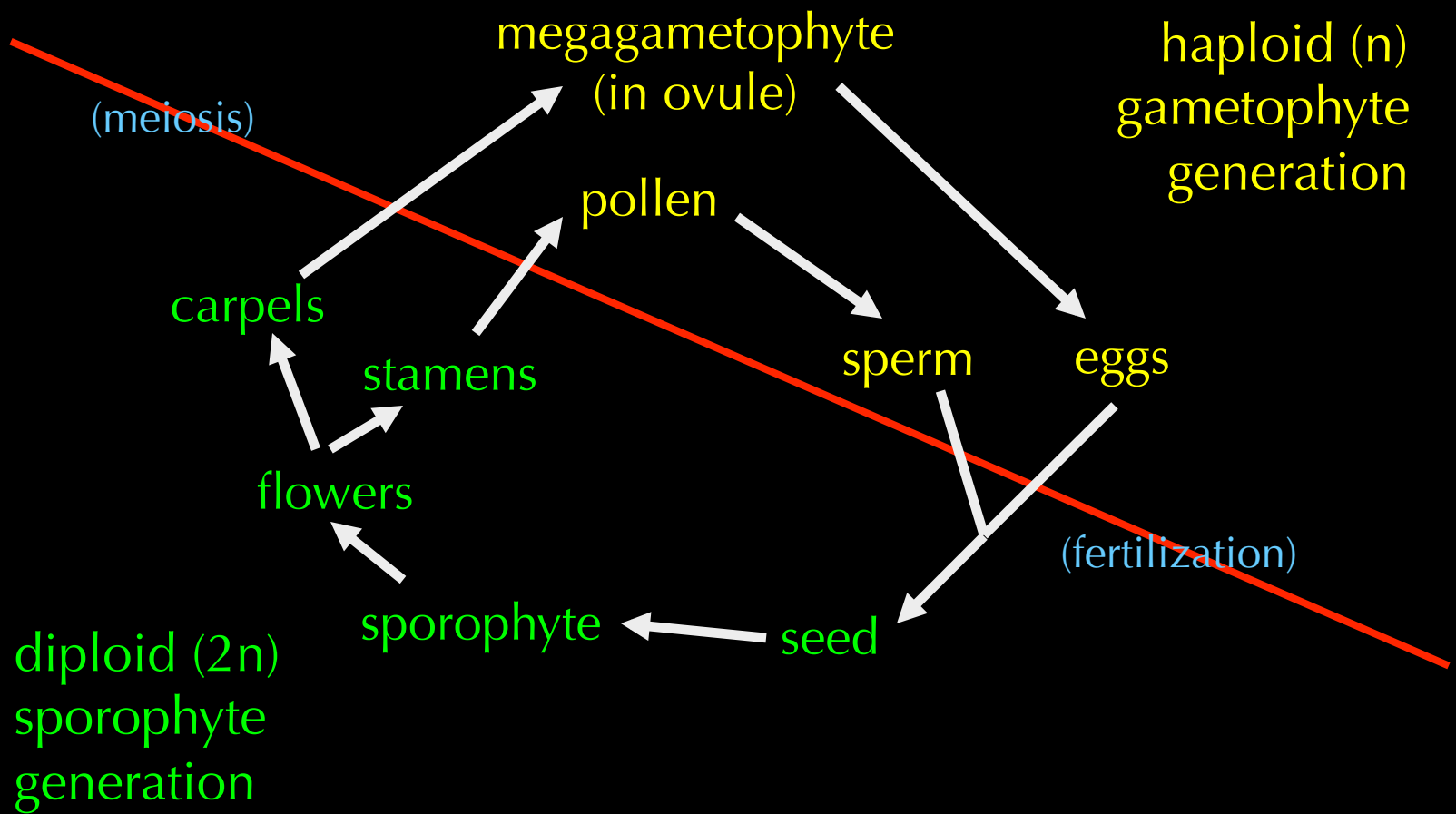
