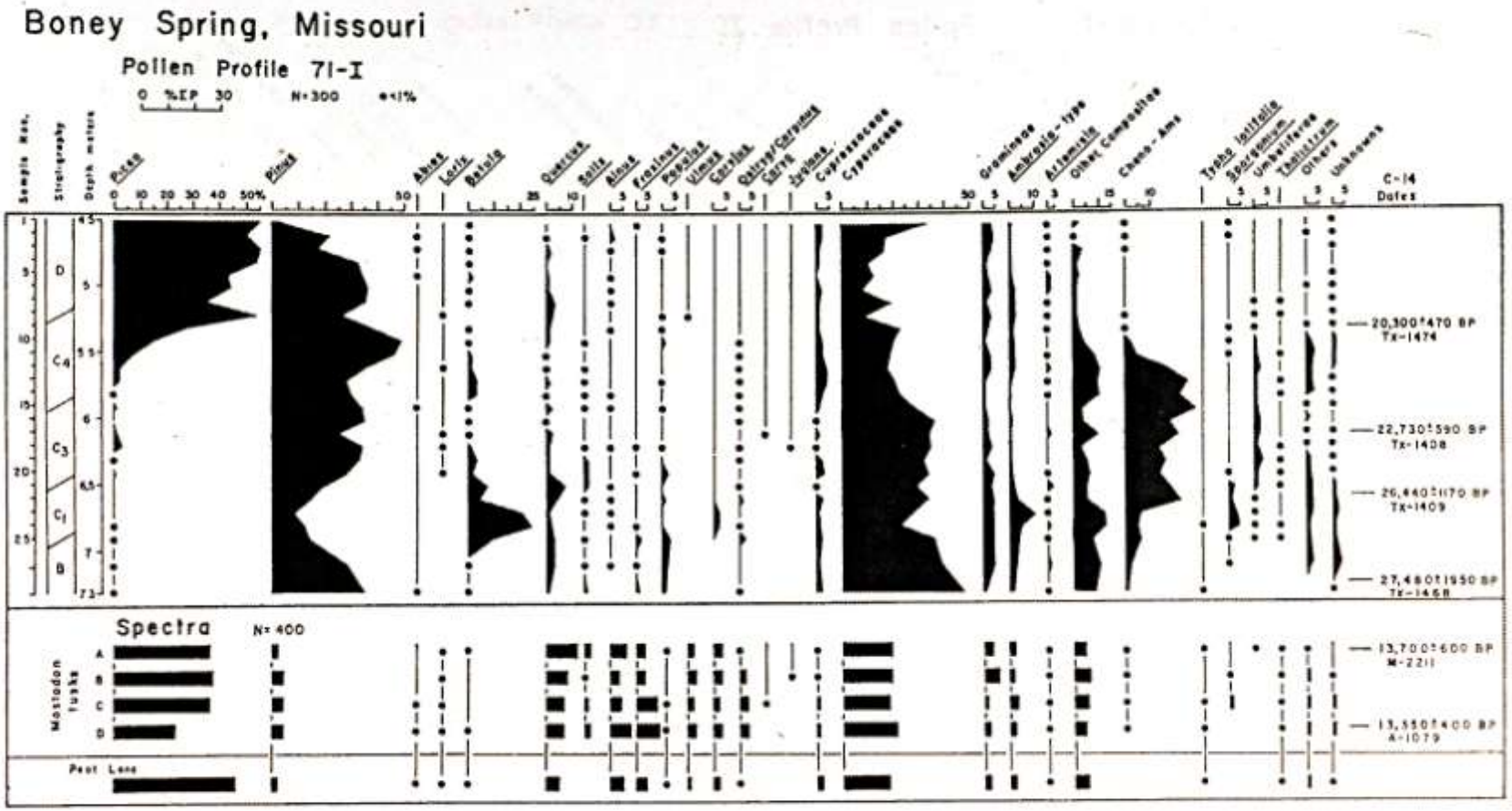
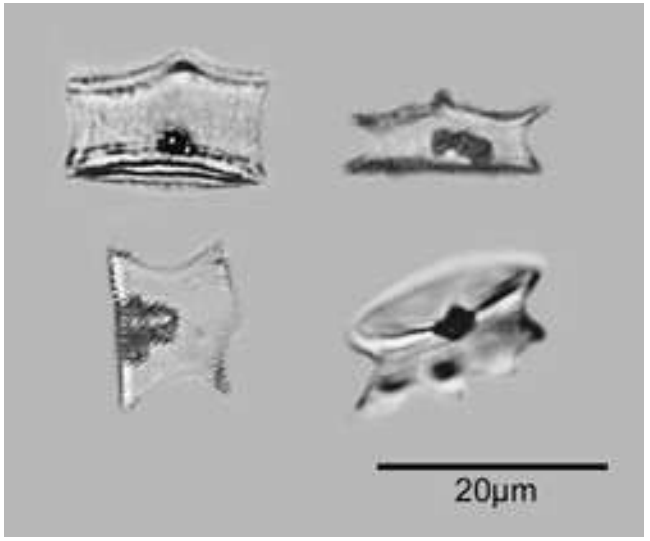


