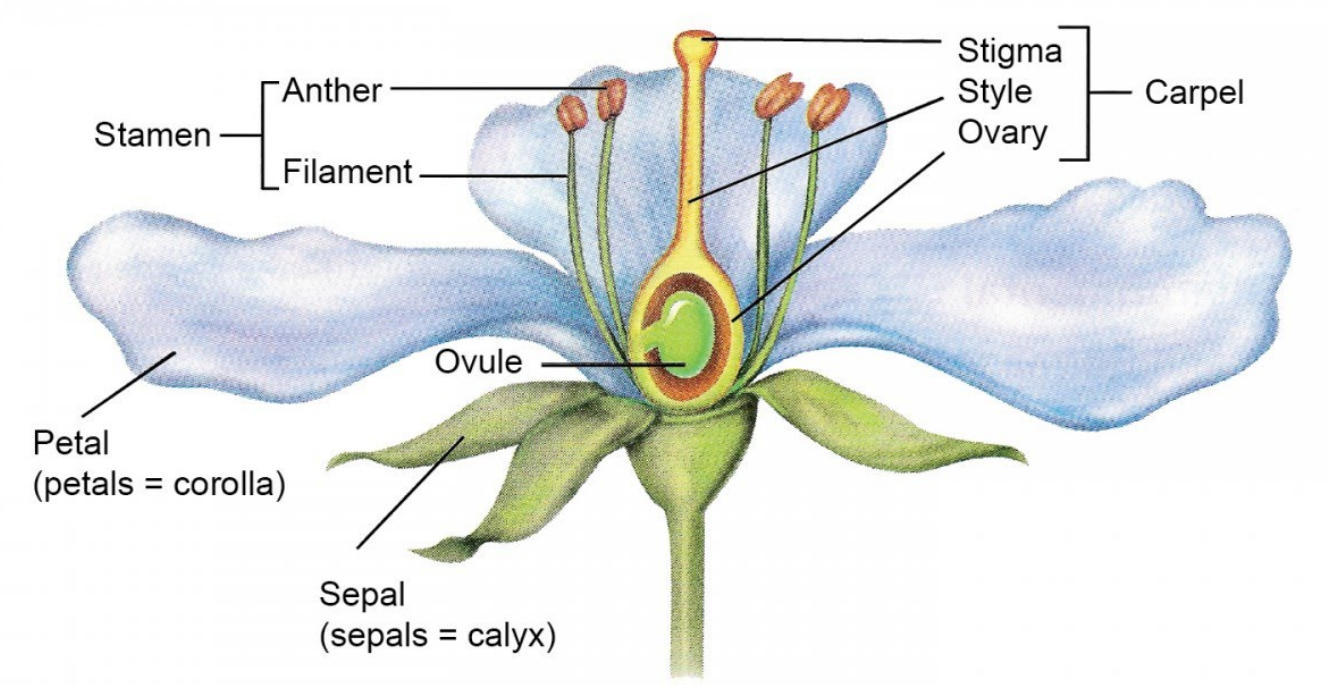
Sexual reproduction in plants

Pollen grains and the embryo sac

A bit equivalently to mammalian sexual reproduction, sexual reproduction in plants involves complementary gamete cells that join to create a zygote that further develops into a new organism of that species.

