

MENDEL'S PEAS

Gregor Mendel's seven pea plant traits, which laid the foundation of genetics, were long understood only at the phenotypic level. Over recent decades, researchers identified the molecular basis for four of these traits. In a major milestone, this new study, which appeared in *Nature*¹ (see also the comment in *Science*²), finally reveals the genetic basis of all seven of Mendel's original traits.

Using a massive genomic analysis involving nearly 700 pea varieties, researchers created a detailed variation map with 155 million SNPs. They confirmed and extended the knowledge about the known genes for: seed shape, seed color, flower color, and plant height, and, crucially, identified the genetic causes of the three previously unresolved traits:

- Pod color (Gp): Linked to a large deletion (~100 kb) near the *ChlG* gene, affecting chlorophyll synthesis and leading to yellow pods.
- Pod shape (P and V loci): Two genes were found (*PsCLE41* and *PsMYB26*) which affect secondary cell wall development and pod "parchment" formation, critical for edible versus inedible pods.
- Flower position / Fasciation (Fa): A 5-bp deletion in a *CIK*-like receptor kinase gene (*PsCIK2/3*) explains the fasciated stem phenotype, modulated by an additional modifier locus (*Mfa*).

The work used a combination of Genome-wide association studies (GWAS), genetic mapping, RNA sequencing, and functional tests like mutant analysis to pinpoint these genes. Notably, this research highlights how Mendel intelligently chose simple, easily trackable traits (what we now call "simple Mendelian traits") after carefully testing many other pea characteristics. His focus on traits controlled by major, easily segregating alleles was key to the clarity of his discoveries.

Beyond solving the historical mysteries, the study also opens new breeding possibilities by identifying many genes affecting agriculturally important traits (like seed size, pod width, and plant architecture).

1. <https://www.nature.com/articles/s41586-025-08891-6>
2. <https://www.science.org/content/article/massive-pea-study-solves-last-genetic-riddles-famed-friar>