FIG. 16. Boney Spring pollen profile 71-I and miscellaneous pollen spectra. Only those radiocarbon dates associated with the profile are shown; the others are listed in Fig. 6 and 7. Other taxa include (sample 2) Polemoniaceae; (6) Polygonaceae; (9) Ranunculaceae; (10) Malvaceae, Onagraceae; (11) 3% Ranunculaceae; (12) *Myriophyllum*, Portulacaceae; (13) Liliaceae, Ranunculaceae, *Ribes*, Rosaceae; (14) *Myriophyllum*, Polygonaceae, *Potamogeton*, Ranunculaceae; (16) Leguminosae, Polygonaceae, Rosaceae; (17) Polygonaceae, Rosaceae; (18) Rosaceae; (19) Rosaceae; (20) *Potamogeton*, Rosaceae; (21) Leguminosae, Polygonaceae;

40,000 BP – non-arboreal, Cyperaceae, Pinus – open pine parkland
25,000 BP – full glacial, pollen shifts to Picea (spruce)
18,000 BP – retreat of glaciers, shift to oak, maple, willow, ash, elm, sedges and grasses
9,000 BP – oak-hickory forest
8,000 - 4,000 BP – Hypsithermal, higher tempeatures, open prairie
600-120 BP (1400-1880 AD - Little Ice Age, wetter, cooler
Recent - oak-hickory again became dominant the Ozarks