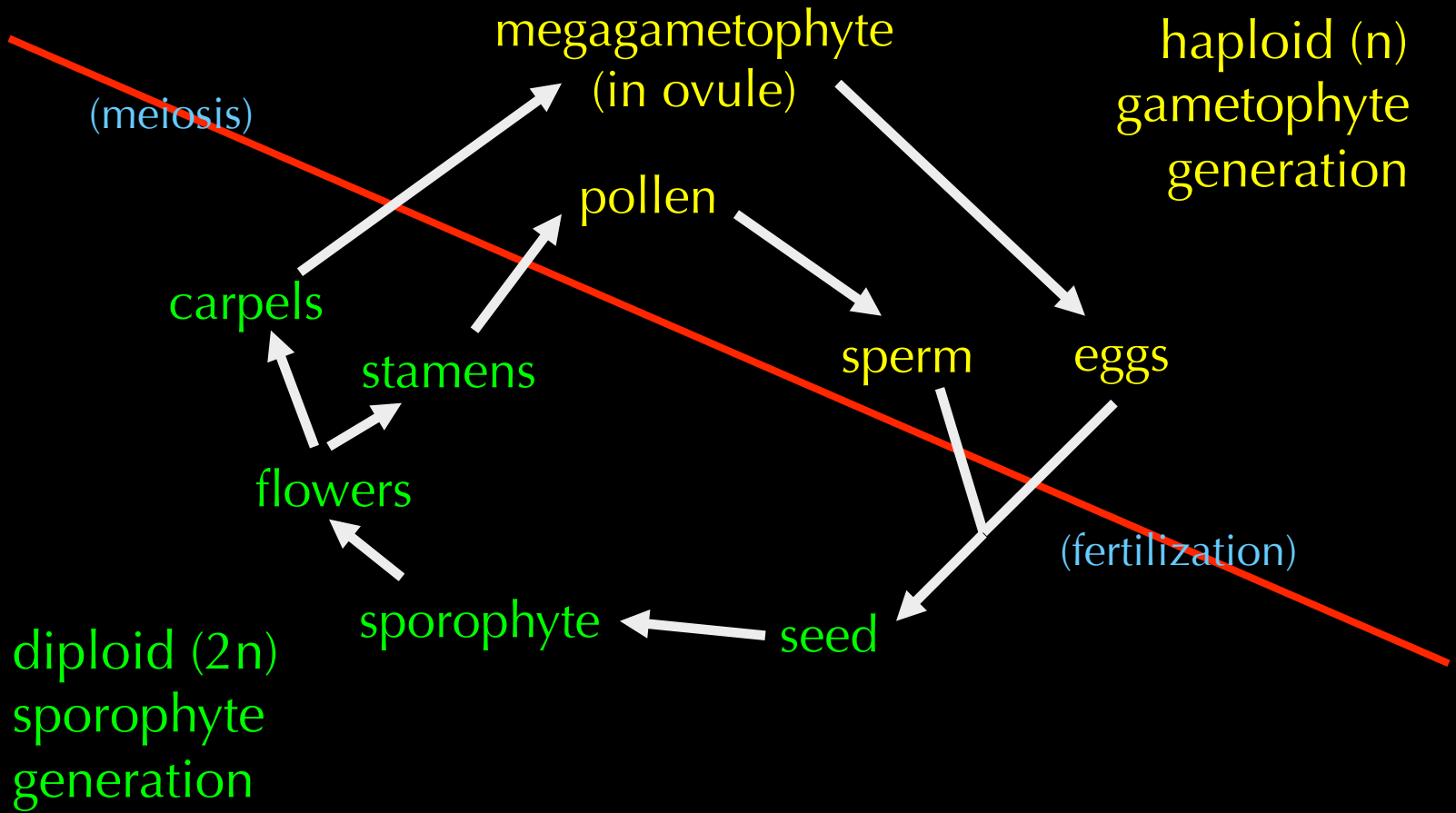

