



Investigations into the mechanisms of activation of the MrRUN1 and MrRPV1 resistance proteins and the signal transduction pathways leading to resistance to grapevine powdery and downy mildew

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Portan



Portan + *MrRUN1*



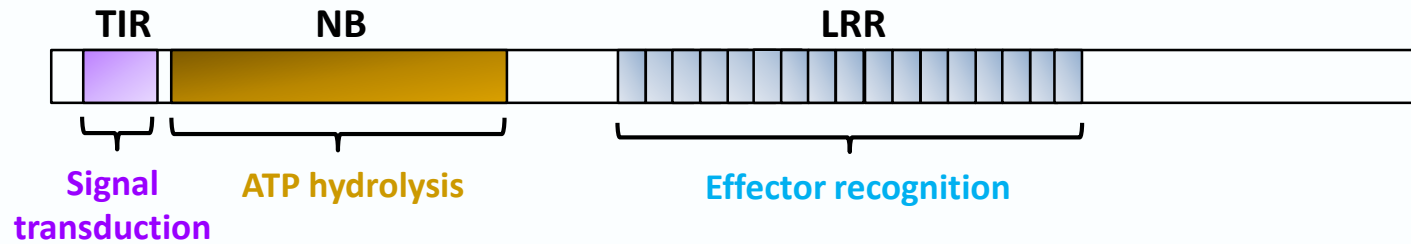
Tempranillo



Tempranillo + *MrRPV1*



MrRUN1 & *MrRPV1* encode TIR-NB-LRR proteins

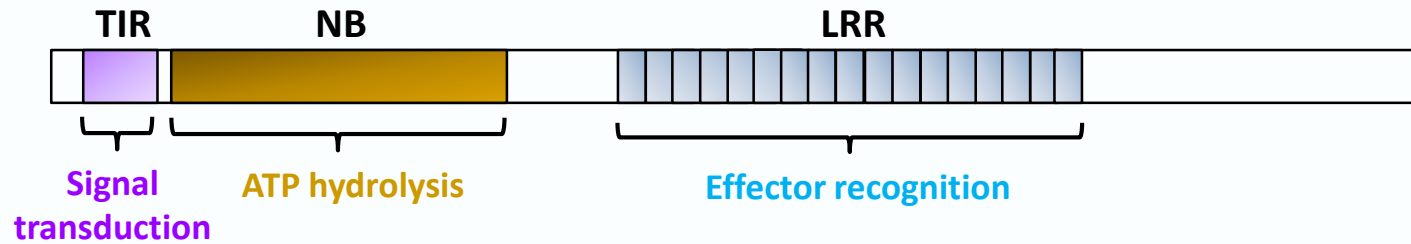


TIR = Toll/Interleukin receptor domain

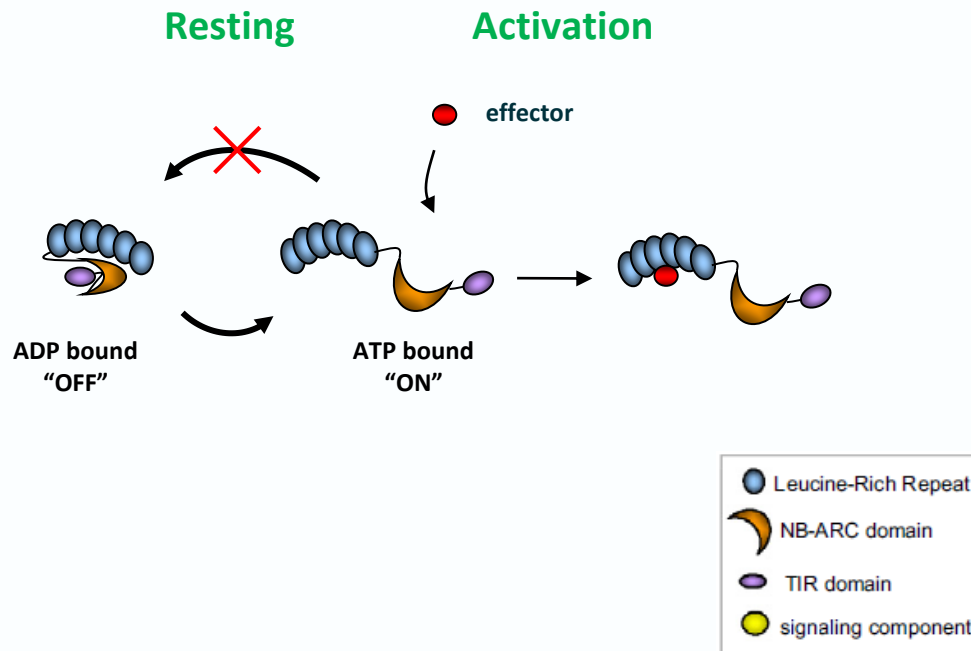
NB = Nucleotide-binding domain

LRR = Leucine-rich repeat domain

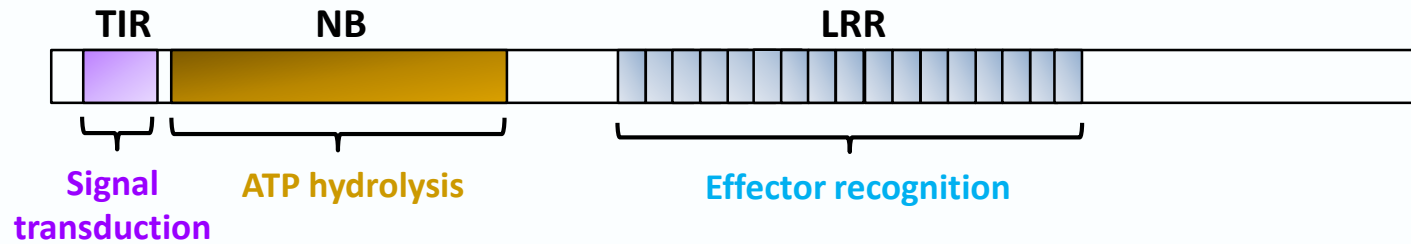
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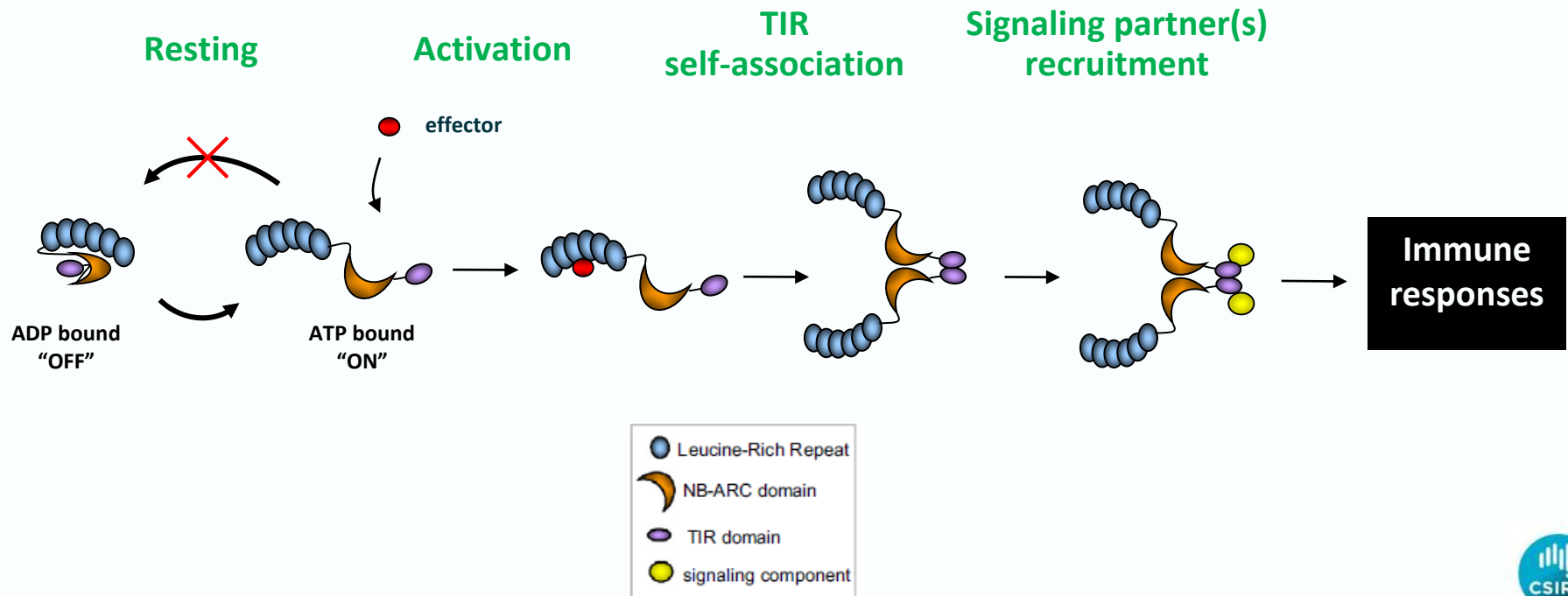
Current model of TIR-NB-LRR activation (*based on L6 rust resistance protein*)



MrRUN1 & MrRPV1 encode TIR-NB-LRR proteins



Current model of TIR-NB-LRR activation (*based on L6 rust resistance protein*)