Phytoliths



Phytoliths from Corn Cobs

Phytoliths from Cucurbita

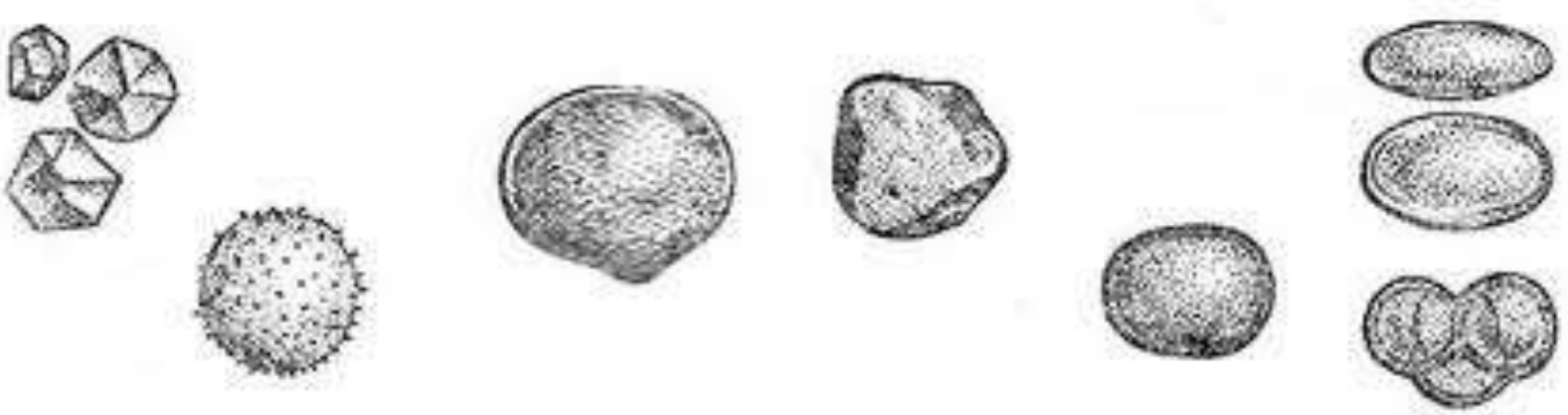
Forensic Palynology

Crime Scenes
Homicide
Genocide
Forgery
Production and distribution of illegal drugs
Assaults
Robbery
Rapes
Terrorism
Arson
Hit and run crimes
Counterfeiting of currency
Origin of fake prescription drugs

Forensics Palynology

Trace Evidence – present in minute amounts.
may also include fibres, hair, glass, etc

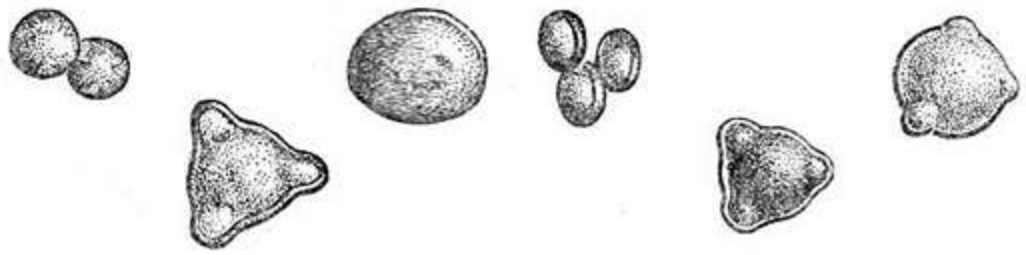
Pollen can be used in several ways.
Mainly used prove or disprove a link between people and objects with places or with other people
Can refute or confirm alibis
Can link people with crime scenes
Can be used by the defense to disprove a potential link



Characteristics of pollen that make it a useful scientific tool:

(1) Microscopic size – most pollen grains are 10-70 um in diameter (there are 1,000 um in a mm).
(2) Abundance - pollen is everywhere.
(3) Resistance to degradation - they can be preserved in rocks for millions of years.
(4) Complexity – most plant species produce pollen or spores that are different from pollen of other plant species.

Pollen evidence is as good as any other form of evidence, but it takes carefully implemented precautionary measures to ensure this evidence remains viable in court proceedings. Pollen samples must be very closely monitored and safeguarded against contamination to maintain their integrity.



Collecting Pollen Evidence

Dirt, Soil, Implements

Clothing

Shoes

Murder Crime Scenes

Collect surface soil samples to determine the types of plants and the pollen print of the crime scene

Use special vacuums or sticky tape to collect pollen from the suspect's car, clothes, shoes, and weapons