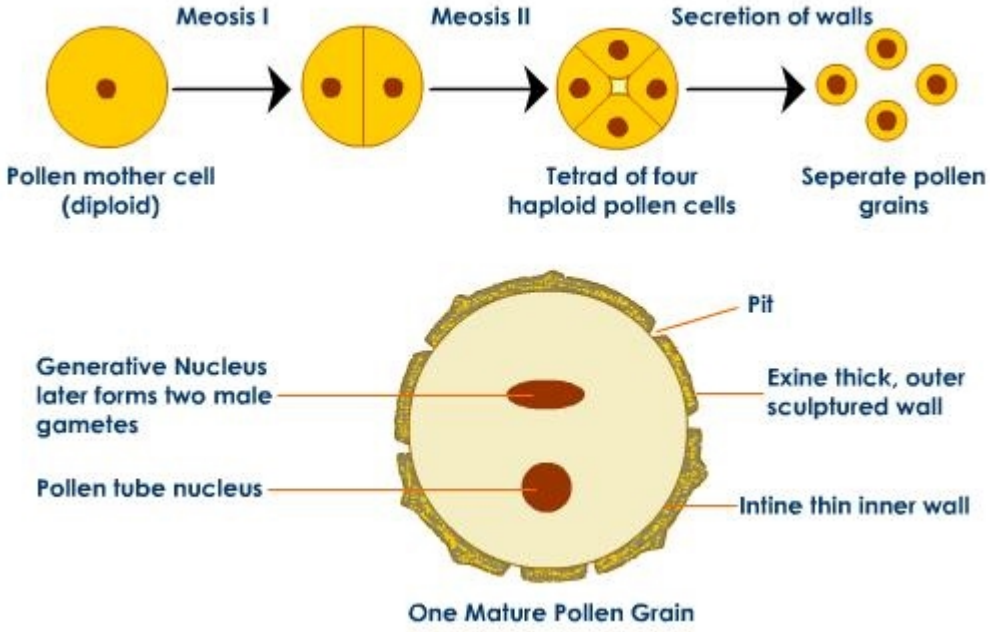
In plants, **pollen grains** are equivalent to spermatozoa in mammals, while the **embryo sac** is equivalent to the ovum. Instead of forming a blastocyst where the embryo starts developing inside a developing placenta, they form a zygote inside a **seed** that also contains nutrients that the little zygote can use once it starts growing. Yes, we are about to learn about plant reproduction and the events that lead to seeds!

In terms of the formation of pollen grains and embryo sacs, the sequence of **meiosis** and **mitosis** between precursor stages of development is similar to that in mammals. Instead of mammalian testes and ovaries, plants have equivalent structures called **anthers** and **ovules**.

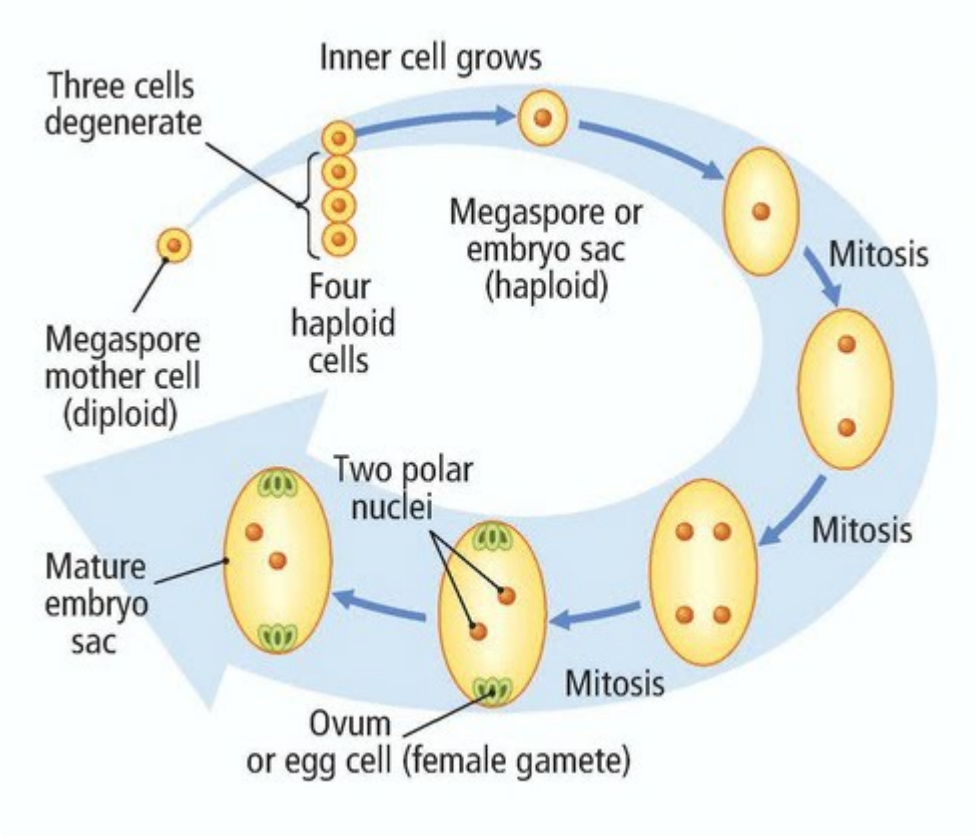


You might notice the ovule is inside a structure also called ovary. The flower ovary is what later develops into fruit. You know, apples, pears, etc. Their seeds are what is created as a result of the processes about to be outlined, inside the ovule. Another point to note is that both reproductive structures, anthers and ovules are present in the same flower. There are species that only have one or the other, but it's common for them to have both. Hence, **self-pollination** versus **cross-pollination** – by the same flower, or between separate flowers.