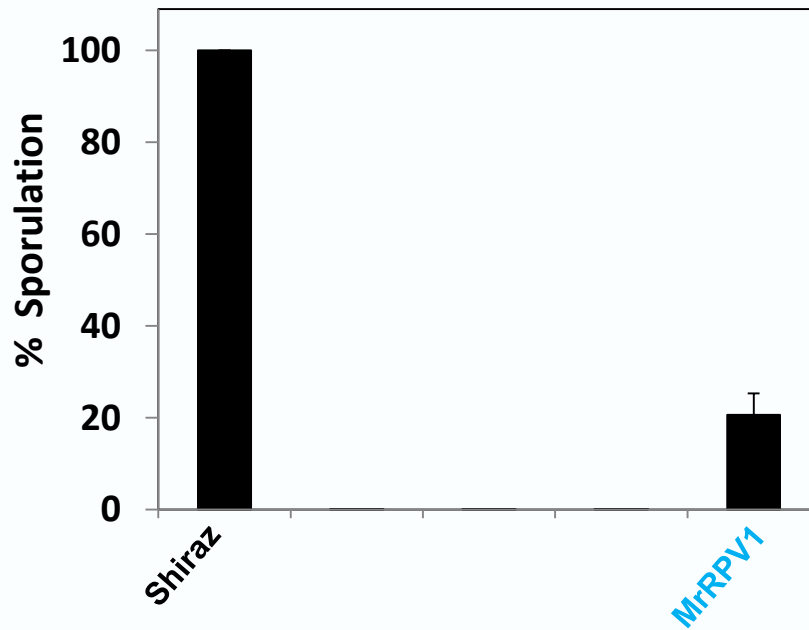


LRR domain is involved in pathogen effector recognition

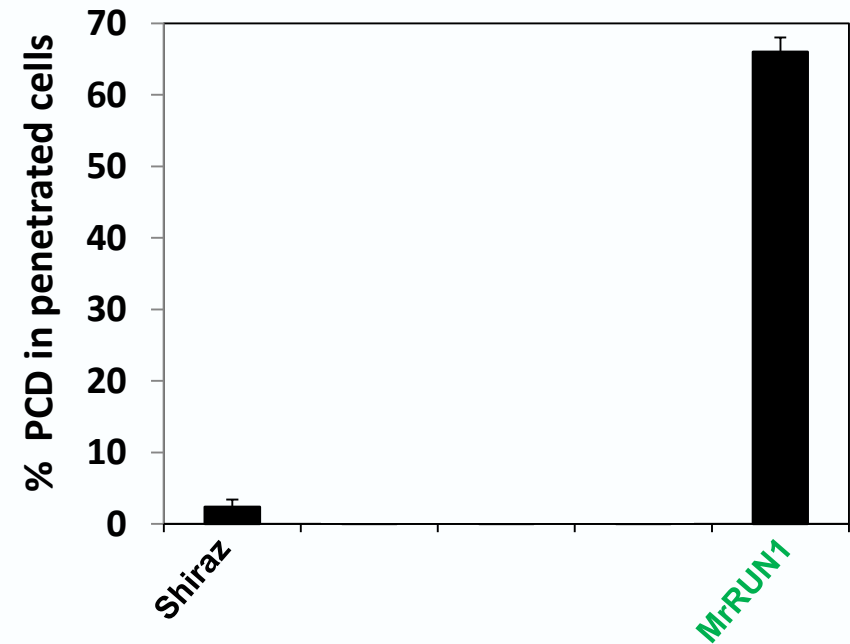
MrRPV1:MrRUN1-LRR



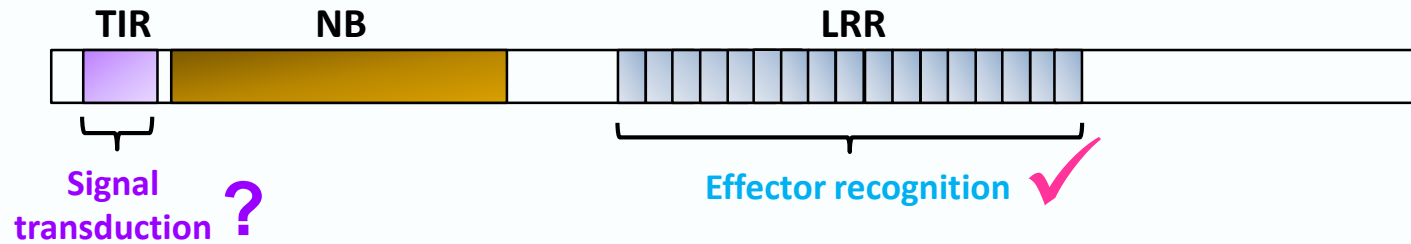
Downy mildew inoculation



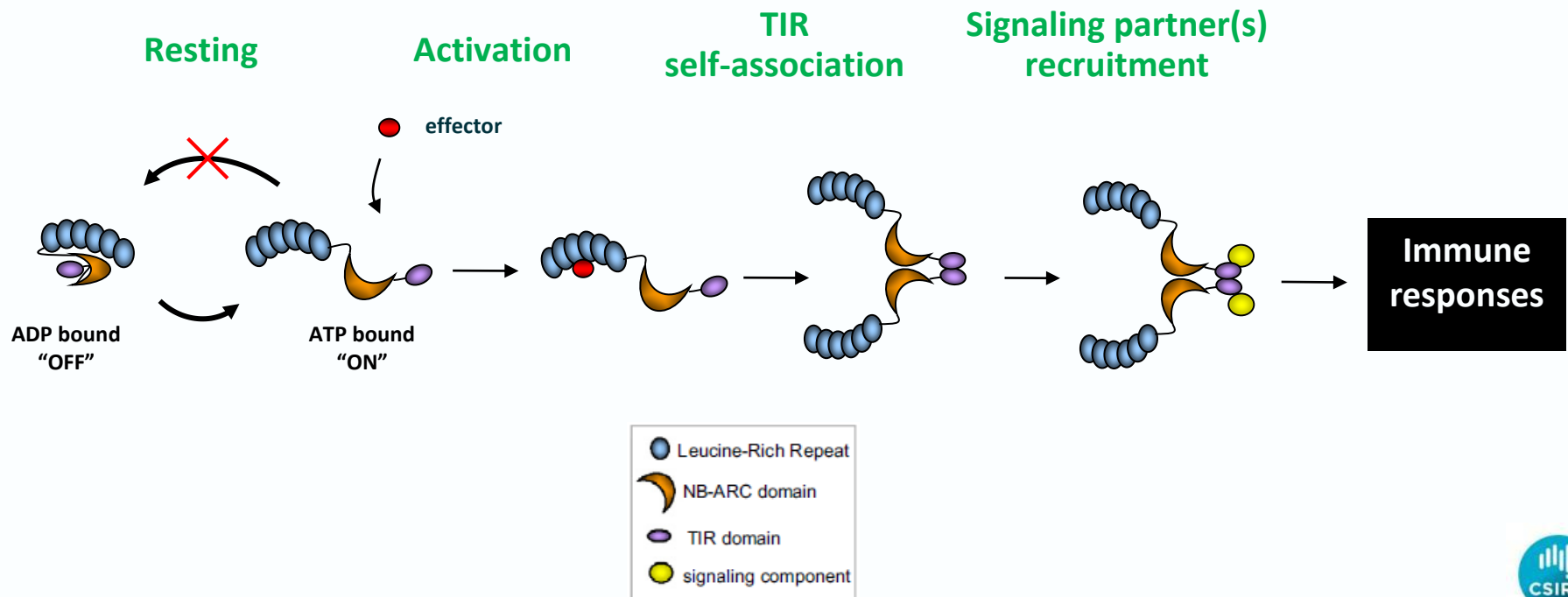