Sexual behavior in plants:
autoeroticism,
ménages á trois,
and other deviations

Basic flowering plant life cycle

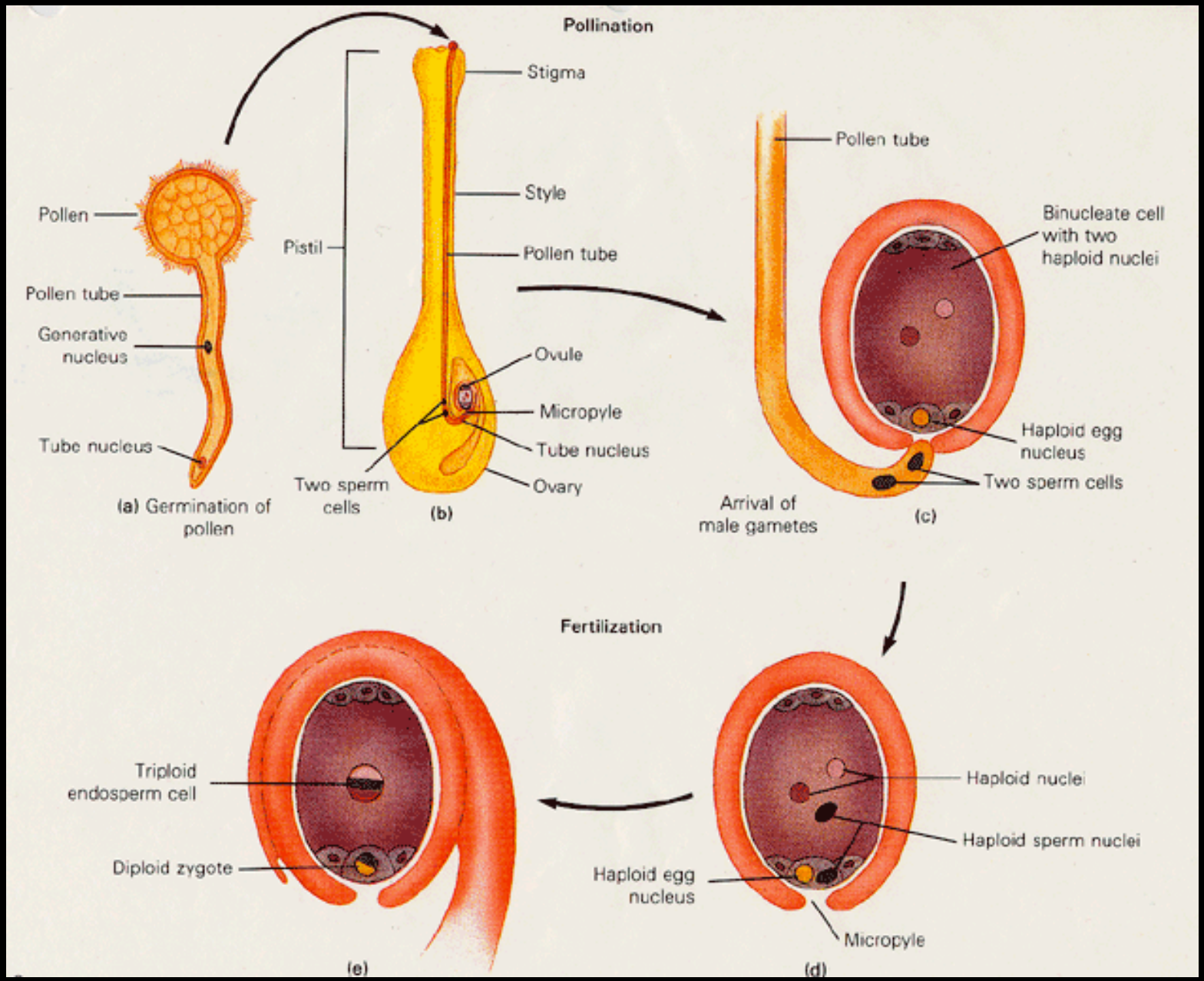


Pollen ≠ sperm!

- two separate processes:
  - pollination (transfer of pollen from anther to stigma)
  - fertilization (union of a sperm & egg)



Pollination & fertilization



Breeding systems

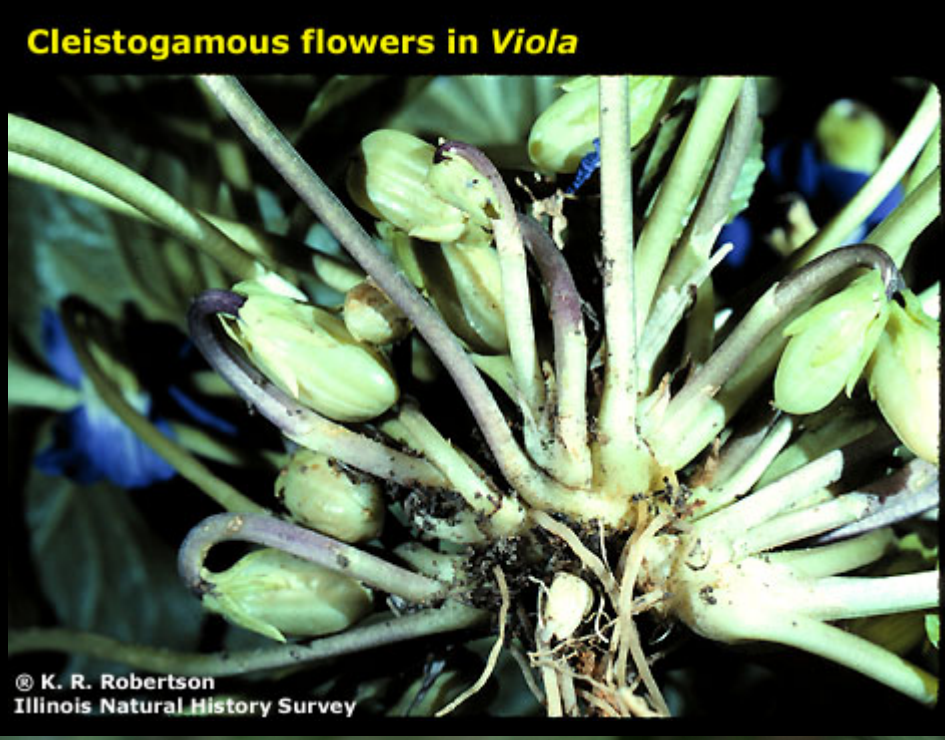
- selfing (autoeroticism): pollen from one sporophyte lands on the stigma of, & fertilized eggs in the ovary of, the same sporophyte;
- out-crossing (often with a ménage á trois): pollen from one sporophyte lands on the stigma of, & fertilized eggs in the ovary of, a different sporophyte;
- asexuality (virgin birth).