Recover pollen and spores in lab

Skeletal Remains

Archeological Site - burial

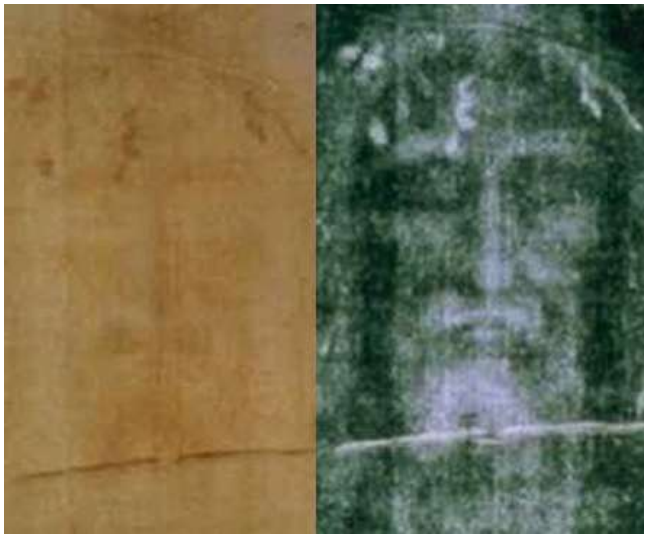
Medieval Burial

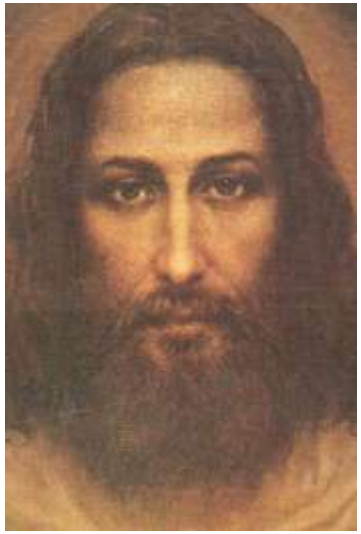
Spanish Civil War

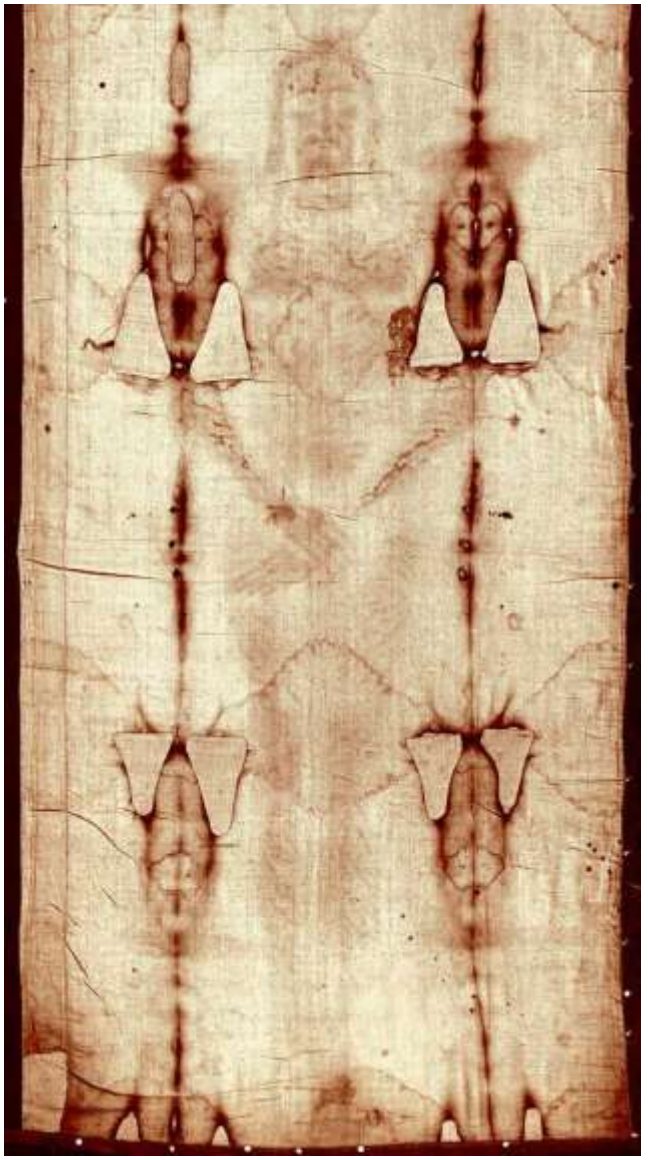
Bosnia - Genocide

Bosnian Genocide (1995), Forensic experts of the International war crimes tribunal inspect remains of the Srebrenica massacre victims in the Pilica mass grave on 24 July 1995.