Powdery mildew inoculation



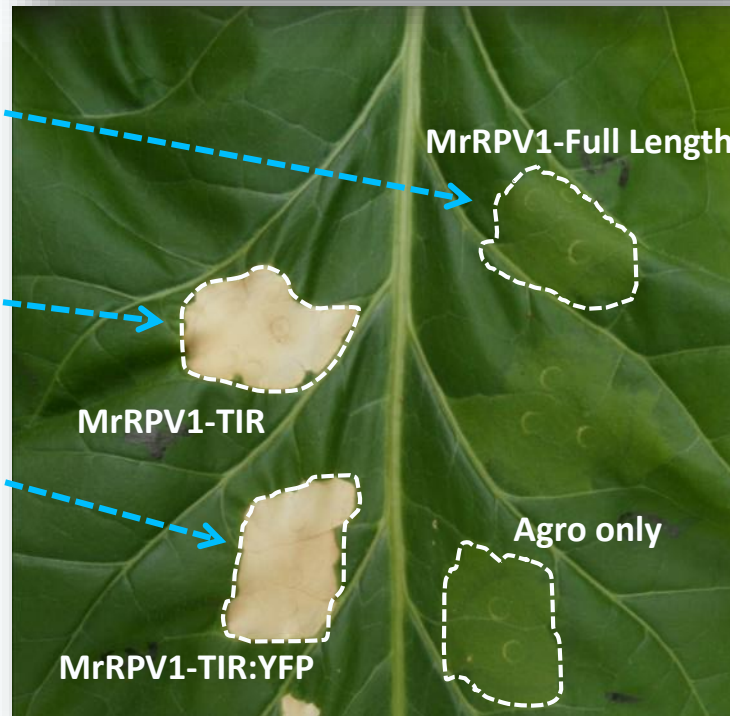
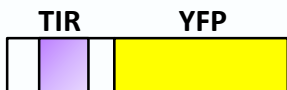
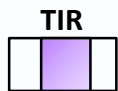
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Current model of TIR-NB-LRR activation (*based on L6 rust resistance protein*)