Selfing

- selfing typically occurs "accidentally"—stamens are usually in the vicinity of stigmas;
- without mechanisms to promote out-crossing, this often results in selfing.

Selfing

- cleistogamous flowers do not open; pollen is shed within the closed flower and has no opportunity to land on another flower;
- most plants that produce cleistogamous flowers *also* produce chasmogamous (open) flowers.



Out-crossing

- requires some mechanism to move pollen between flowers;
- often accompanied by morphological or genetic means of preventing or reducing selfing.

How pollen moves…

abiotic:

- wind pollination
- water pollination (rare!)

biotic:

- **insects**
  - bees
  - butterflies
  - moths
  - flies (carrion flies or pollinating flies)
  - beetles
- birds
- mammals (mostly bats)

Abiotic: Wind pollination

- pollen (lots of it!) shed in the wind
- usually little or no investment in petals, nectar, etc.
- stigmas usually with large surface area, fairly sticky
- grasses!

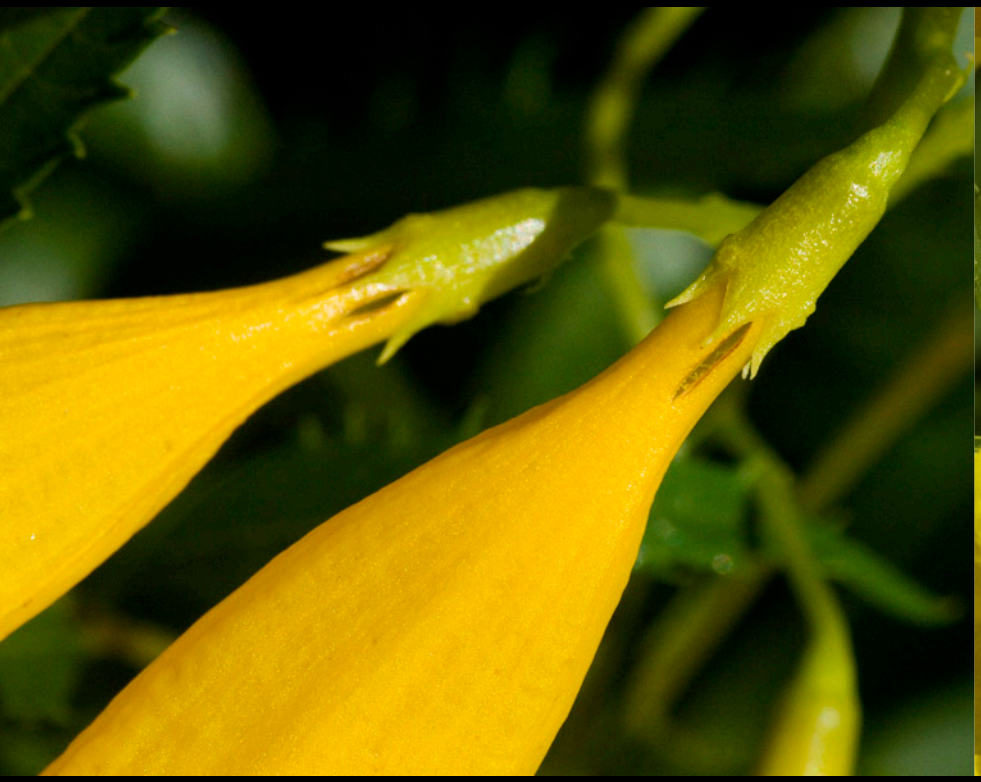
Biotic pollination: Why?