Pollination is the journey of the pollen grain from the anther down the style of the ovary to reach the ovule. But first, how are pollen grains and embryo sacs developed?

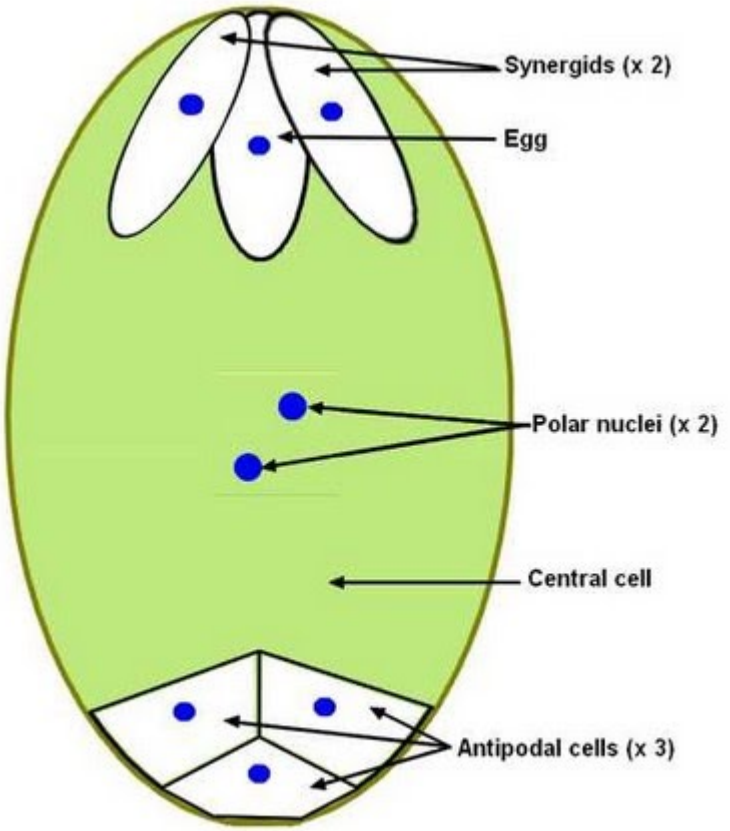


Similarly to mammalian gametes, precursor **pollen** cells undergo meiosis to form 4 offspring cells that become the mature pollen grains. These have specific structure that take part in different aspects of fertilisation, namely the **generative nucleus** which gives rise to the male gametes proper and contributes to the final zygote once in the ovule, as well as the **tube nucleus** whose function is to transport the pollen to the embryo sac in the ovule.



The development of the **embryo sac** involves many divisions. The first is **meiosis** which results in one **inner cell** that develops further and 3 other cells that degenerate (remember polar cells in ovum development in mammals? same thing!). This is now the embryo sac. and it undergoes **mitosis** three times. The final mitosis of a 4-nucleus cell results in the embryo sac having 8 nuclei.