Shroud of Turin - the fabric of the Holy Shroud is covered in pollen







Max Frei – 1973, collects pollen from the Shroud of Turin

Identified a total of 58 different pollens on the Shroud
Israel
Turkey
Europe

The places where pollens have been found by Dr.Frei: ✚

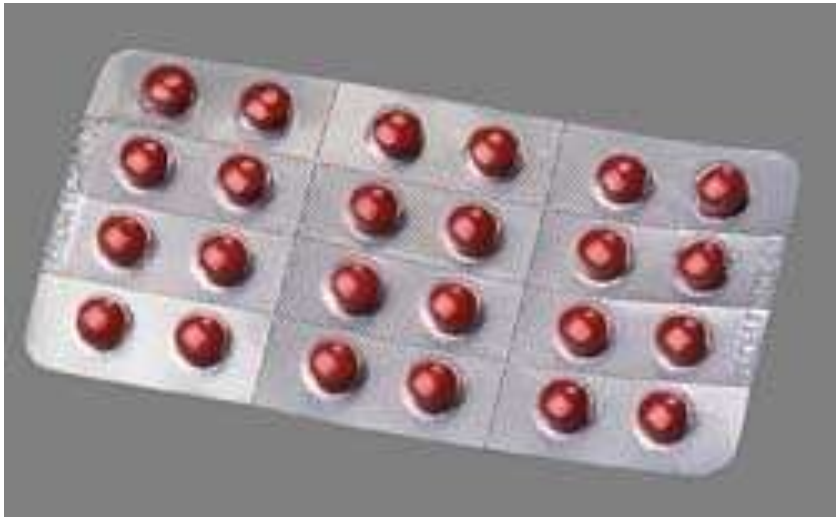
Other areas where the same plants grow: • →

↓ Alphabetic list of all the plants whose pollens have been found on the Shroud:

	France, Italy	Mediterranean area	Constantinople	Urfa/Edessa (Anatolia)	Jerusalem & environs	Iran - Turan	Arabia	Sahara	Regions of North Africa	
1 Acacia albida Del.					✚				•	Plant of deserts Most frequent around the Dead Sea
2 Alnus glutinosa Vill.	•									
3 Althaea officinalis L.	•	•			✚					Halophyte
4 Amaranthus lividus L.	•									
5 Anabasis aphylla L.					✚	•	•		•	Plant of deserts, halophyte. Frequent in South Palestine
6 Anemone coronaria L.		•			✚					
7 Artemisia Herba-alba A.				✚	✚	•	•		•	Plant of semideserts: Most frequent in the east of Jerusalem.
8 Atraphaxis spinosa L.				✚		•				Plant of deserts: Iran, Turan, Anatolia
9 Bassia muricata Asch.					✚					
10 Capparis spec.		•		✚	✚	•				Plant of semideserts. Frequent on rock debris and old walls
11 Carduus personata Jacq	•									
12 Carpinus betulus L.	•									

