

# 进化和结构分析预测拟南芥**PRK6**的共受体

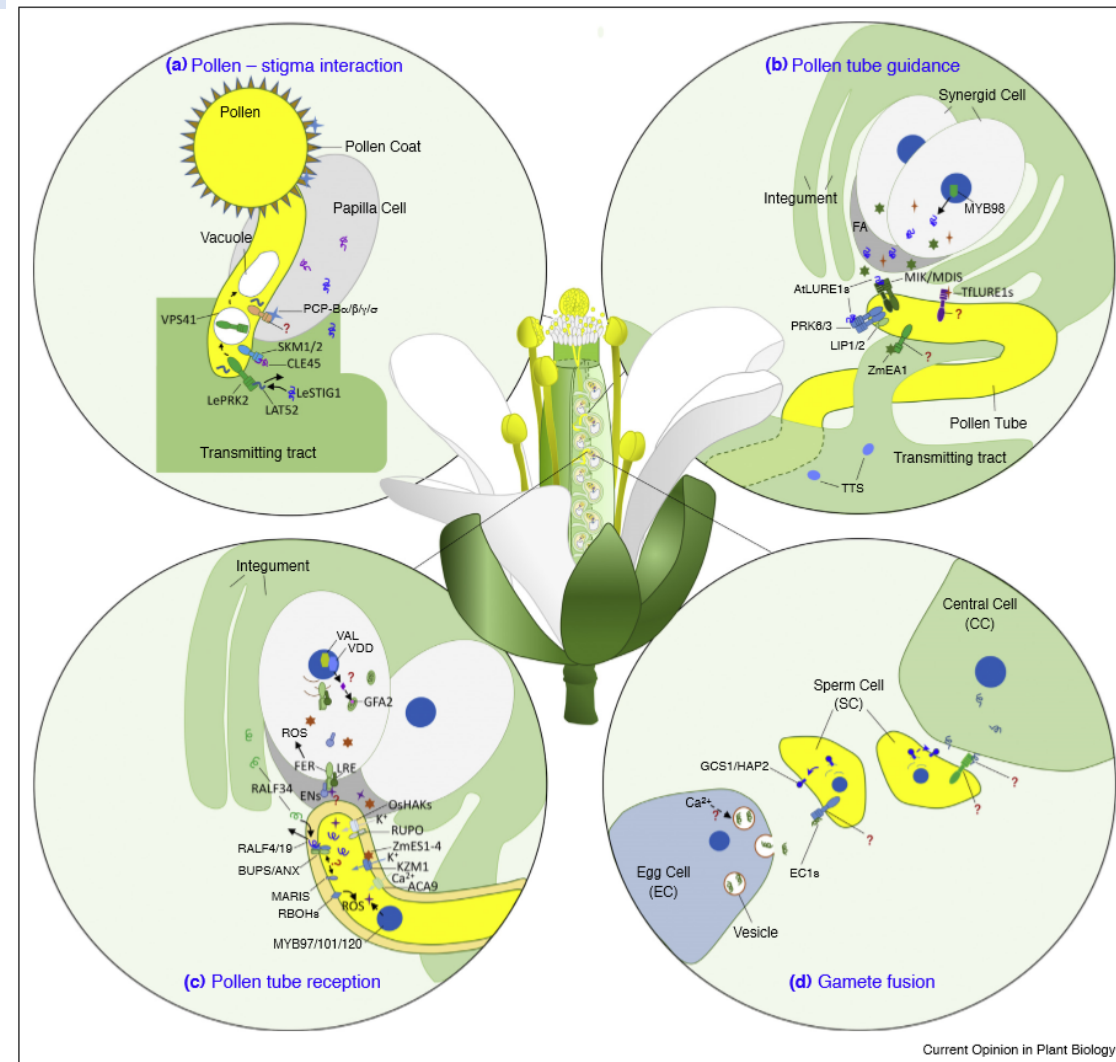
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- G01C** 王鼎岳
- G01D** 李其昀

**汇报人:** **G01B** 路茵

# BACKGROUND

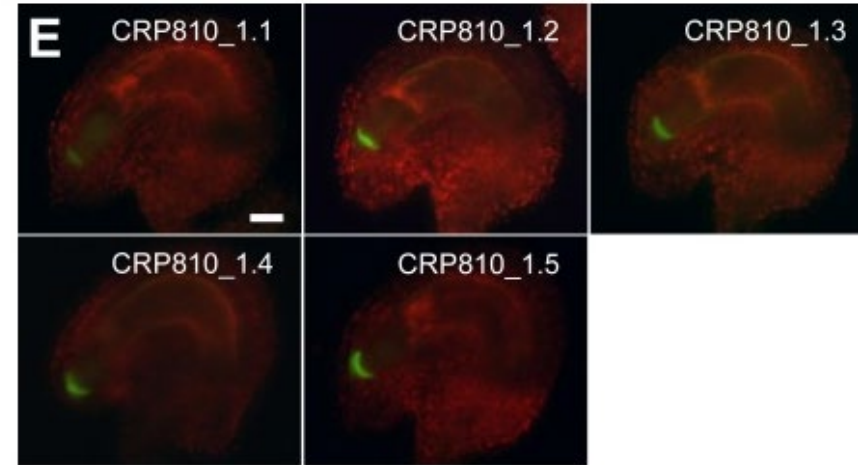
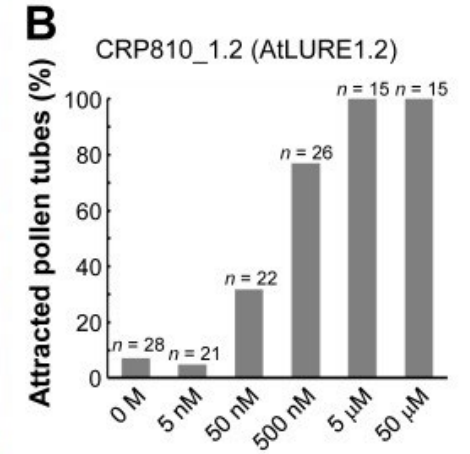
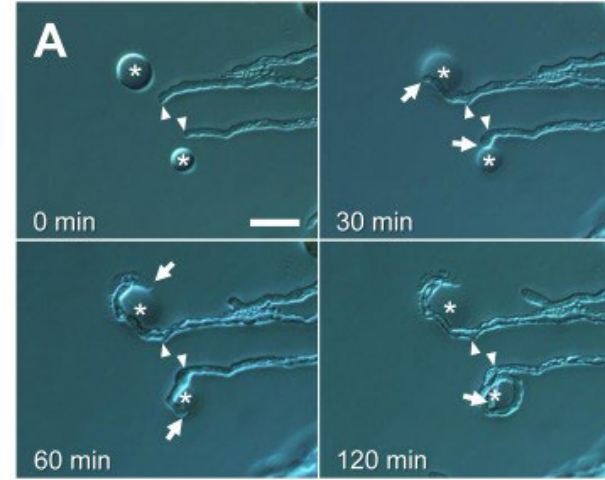
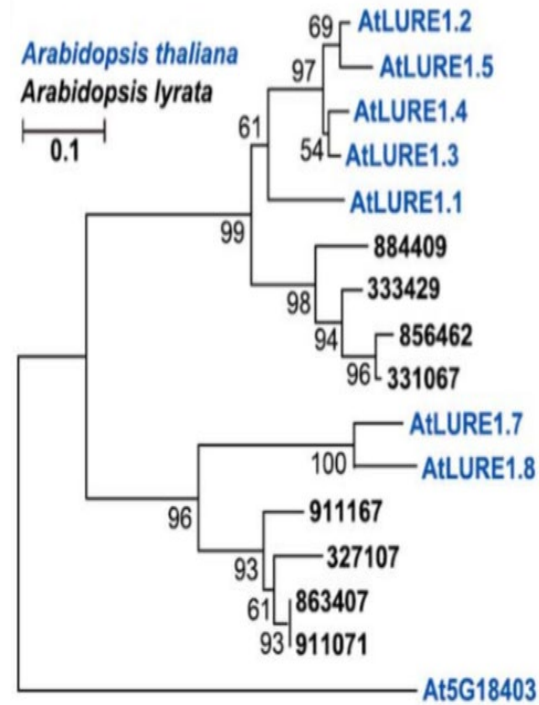
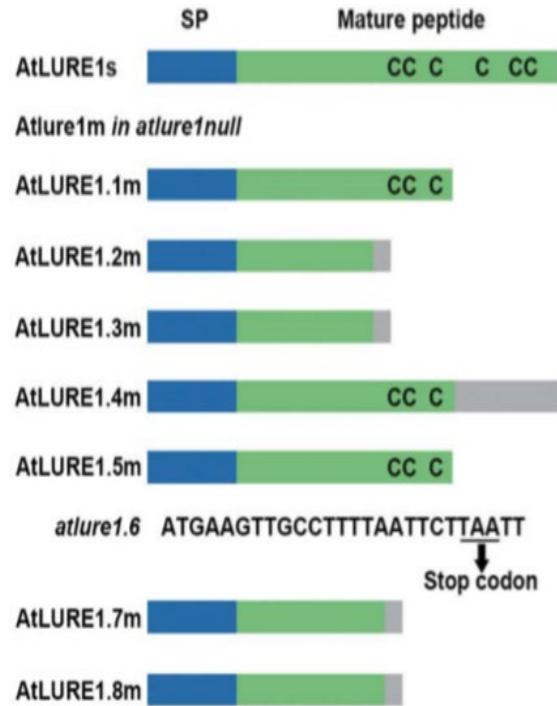
# BACKGROUND



