Geometric and mechanical guidance in Arabidopsis' fertilization

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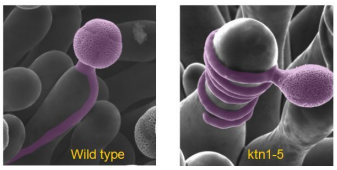

In Arabidopsis thaliana, successful fertilization relies on the precise guidance of the pollen tube as it navigates through the female to deliver sperm cells to ovules. While prior research has focused on pistil signals directing pollen tubes towards the ovules, the pollen tube growth within the stigmatic epidermis has received limited attention. Comparison between pollen tube paths in wild-type and katanin1-5 stigmatic cells revealed a striking influence from the mechanical properties of the invaded stigmatic cell : pollen tubes coil at the surface of ktn1-5 papillae instead of heading toward the ovule with a straight trajectory. We explored the possible trajectories in a geometrical model where pollen tubes follow the geodesics of the papillae, and infer from comparisons between the theoretical phase diagram and numerous experimental observations that in wild-type papillae, the pollen tube should be guided by anisotropic mechanical properties. We quantitatively explain this latter by a combination of adequate elastic and geometrical features at the papilla's scale.