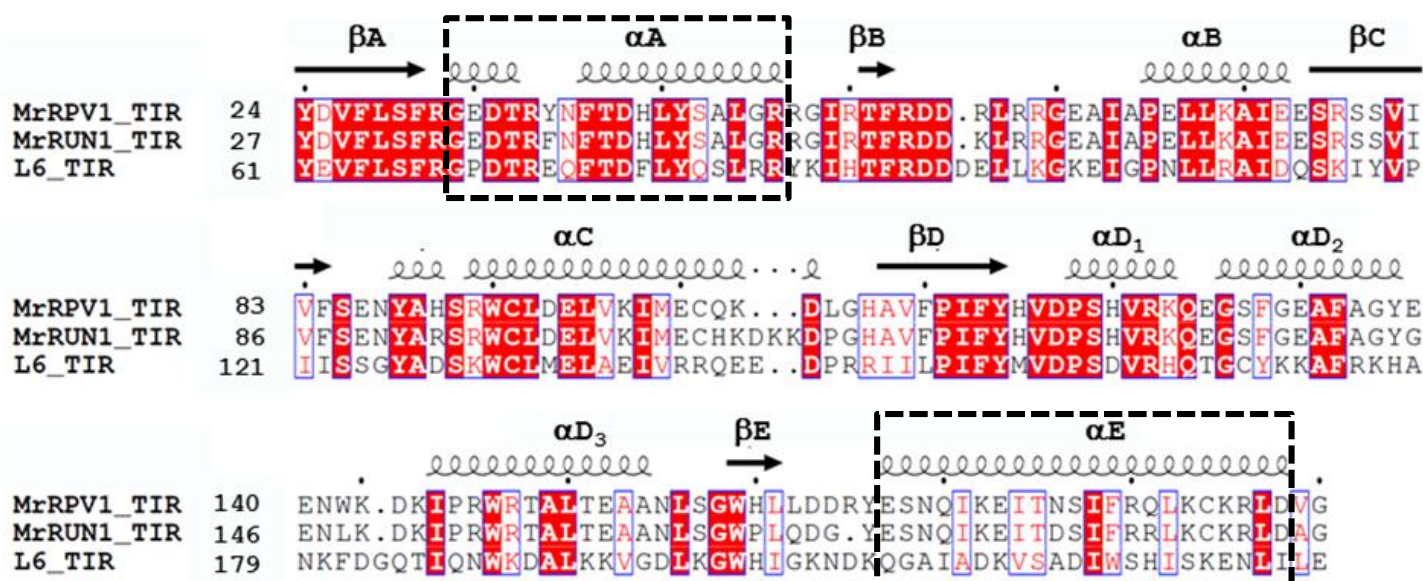
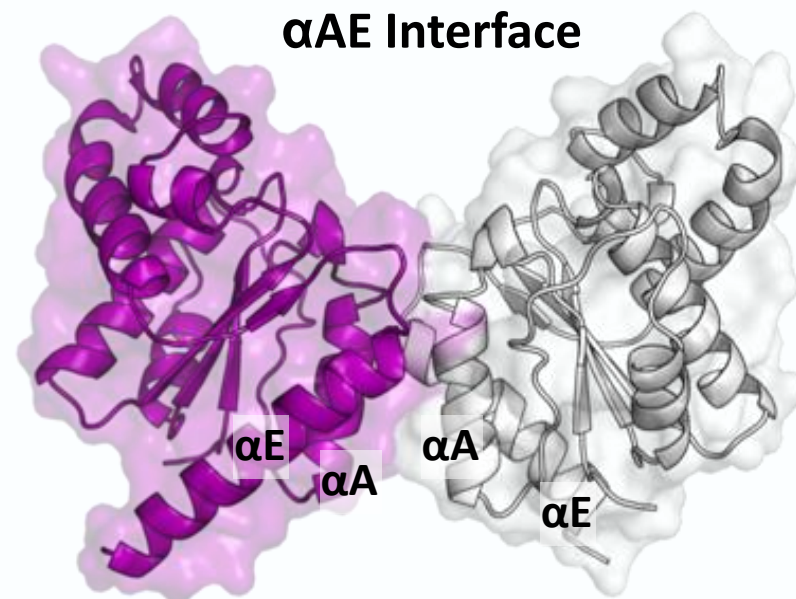
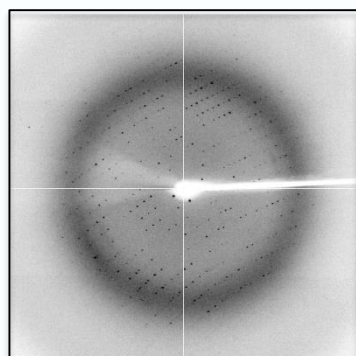
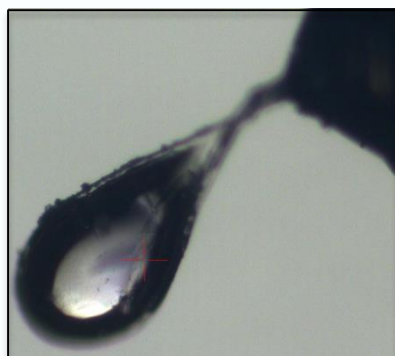


The TIR domain induces cell death in tobacco

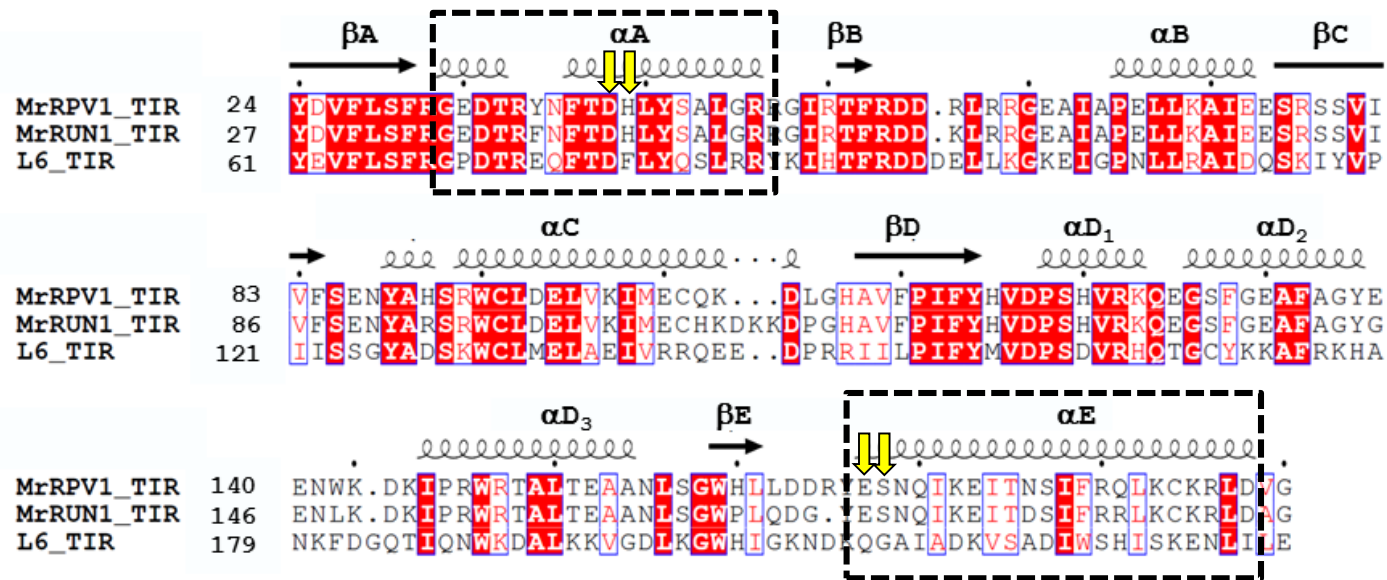


N. tabacum cv. White Burley – 5 dpi

Crystal structure of MrRUN1 and MrRPV1 TIR domains reveals a conserved dimeric interface