- 花粉粘附，水合，萌发
- 花粉管生长，导向，接受
- 配子激活，融合

# ATTRACTANT

## AtLURE1s

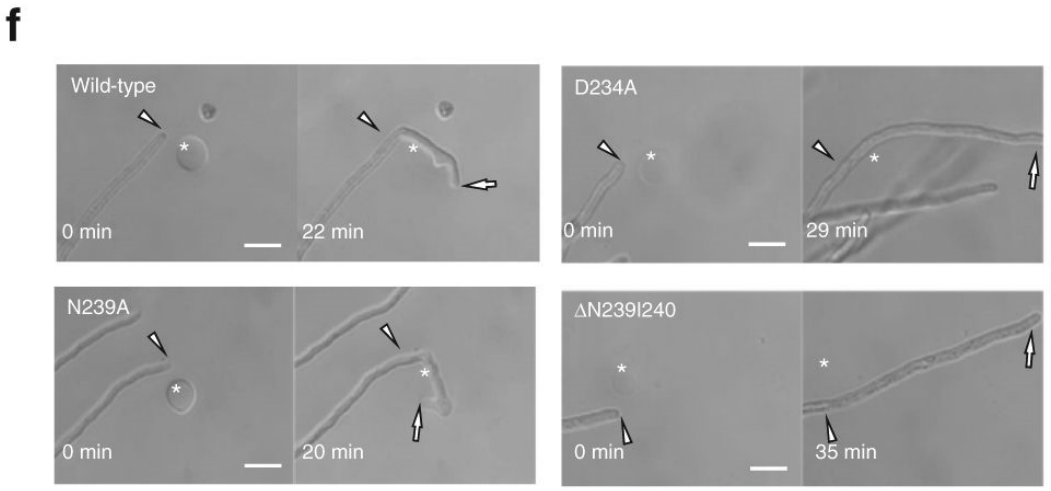
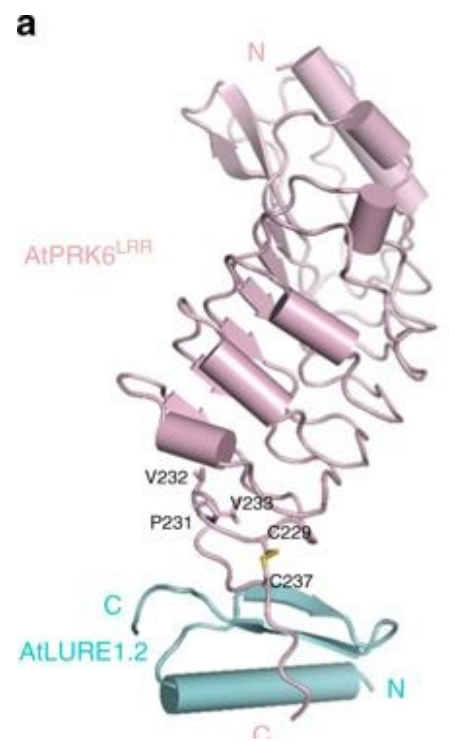
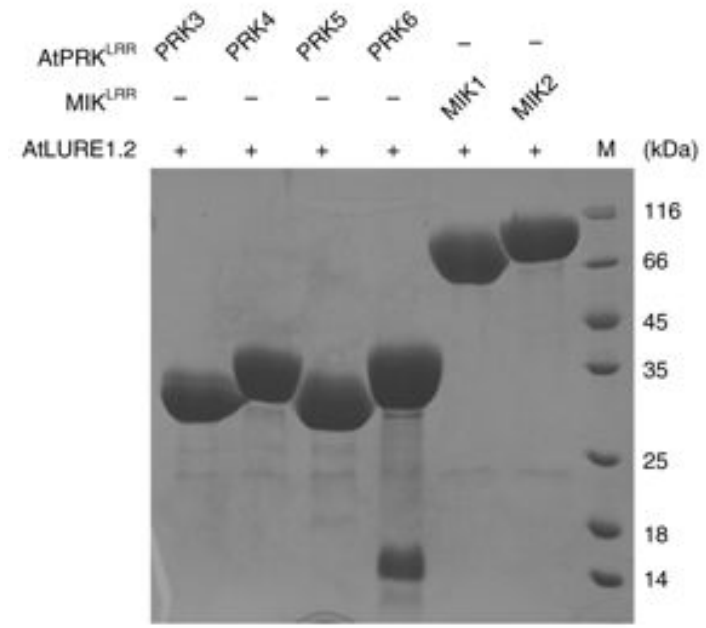
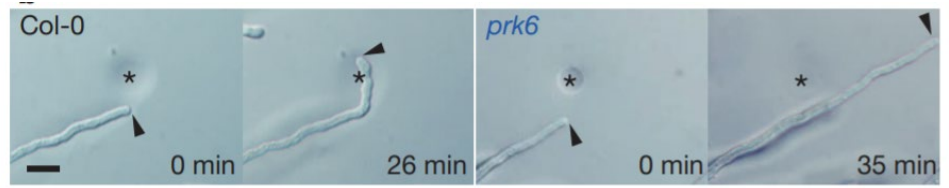