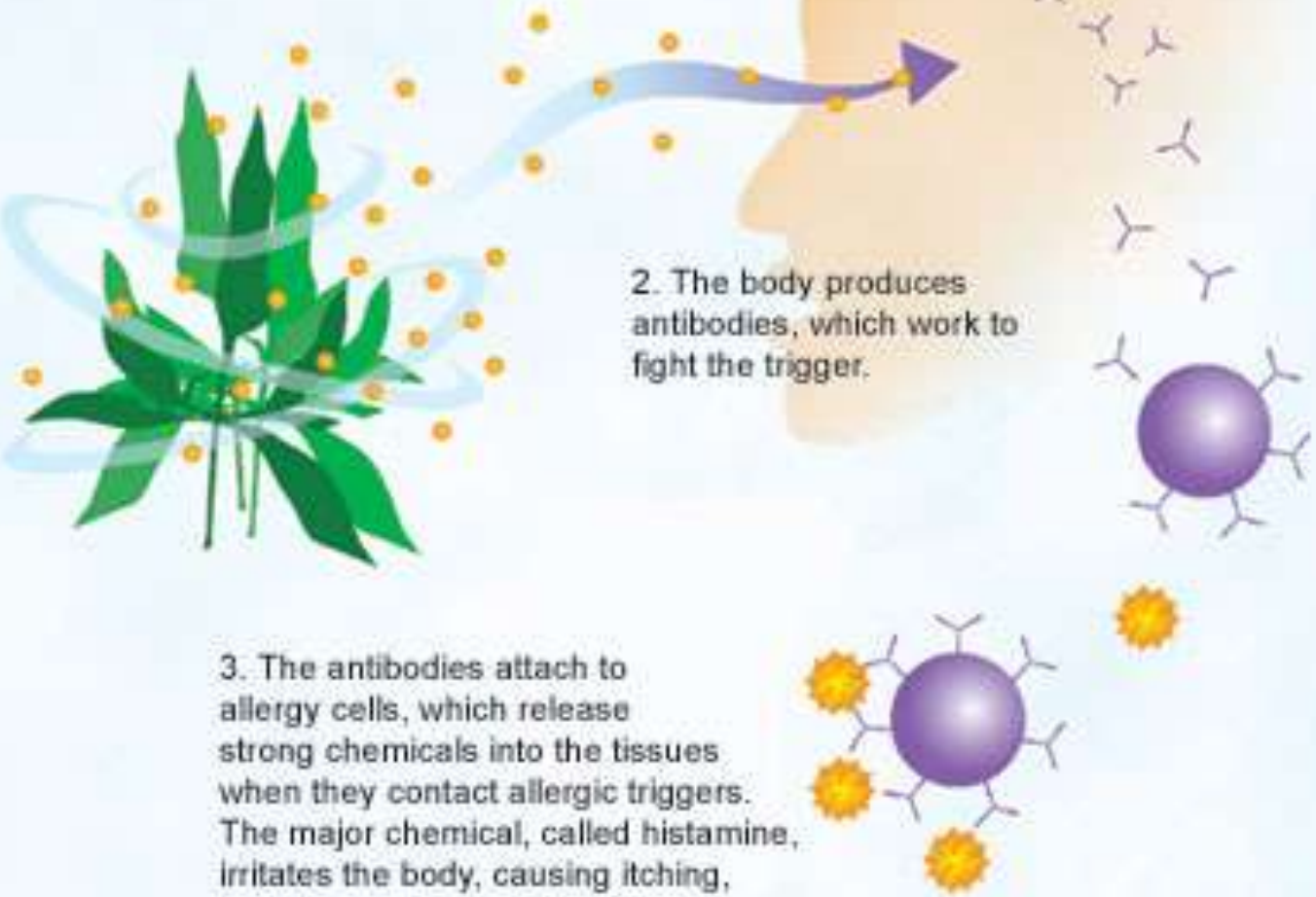
Source and Distribution of Illegal Drugs

Fake Drugs – track the source



How allergies make us sneeze and wheeze

1. Pollen, dust or animal skin flakes enter the eyes, nose or lungs. When these allergic "triggers" enter the bodies of people who have allergies, their immune systems overreact.



2. The body produces antibodies, which work to fight the trigger.

3. The antibodies attach to allergy cells, which release strong chemicals into the tissues when they contact allergic triggers. The major chemical, called histamine, irritates the body, causing itching, swelling and tearing.

Source: American Academy of Allergy, Asthma and Immunology


GESUNDHEIT!
—NEWS—
VERY HIGH POLLEN COUNT!
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End