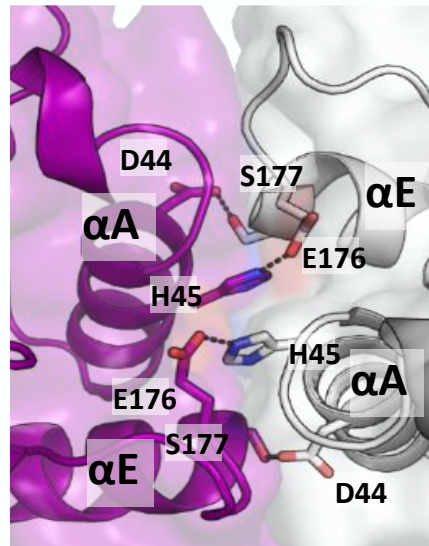
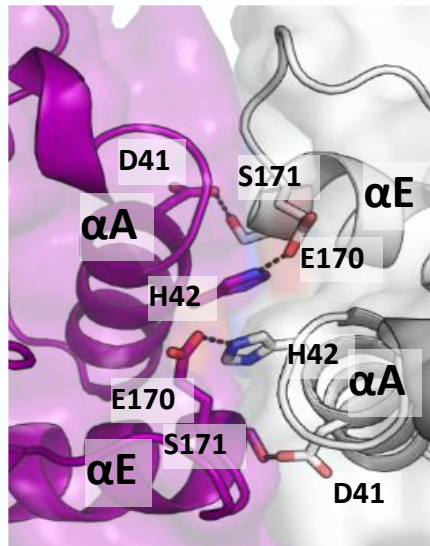