Zhong et al. *Science* 2019

Takeuchi et al. *PLoS Biol* 2012

# ATTRACTANT RESPONSE-PRK6 (pollen-specific receptor kinase 6)

## AtLURE1s receptor PRK6 (pollen-specific receptor kinase 6)



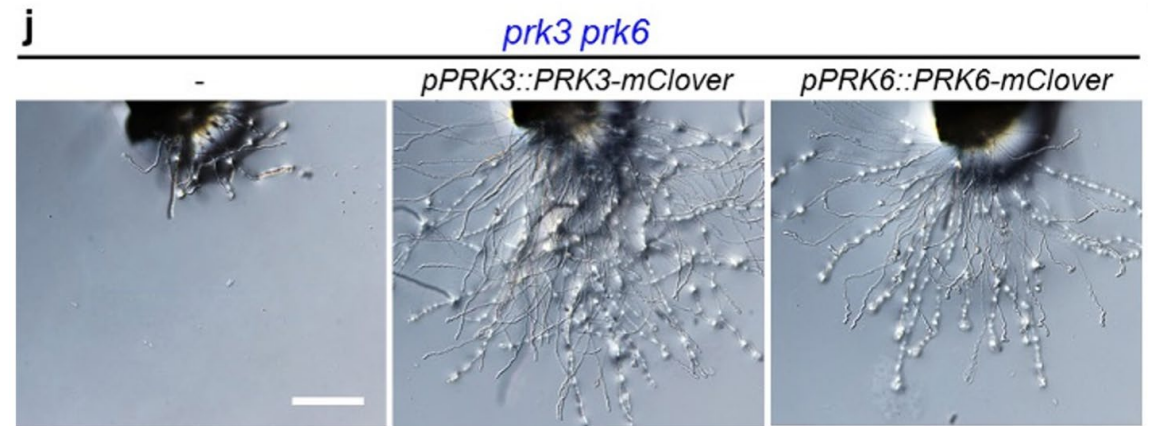
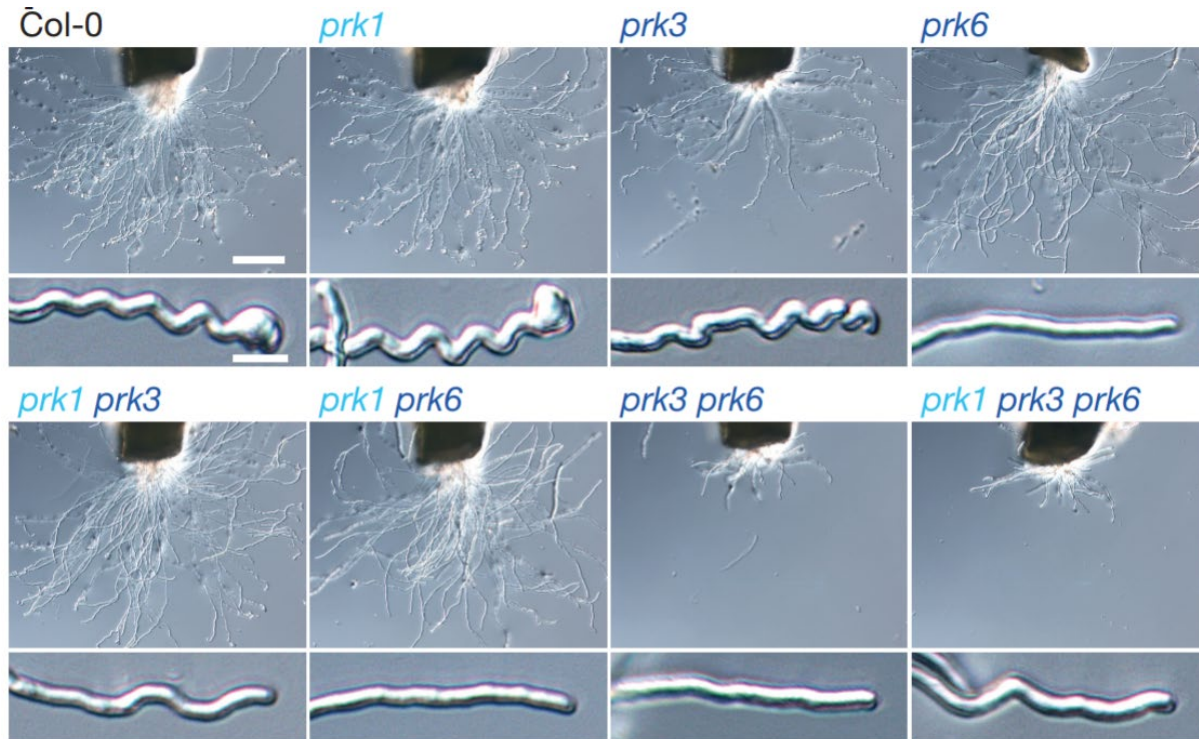
- AtLURE1.2 specifically interacts with AtPRK6<sup>LRR</sup>
- Interaction between AtLURE1.2 and AtPRK6<sup>LRR</sup> is mediated by a combination of polar and hydrophobic contacts