- the benefit for plants is straightforward: pollinators move pollen around much more efficiently than the wind;
- pollinators paid in food (nectar and/or pollen; the "oldest profession");
- pollinators *tricked* by a false promise of food.

photo: Martin Heigan

Biotic pollination: theft & deviance…

- pollinators often engage in theft…



Biotic pollination: theft & deviance…

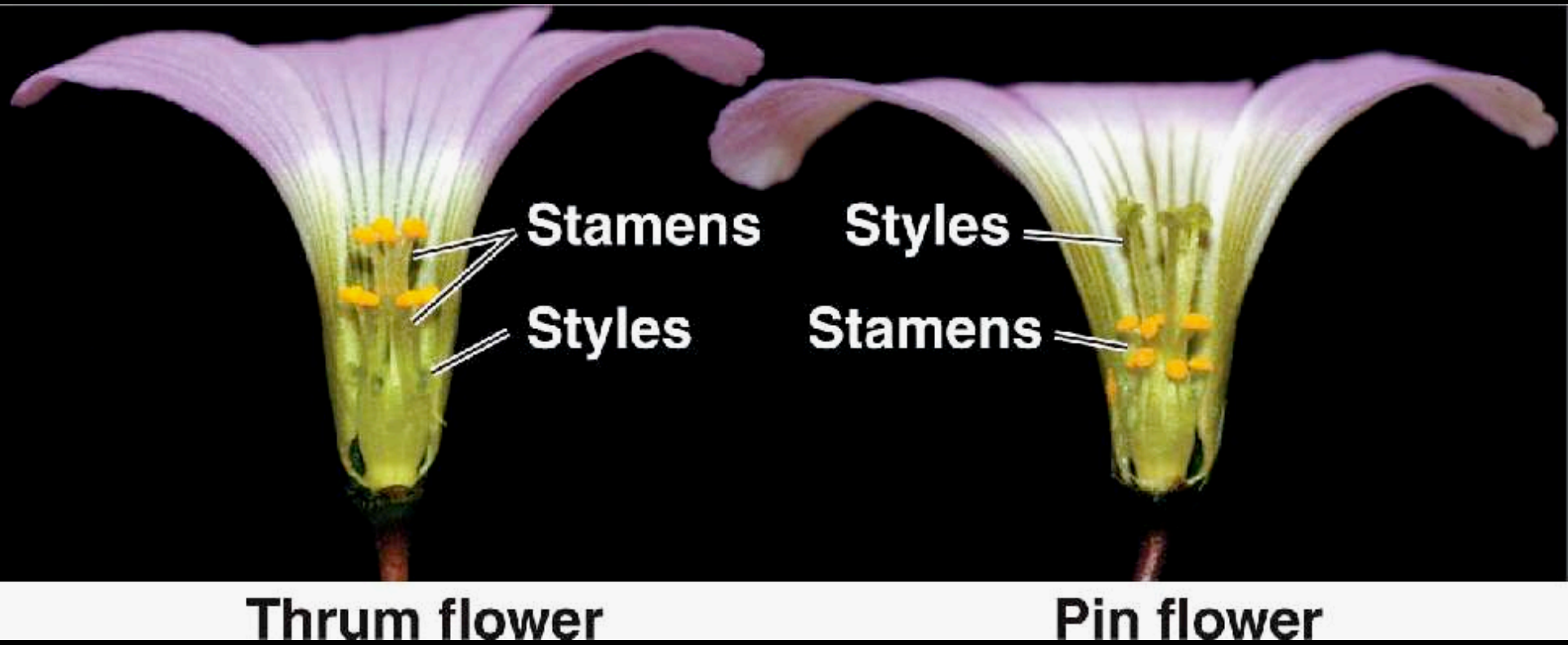
- and some plants take trickery perhaps too far…

Out-crossing

- so, we can move pollen around—but how do we prevent selfing?
  - morphology:
    - perfect flowers may have morphologies that reduce self-pollination
    - imperfect flowers also increase the likelihood of out-crossing; and when a plant is dioecious, out-crossing is *obligate*
  - genetics:
    - self-incompatibility genes can prevent self-fertilization if self -pollination occurs

