BioFrontiers - Biology Seminar

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Life Sciences Building - A117

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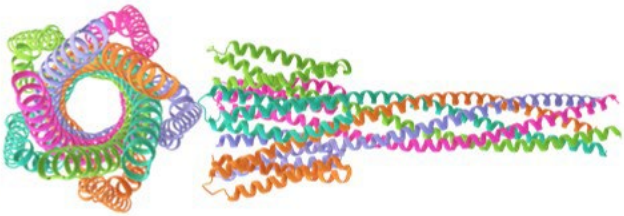
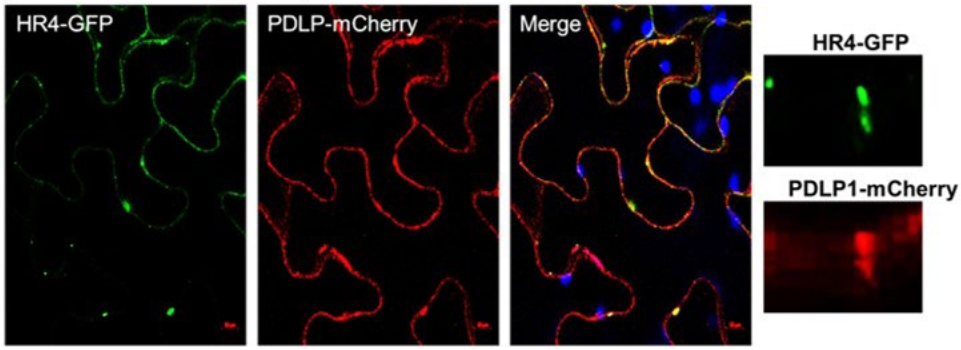
The dual shield: HR4, an immune protein, modulates plant defense against aphid & viruses

Insect pests destroy an estimated 18–26% of global crop production, and their control still relies largely on insecticides. The green peach aphid (GPA; *Myzus persicae*) feeds on the phloem sap of more than 400 plant species across nearly 50 families, yet most of its economic impact stems from its role as a vector of over 100 viruses, with global losses estimated at US $30-60 billion annually. Host genetic resistance to GPA is rare and typically narrow in scope. *HR4* (*HOMOLOG OF RPW8 4*), a recently evolved gene, which is present in only a subset of *Arabidopsis thaliana* accessions, limits GPA infestation. Its close homolog RPW8 confers resistance to both powdery mildew and downy mildew, diseases caused by fungal and oomycete pathogens, respectively. This cross-kingdom activity distinguishes the HR4/RPW8 family from race-specific resistance genes and points to a broad-spectrum mechanism distinct from canonical effector recognition. In addition to conferring resistance to the GPA, insect infestation was found to induce an HR4-dependent antiviral response; the *hr4* mutant plants exhibit greater growth retardation following viral infection. A plant that activates antiviral immunity upon sensing its insect vector, before the virus arrives, represents a defense strategy not yet exploited in agriculture. The HR4-conferred resistance to GPA can be transferred to the oil seed crop *Camelina sativa,* which is naturally susceptible to GPA, highlighting the potential of *HR4* for engineering integrated resistance to aphids and aphid-vectored viruses, for sustainable crop protection.