Dimer formation is required for TIR signal transduction



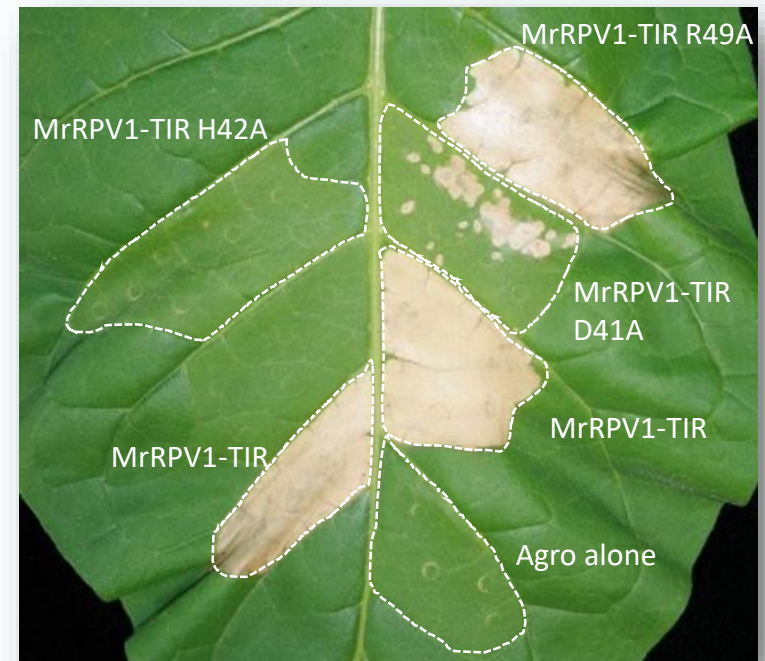
MrRPV1

MrRUN1

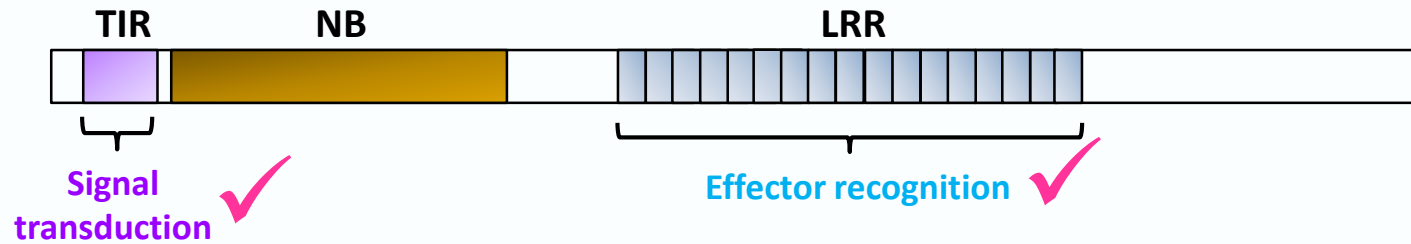


D41-S171 & H42-E170

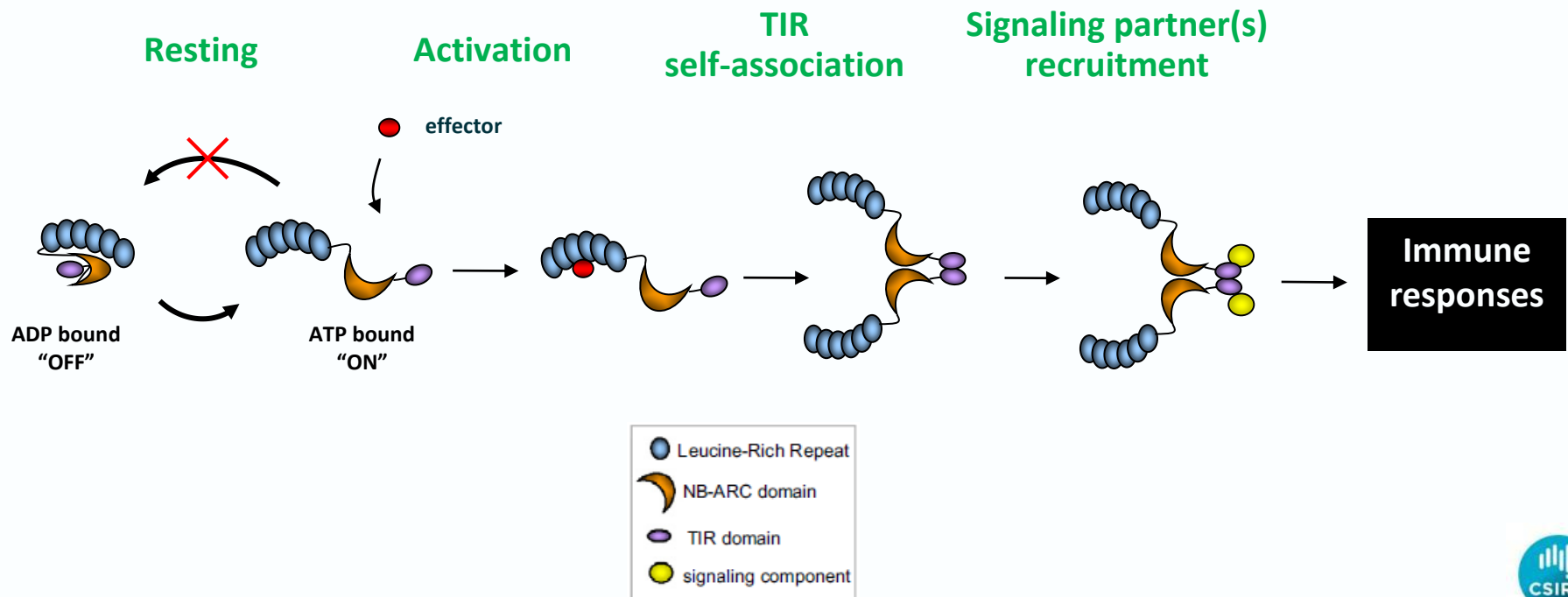
D44-S177 & H45-E176



MrRUN1 & MrRPV1 encode TIR-NB-LRR proteins



Current model of TIR-NB-LRR activation (*based on L6 rust resistance protein*)



Many organisms have proteins with TIR domains

Mammalian TIR domain-containing proteins

Toll-like receptor family



Interleukin-1 receptor family



MyD88



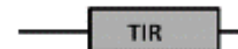
MAL



TRIF



TRAM



SARM



Plant TIR domain-containing proteins

TIR-NB-LRR resistance proteins



Bacterial TIR domain-containing proteins

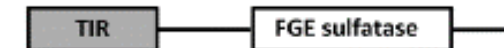
TipA/TcpB



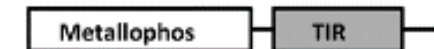
TcpC



A0ZF71_NODSP



A7BQY8_9GAMM



Q21Z38_RHOFD



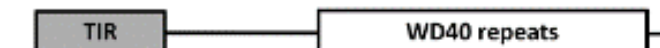
Q39WE1_GEOMG



A3DFE7_CLOTH



B7KCU4_CYAP7

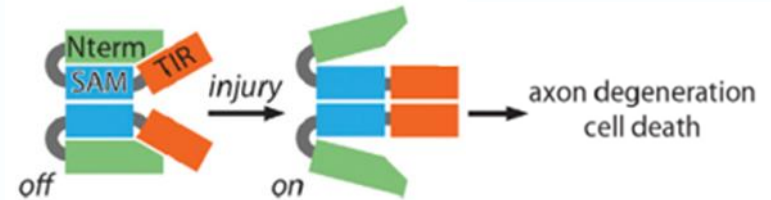
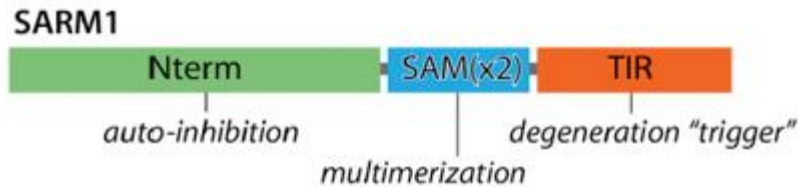


Q3M5F3_ANAVT



Ve *et al.* (2015) Apoptosis 20:250-61

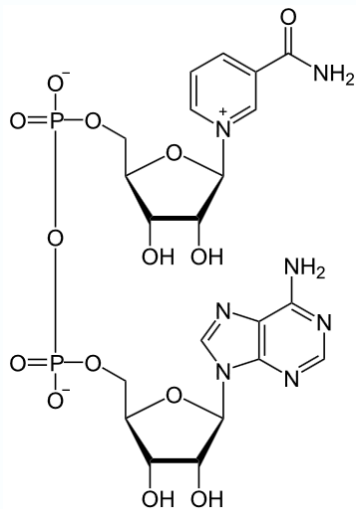
SARM1 = sterile alpha and Toll/interleukin-1 receptor motif-containing 1



Gerdt et al. (2016) Neuron 89: 449-460

Essuman et al. (2017) Neuron 93, 1334-1343

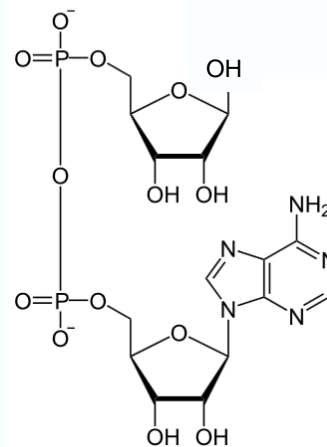
The SARM1 Toll/Interleukin-1 Receptor Domain Possesses Intrinsic NAD^+ Cleavage Activity that Promotes Pathological Axonal Degeneration