Out-crossing: perfect flowers

- heteromorphic spatial separation of stamens & stigmas promotes out -crossing



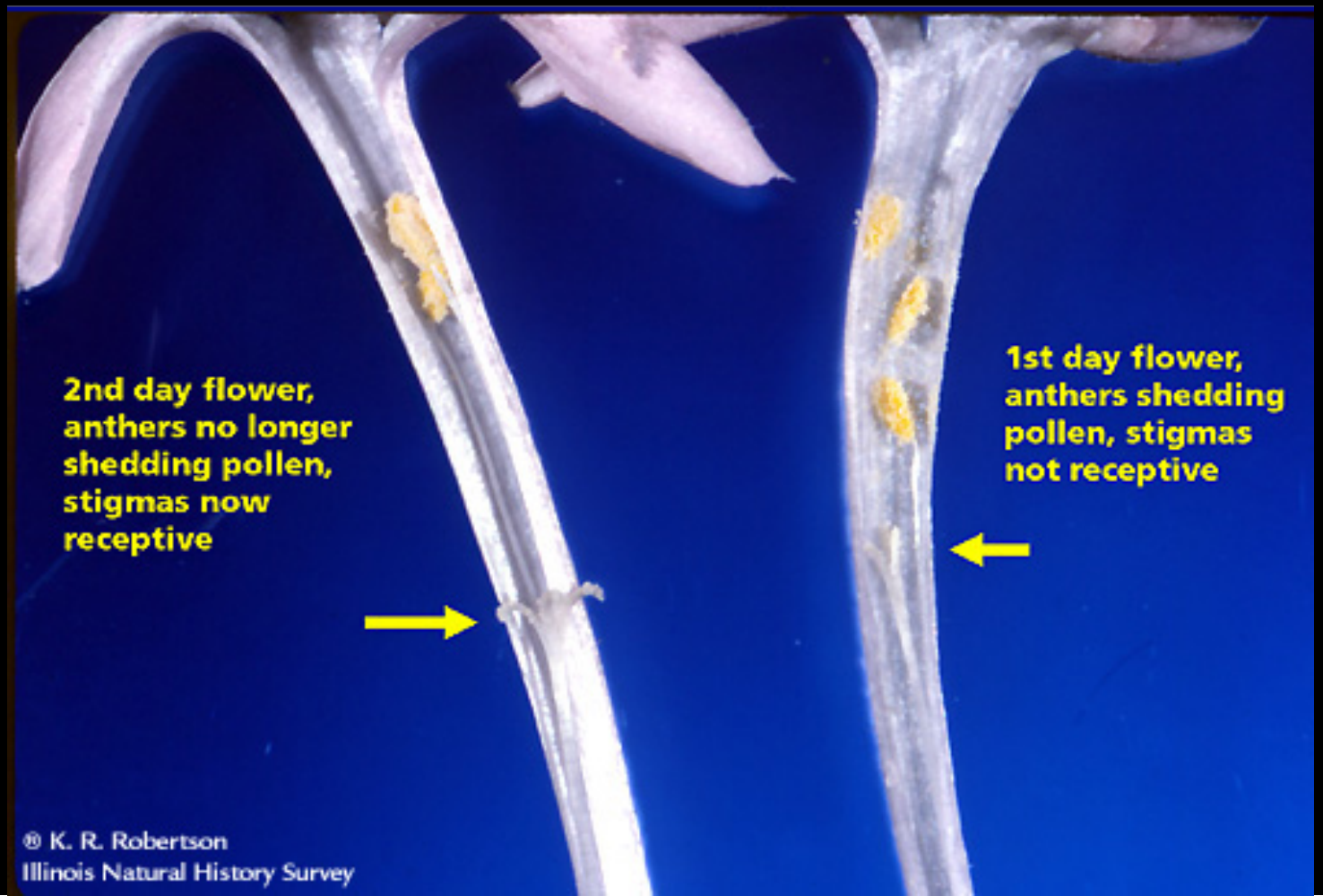
Out-crossing: perfect flowers

- temporal separation of pollen release & stigma receptivity promotes out-crossing

- protogyny: the stigma is receptive *before* the stamens dehisce

Out-crossing: perfect flowers

- temporal separation of pollen release & stigma receptivity promotes out-crossing
- protandry: the stamens dehisce before the stigma is receptive