Takeuchi et al. *Nature* 2016  
 Zhang et al. *Nat Comm* 2017



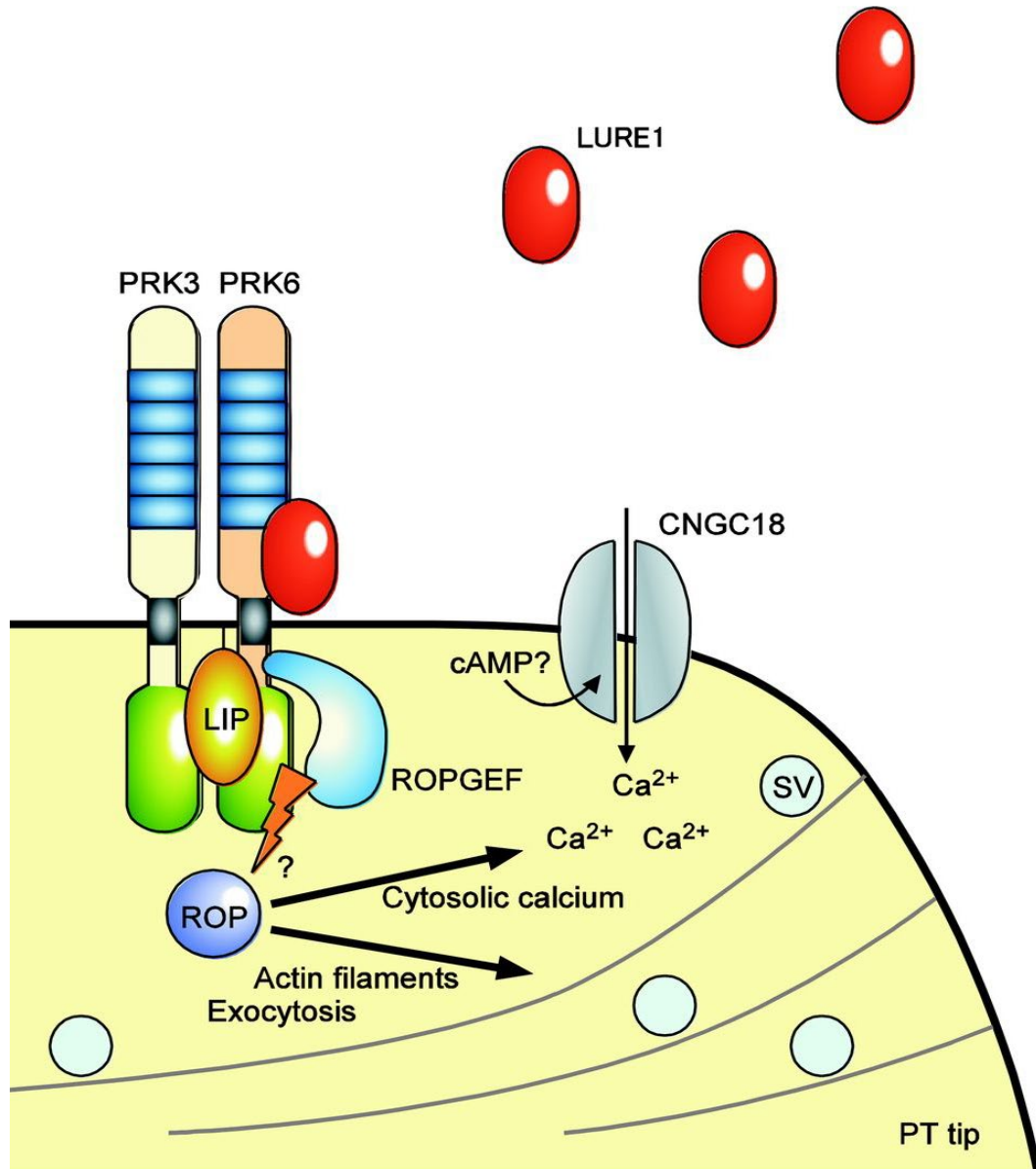
# PRK FAMILY

## PRKs in ovular guidance——PRK1/3/6



- *prk1 prk3* double mutations as well as a *prk6* single mutation **impaired the response to AtLURE1.2**
- **Expression of PRK3 in *prk3 prk6***, which showed similar tip localization to that of PRK6, restored the growth defect but **not the wavy response to AtLURE1**