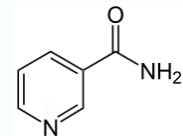
NAD^+

SARM1-TIR

NADase

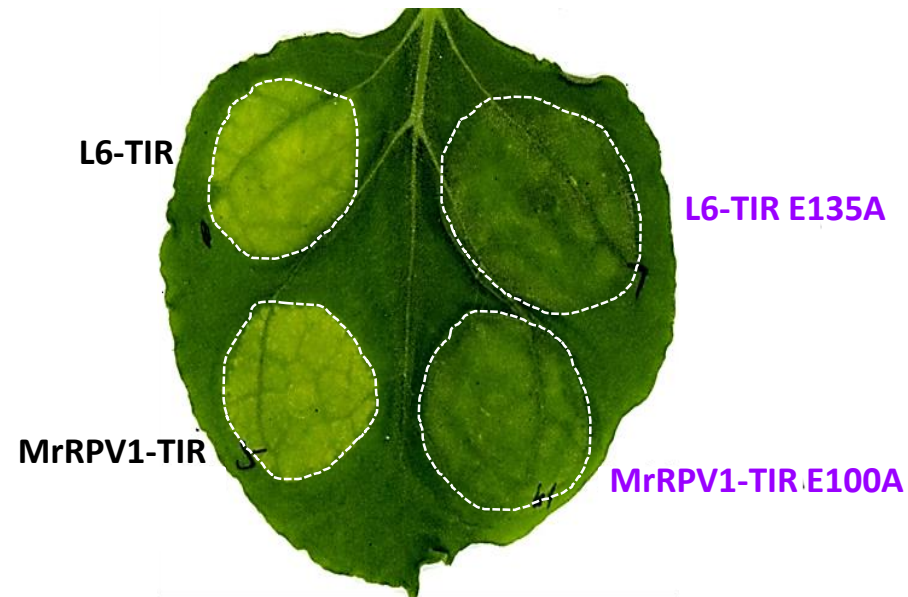
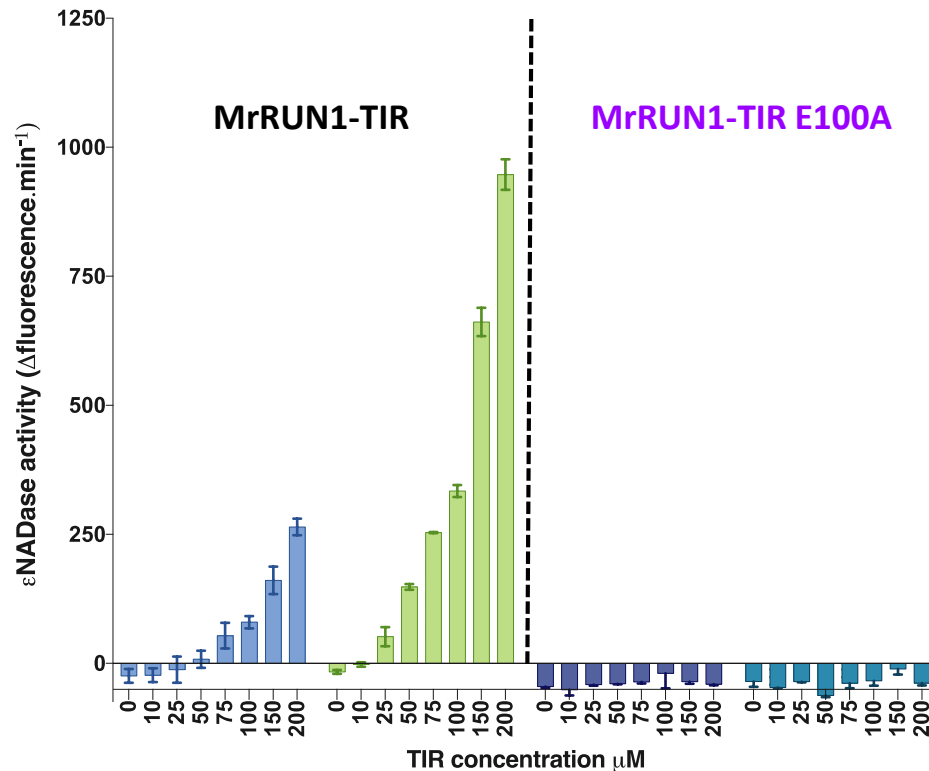
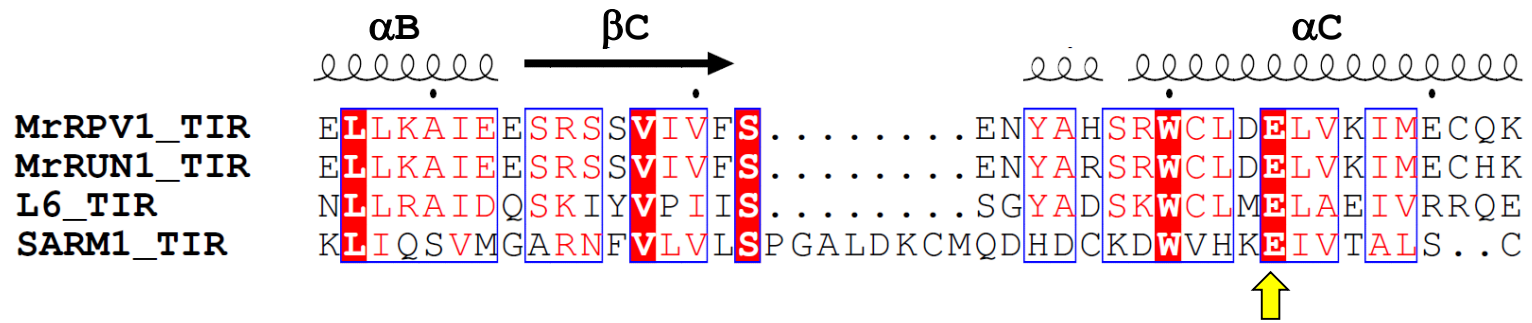