Out-crossing: imperfect flowers

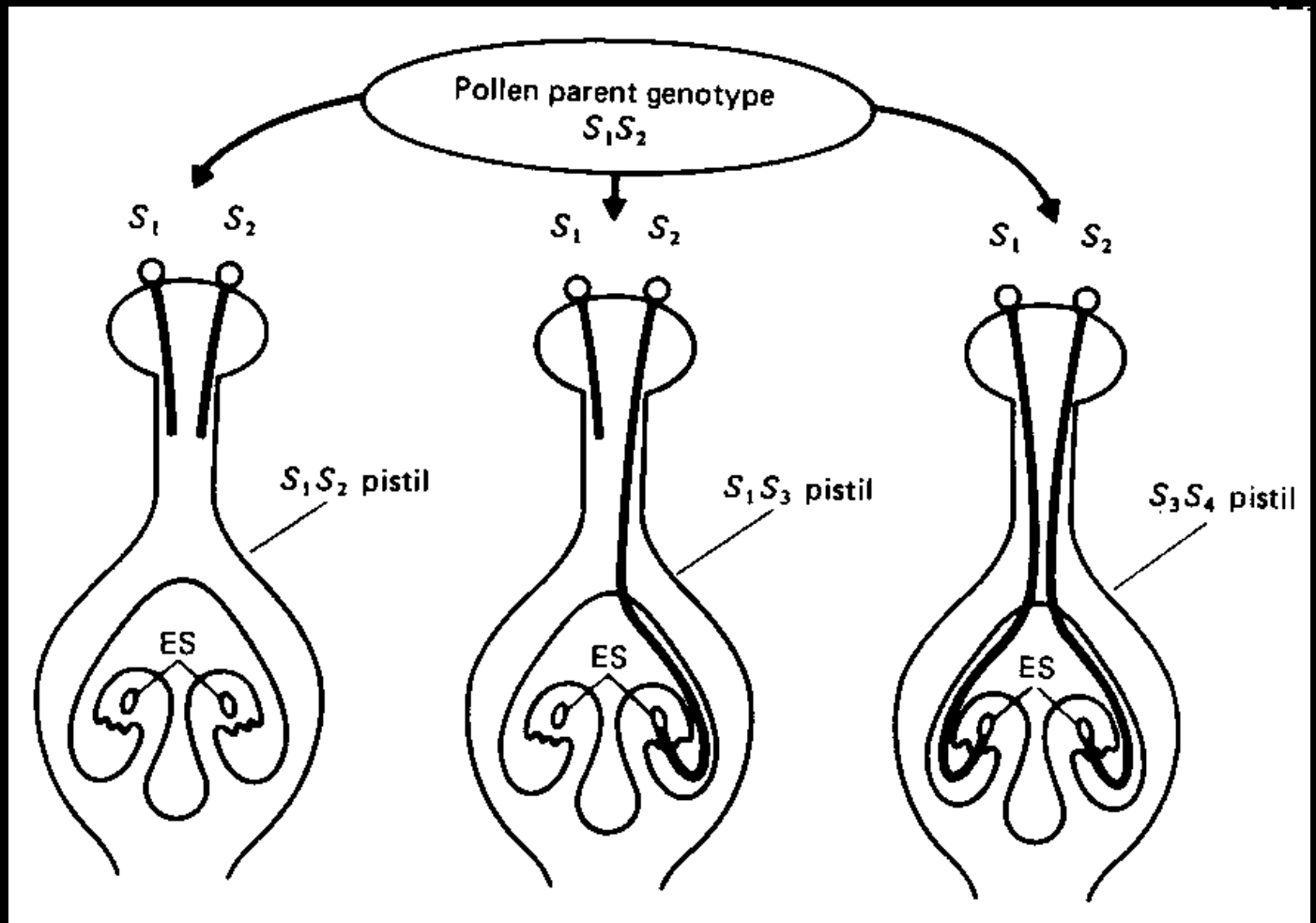
- self-pollination of a single flower is impossible when plants have imperfect flowers:
- self-pollination of different flowers on a single plant is possible when the plant is monoecious;
- but self-pollination of any kind is impossible in dioecious plants.

Out-crossing: imperfect flowers

- dioecy is sometimes accompanied by the evolution of sex chromosomes like those present in mammals & many other animals;
- this occurs in some *Silene*.

Out-crossing: genetic self-incompatibility

- genetic self-incompatibility prevents self-fertilization even if self -pollination occurs;
- self-incompatibility may be either gametophytic (shown below) or sporophytic.