Takeuchi et al. *Nature* 2016



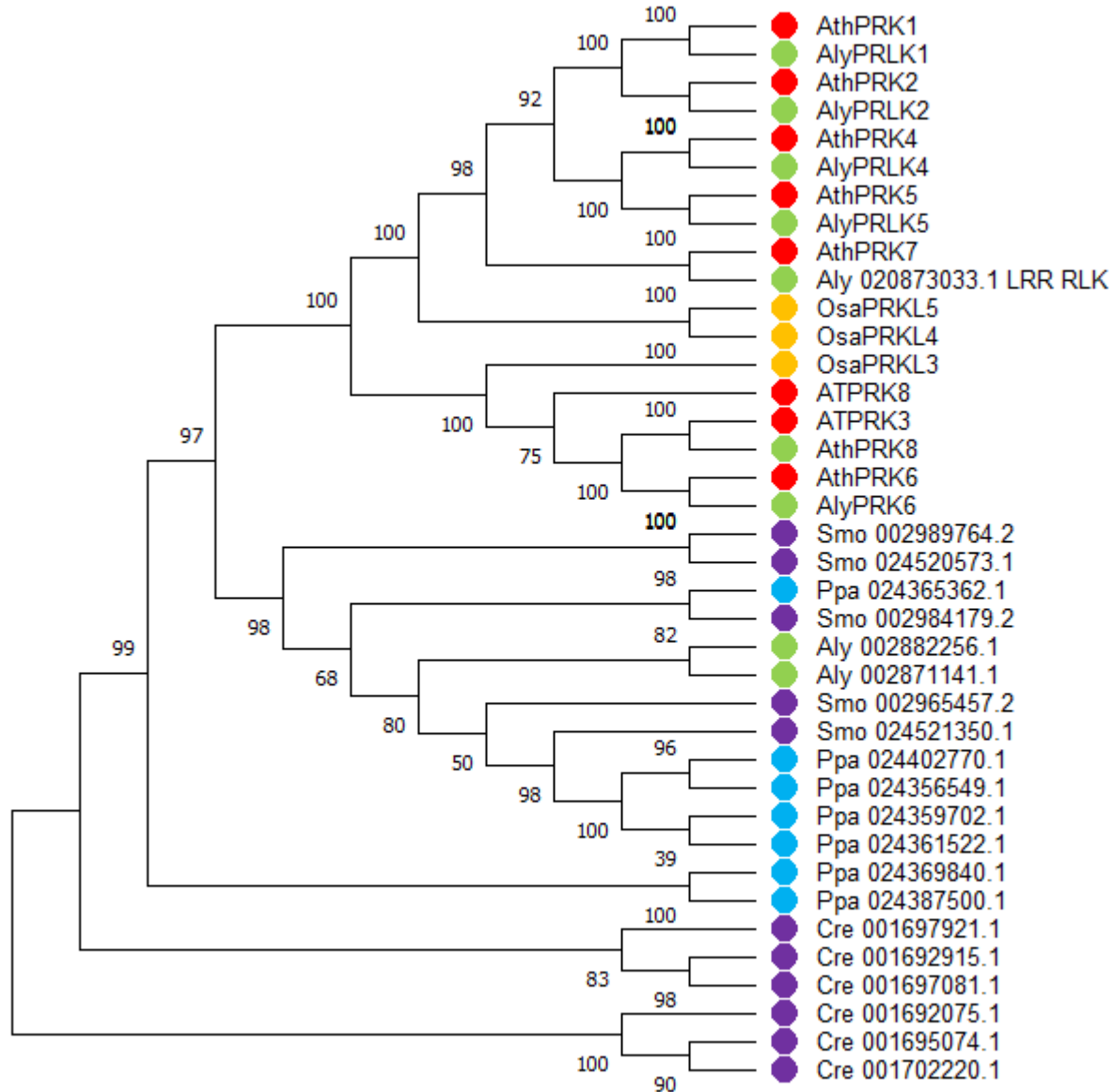
Higashiyama et al. *Plant Physiol* 2016

- 1.PRK6二聚化起作用
- 2.PRK3似乎可增强PRK6的作用
- PRK6结合LURE1是否有共受体?
- 进化分析+结构预测

# Phylogenetic analysis



# Phylogenetic tree of plant PRKs



Ath - *Arabidopsis thaliana*, 拟南芥

Aly - *Arabidopsis lyrata*, 琴叶拟南芥

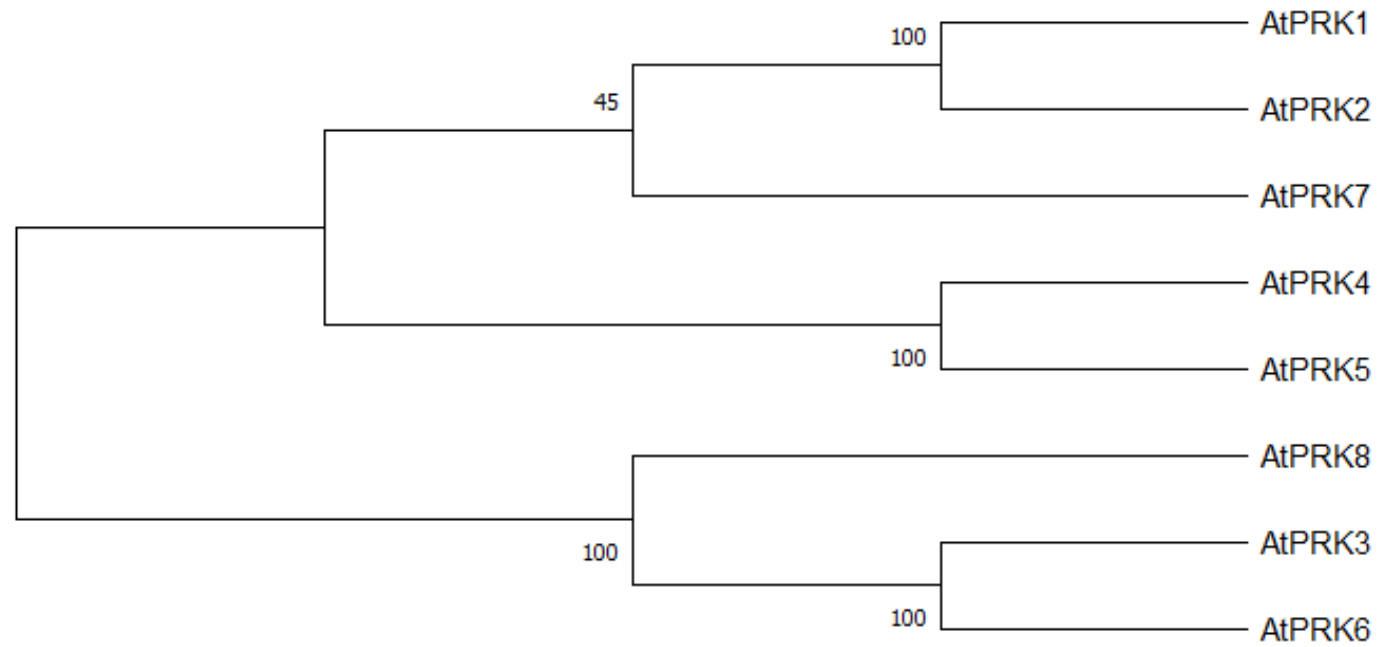
Osa - *Oryza sativa*, 水稻

Smo - *Selaginella moellendorffii*, 江南卷柏

Ppa - *Physcomitrella patens*, 小立碗藓

Cre - *Chlamydomonas reinhardtii*, 莱茵绿藻

# Phylogenetic tree of AtPRKs



# Multi sequence alignment of AtPRKs

LRR domain

```
AtPRK7/1-676 1-----MTRDDKFP-IVYS-----LLLIVLLF-----VSPYIGDGDADALLKFKSSLVNA--SSLGGWDSGEPSPCSGDKGSDKWKGVMSNG-SVFLRLENMSLSGELDVAALGSIRGLKLSIFMRNHFEKIPRGIDGLVSLAHLYLAHNOFTGEIDGDLFSGMKALLKVVHLEGNRF 160