ADP-ribose

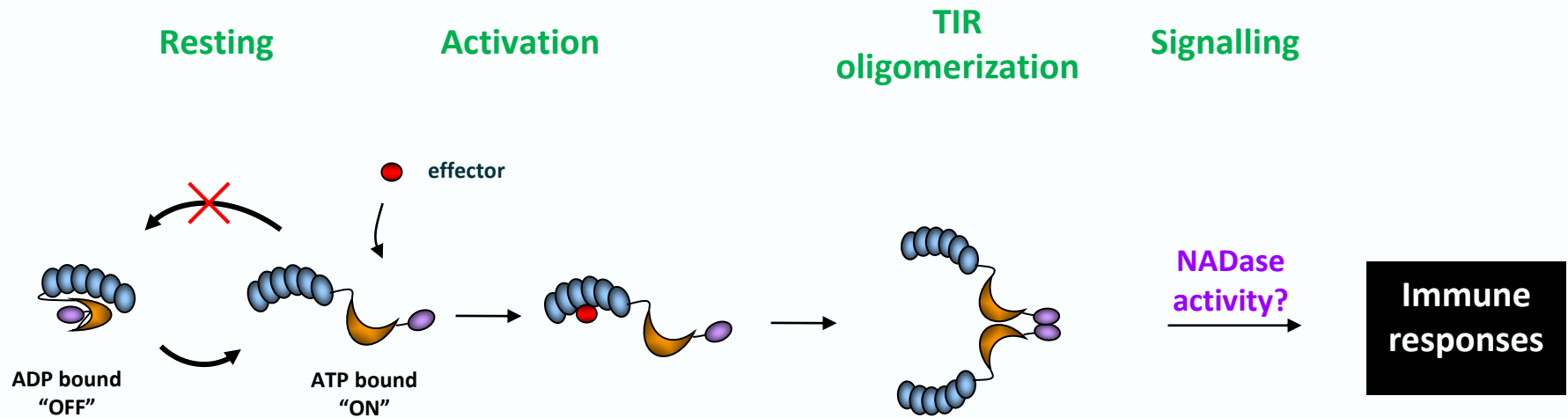


Nicotinamide

A conserved glutamate residue is required for NAD cleavage activity in SARM1-TIR



Proposed mode of action of MrRUN1 & MrRPV1



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Tempranillo

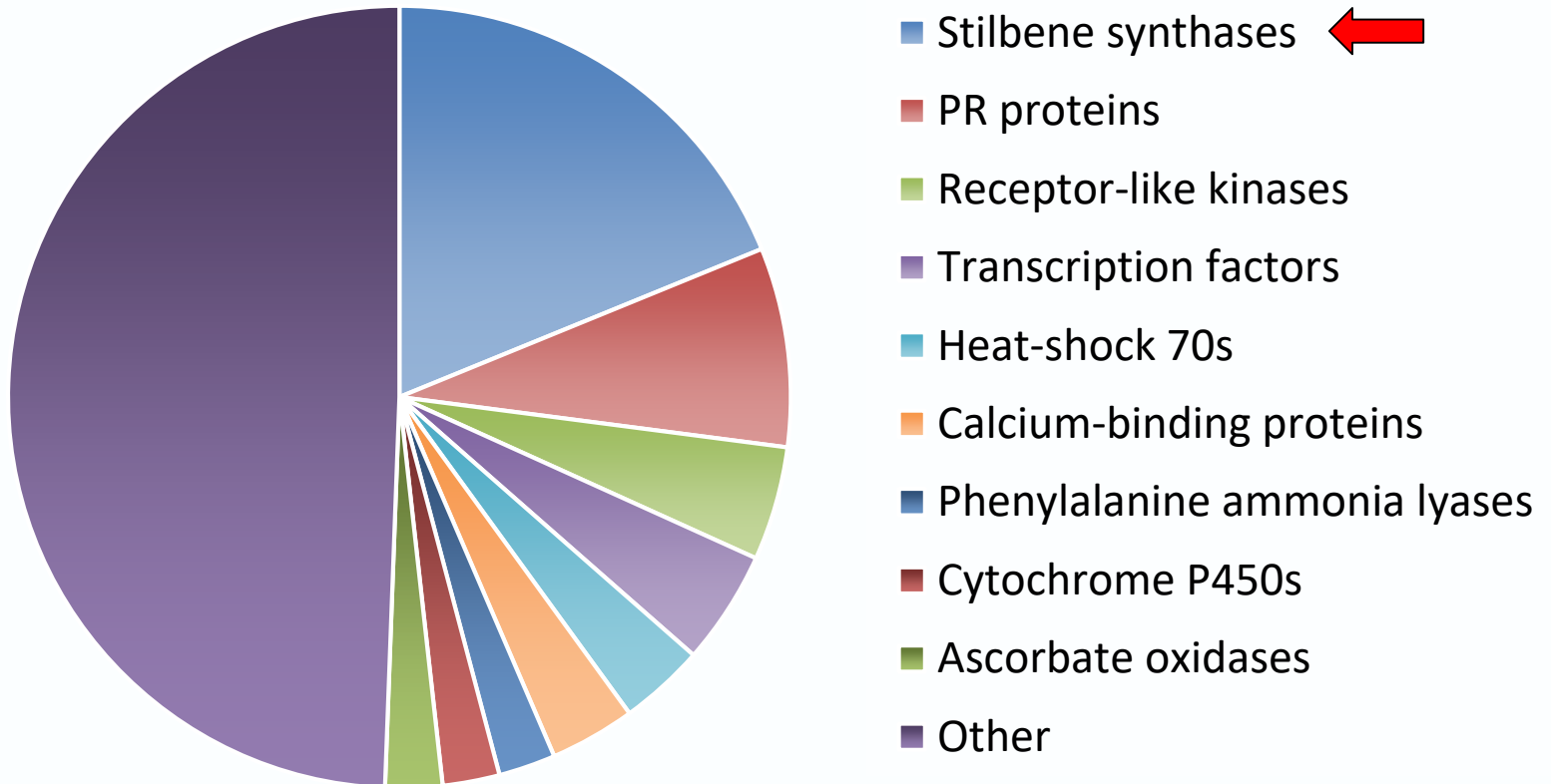


Tempranillo + *MrRPV1*

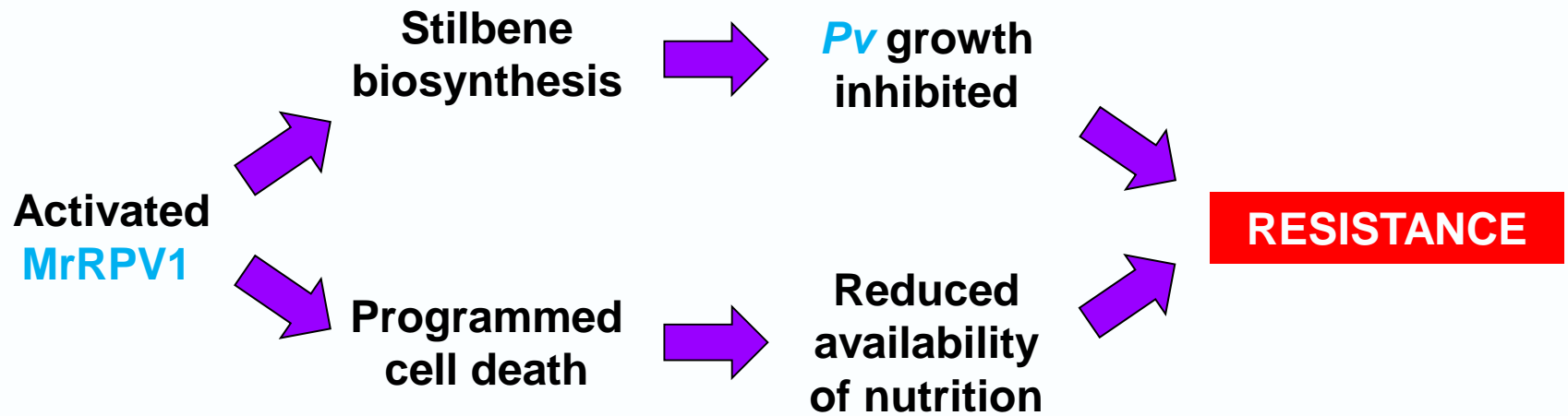


Effector-triggered MrRPV1-dependent gene expression in transgenic downy mildew resistant Shiraz

- 85 genes found to be significantly upregulated in *MrRPV1*-Shiraz vs control Shiraz at 18hpi with downy mildew



Is effector-triggered **MrRPV1** resistance mediated by stilbenes?





Wine Australia



Australian Government

National Health and
Medical Research Council

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