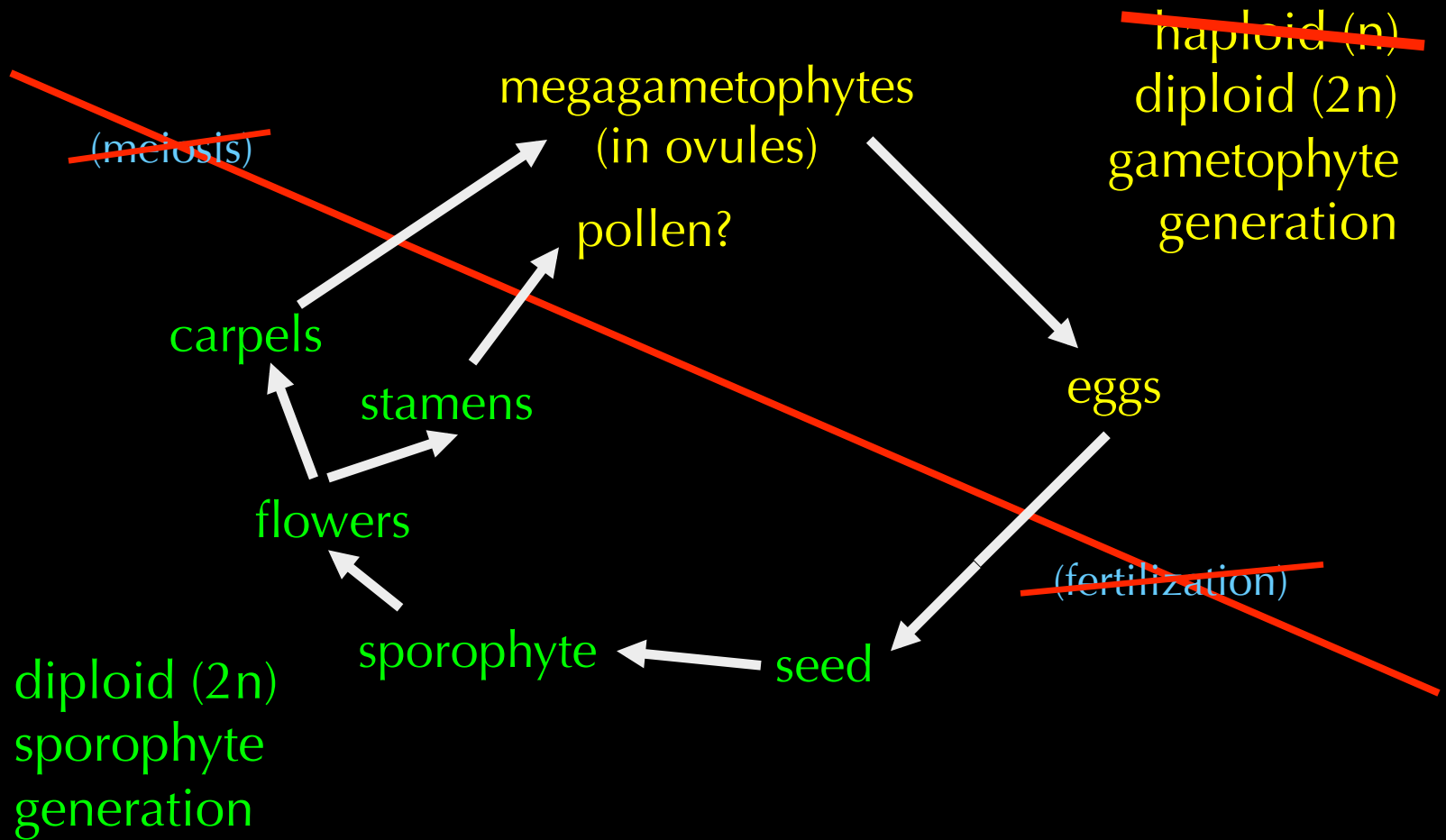
Asexual reproduction: vegetative

- vegetative reproduction: reproduction without flowers or seeds, by means of modified stems or leaves (rhizomes, stolons, plantlets, etc.).

photo: poppy2323 (flickr)

Asexual reproduction: apomixis

- apomixis: production of seeds without fertilization; typically through modification of meiosis; usually associated with hybridization.



Why all this variation?

- out-crossing promotes genetic diversity;
- self-fertilization, on the other hand, results in inbreeding but can be a "sure thing" in sparse populations or harsh years.
- asexuality doesn't run the risks of inbreeding, but does not promote any new genetic diversity.