During meiosis one cell divides into four daughter cells. Those daughter cells have only half of the mother cell's genetic material (DNA) and are called gametes. During fertilization, one gamete from a mother (egg cell) and one gamete from a father (sperm cell) join together to create a zygote, which have full portion of DNA and will eventually develop into a new organism. However, who decides what portion of parents' genetic information enters into a gamete (e.g. which half)?

A diploid organism has two sets of DNA, that is packed into structures called chromosomes and each chromosome is present in two copies. During meiosis, a phenomenon called crossing-over occurs (or in other words: meiotic recombination), where chromosomes pair with their identical partners, homologs, and exchange portions of DNA between each other. This exchange of chromosomes fragments creates new genetic combinations in the offspring – this is the reason why two siblings are not identical.

There are many factors influencing the localization and frequency of meiotic recombination. One of them is the presence of polymorphisms between two homologous chromosomes. DNA contains two strands, built with small bricks called nucleotides. Each nucleotide contains one of four bases, which pair with another base from a second DNA strand in a specific way. Polymorphisms (mismatches) appear when a base is paired with a wrong partner. Those can be recognized and repaired by a conserved mechanism called mismatch repair system (MMR). In our previous studies, we were able to prove that members of MMR can affect distribution of crossovers in response to polymorphism presence. In the proposed project we plan to investigate possible genetic interactions between MMR and recombination machinery proteins, as some of them might also react to mismatches.

This might shed more light into the decision of crossover formation and might bring us closer to the ability to design recombination in plants. Breeders would like to specifically target crossover events into places on the chromosome where desirable genes are present – for instance, those responsible for higher productivity or resistance to environmental stresses.