AtPRK4/1-679 1MLTWETPVMLASNTASTKKLAFI--T-TFLIIVLCPVTMVMSQPQADVLPASDADCLLRFKDTLVNA--SFISSWDPSISPKRNL--SENWFGVLCVGTG-NWGLQLEGMGLTGKLDLEPLAAIKNLRSLFMNKNFNGSMP-SVKNFALKSLYLSNNRFTGEIPADAFDGMHLLKLLANNAF 179
AtPRK5/1-686 1MRNMEDPFTLACNTALKKNLPSCIF-I-IFISVLCPVAMS-----QVVVPSDADCLLRFKDTLANG--SEFRSWDLSSPCQGN--TANWFGVLC-S-N-YWGLQLEGMGLTGKLNLDPLVPMKNLRTISFMNKNFNGSMPQ-VKRFSLKSLYLSNNRFSGEIPADAFDGMPLKLLANNAF 173
AtPRK1/1-662 1-----MPPMQA-----RTLSV--YN--VMVPLVCLLFF-----STPTHGLSDSEAILKFKESLVVQGENALASWNAKSPCT-----WSGVLCNGG-SWRLQMENLELSGSIDIEALSGLTSRLTSLFMNKNFEGFPD-FKKLAALKSLYLSNNQFGDIPGDAFEGMGWLLKVVHLAQNKF 158
AtPRK2/1-647 1-----MES-----K-----CLMFVSVSVF-----FMVVNGVSETETLLKFKNSLVIGRANALESWNRRNPCK-----WTGVLCDRG-FWGLRLENLELSGSIDIEALMGLNSLRSLSFINNKFKGPFPE-FKKLVALKSLYLSNNQFDLEIPKDAFDGMGWLKLLHLEQNRF 148
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AtPRK6/1-659 1-----MAAAVLNPGFFLLILLLSFSI-----SPSLQYVSESEPLVRFKNSVKIT-KGDLNSWREGTDCS-----GKWFGIYQKGLTVSGIHVTRLGLSGTITVDDLDKLPNLTIRLDNLLSGPLPH-FFKLRGLKSLMNSNSFSGEIRDDFKDMSKLRFLDHNKF 156