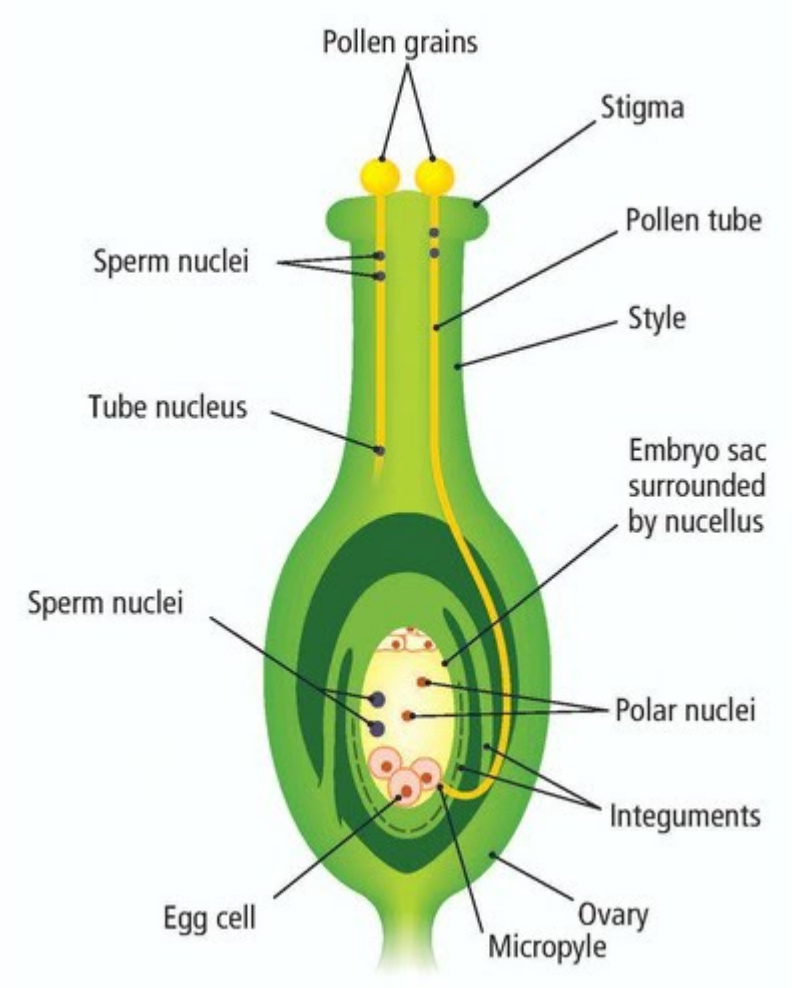
That's a lot of nuclei. One of them develops into the **ovum** or egg cell proper, while two nuclei become **polar nuclei** and will later contribute to the nutrients in the seed, alongside one of two of the pollen grain's gametes arising from its generative nucleus. The remaining two cells either side of the egg are the *synergids* which are thought to assist the pollen nucleus reach the egg, while the opposing 3 cells on the other end of the embryo sac are the *antipodal cells* which may contribute to embryo nutrition.



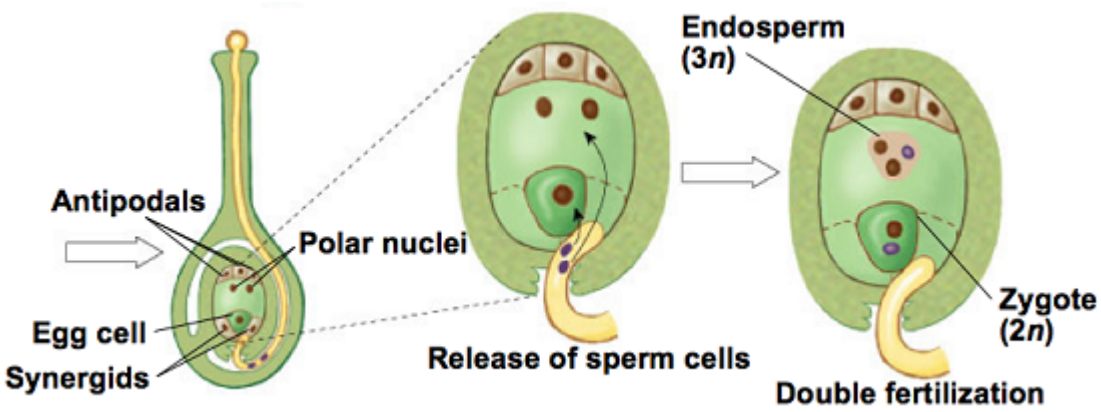
Embryo sac of an Angiosperm

Pollination and fertilisation

Finally, the fun part! The pollen grain makes its way towards the embryo sac down the style of the ovary. The **tube nucleus** develops into a **pollen tube** which with the help of digestive **enzymes** that can break away through the style travels down towards the embryo sac.



Once the two pollen gametes reach the embryo sac, one of them fertilises the egg to create the **zygote** which will develop into the actual new plant, while the other pollen nucleus has a threesome with the two polar nuclei to form the **triploid endosperm** which provides the nutrients for the zygote later in development.



And then this little thing is a seed! And there may be many of them within an ovary which then grows into apples and pears and etc.! Such fun.

Ok byeeee