AtPRK3/1-633 1-----MTAVLFLCFLLCFSF-----TPSLQNVSESEPLVRFKRSVNIIT-KGDLNSWRTGTDCN-----GKWFGIYQKGLTVSGIHVTRLGLSGTINIEDLDKLPNLTIRLDNLLSGPLPH-FFKLPGLKSLMNSNSFSGEIADDFFKETPQLKRVFLDNNRL 151
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PRK6-AtLURE1 binding site

kinase domain

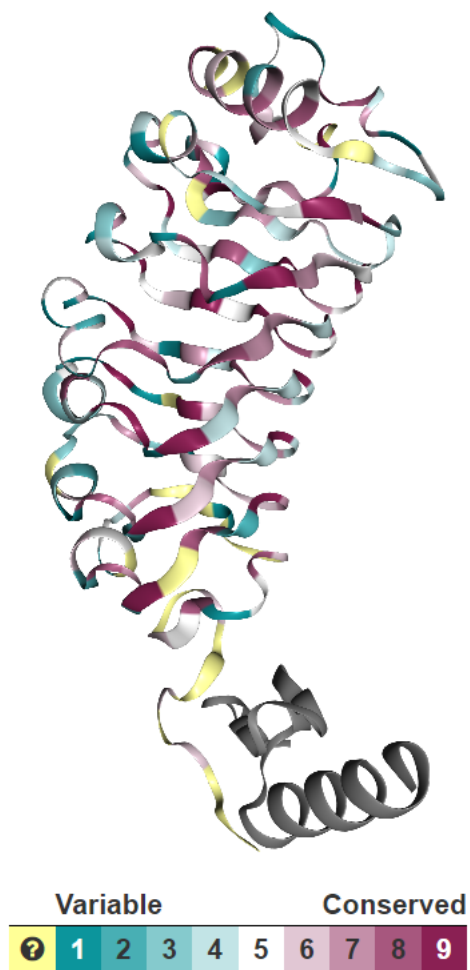
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# Structure analysis

# Mutant structure prediction of PRK6

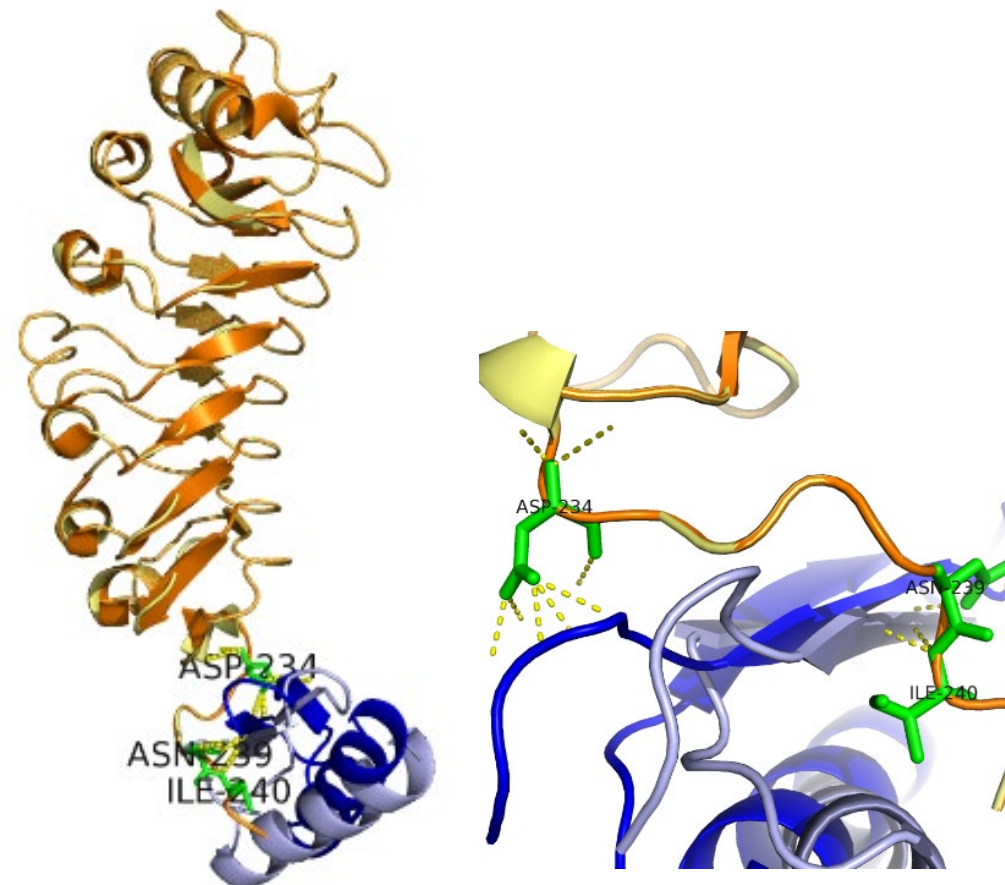
WT PRK6 保守度分析



WT PRK6-AtLURE1.2



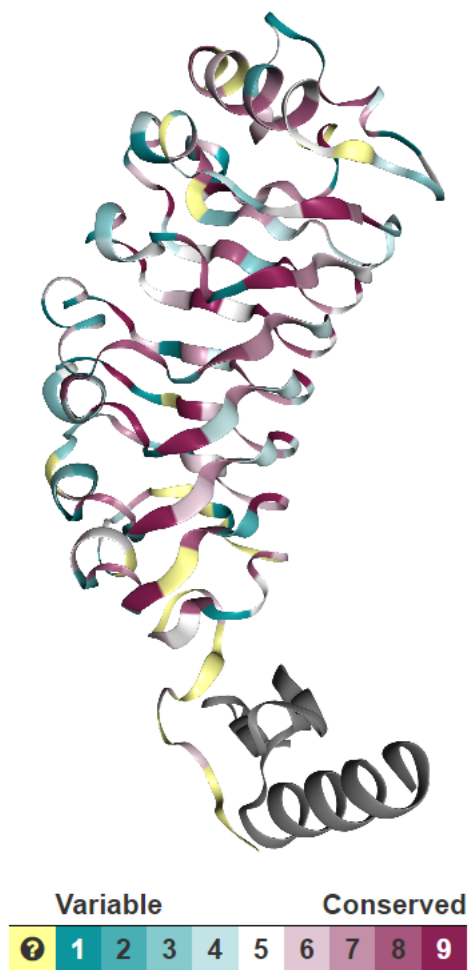
WT PRK6-ZDOCK PRK6 结构对比



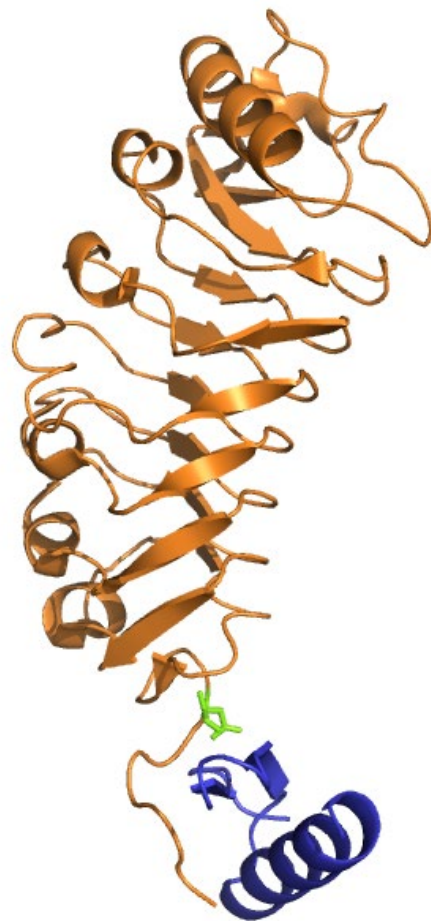


# Mutant structure prediction of PRK6

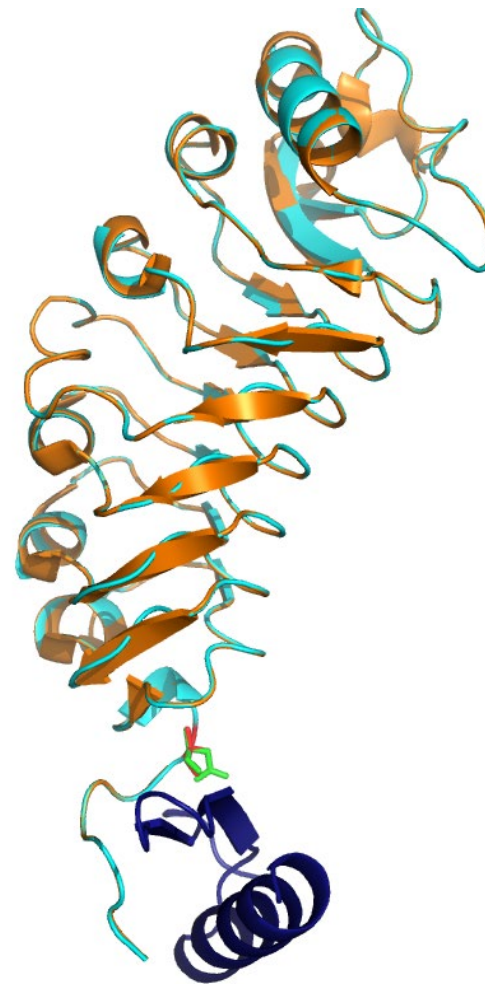
WT PRK6 保守度分析



WT PRK6-AtLURE1.2



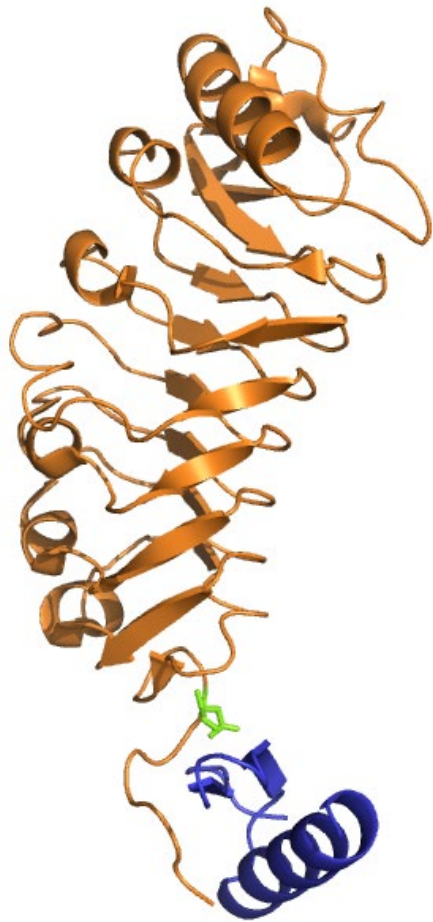
D234A PRK6-WT PRK6 结构对比



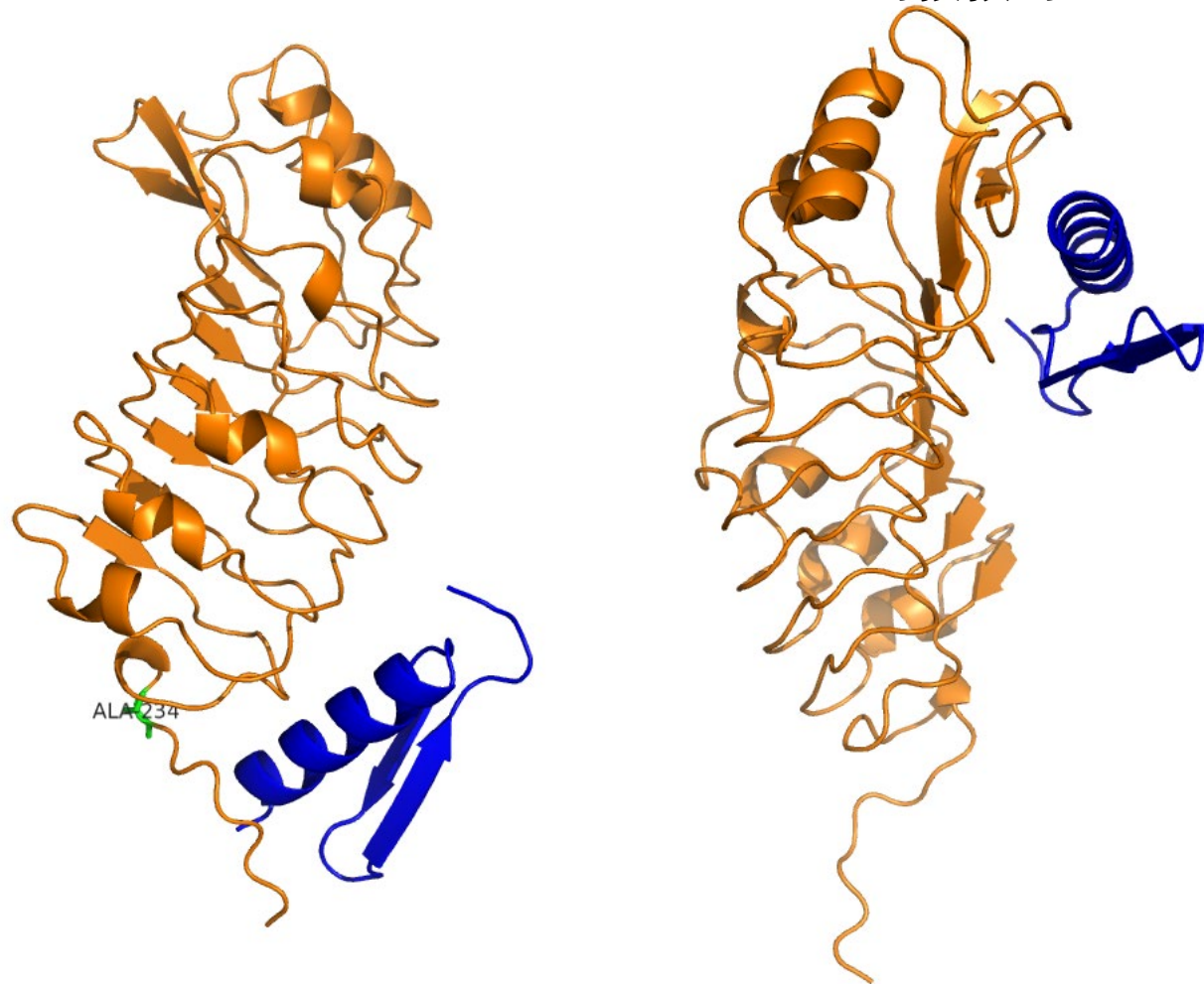


# Molecular docking prediction of mutant PRK6 and AtLURE1.2

WT PRK6-AtLURE1.2



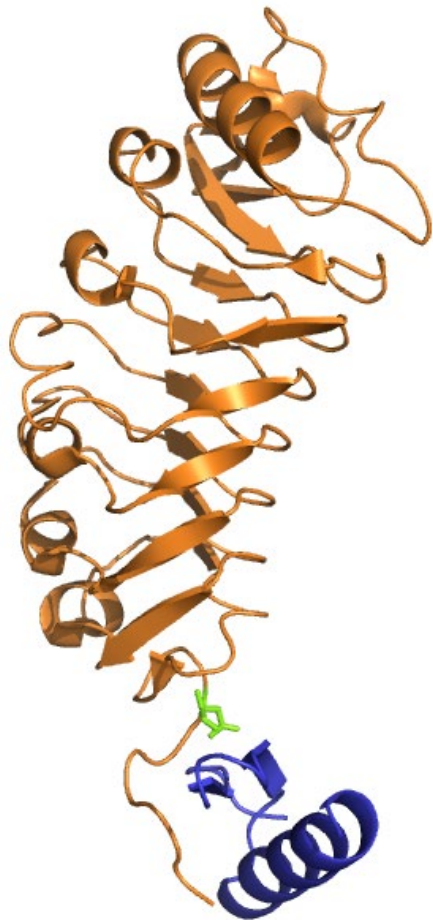
D234A PRK6-AtLURE1.2 ZDOCK对接预测



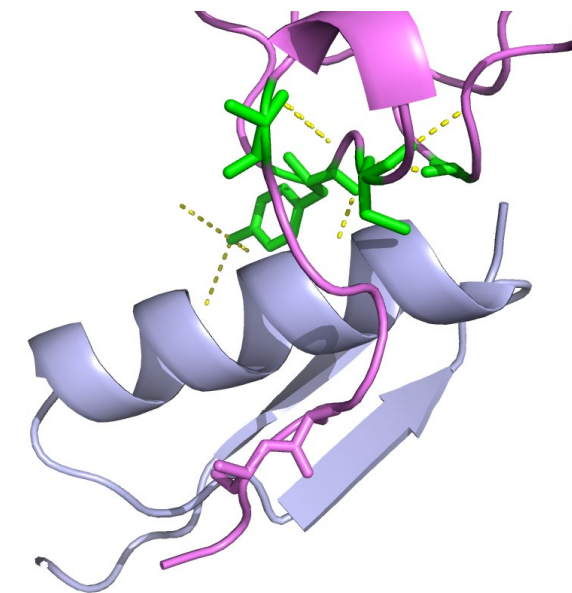
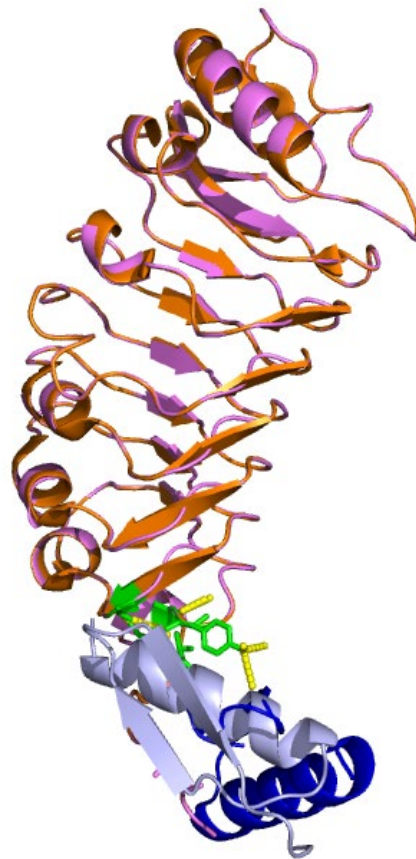
➤ 初步认为突变结合位点后的PRK6丧失与LURE的结合能力

# Molecular docking prediction of mutant PRK6 and AtLURE1.2

WT PRK6-AtLURE1.2



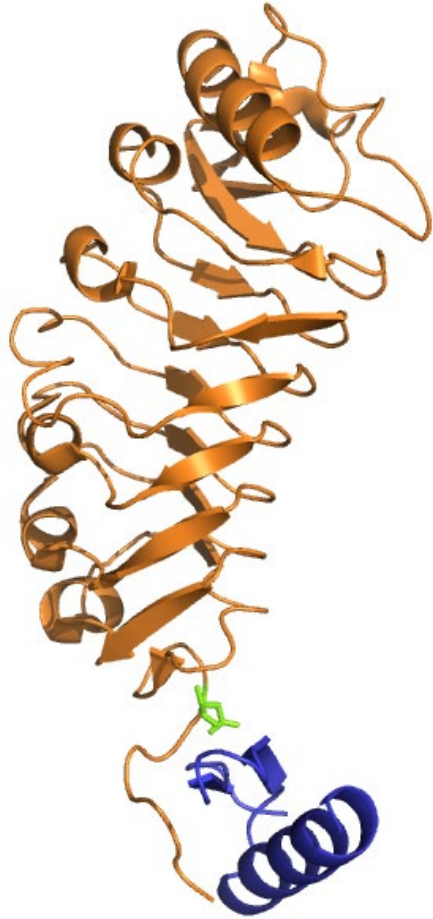
D234A N239A I240A PRK6-AtLURE1.2 ZDOCK对接预测



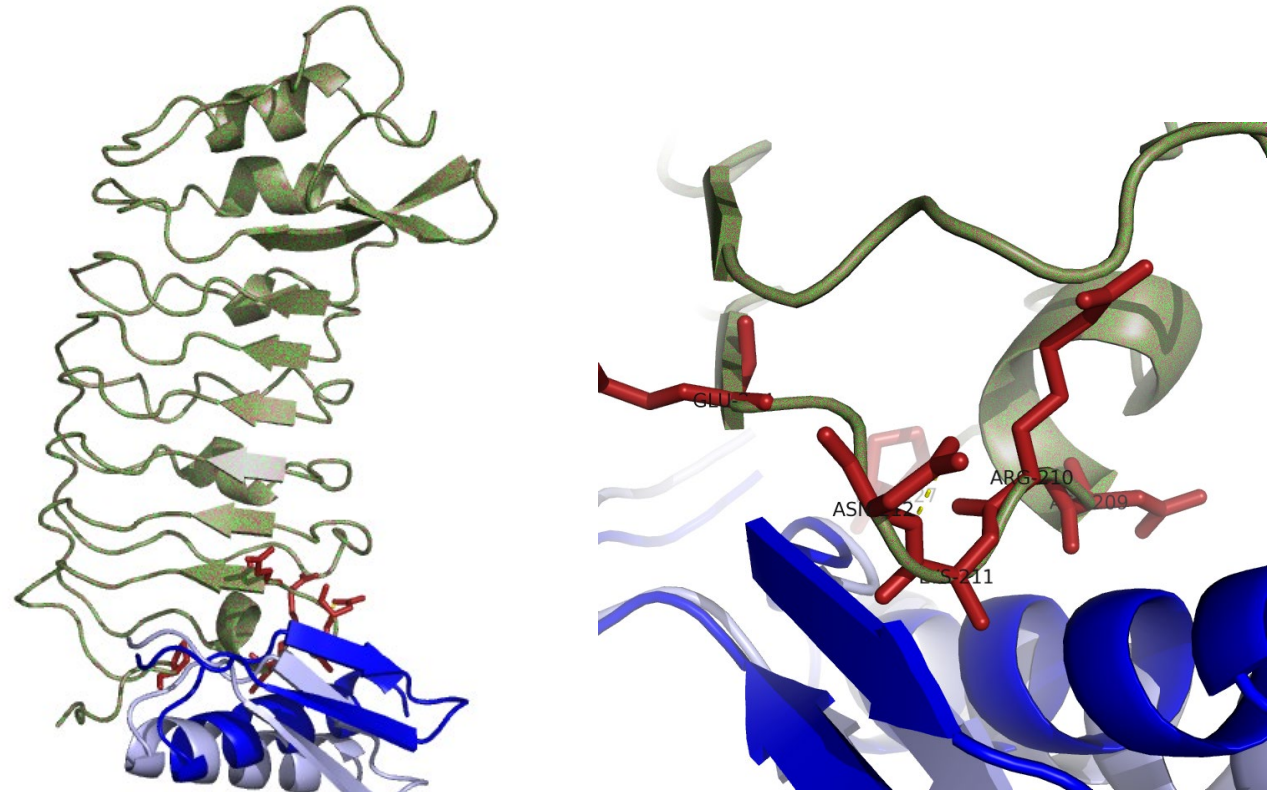
- 初步认为突变结合位点后的PRK6丧失与LURE的结合能力，无有效氢键

# Molecular docking prediction of PRK3 and AtLURE1.2

WT PRK6-AtLURE1.2



WT PRK3-AtLURE1.2 ZDOCK对接预测



PRK3-AtLURE1.2实际上无有效氢键联系

- 初步认为PRK3不具备与LURE的结合能力

# 总结

- 1.与PRK6亲缘关系最近的 PRK3或许不是PRK6结合AtLURE1的共受体，或者是共受体但不负责结合AtLURE1。
- 2.应通过生化、遗传实验进一步证实
- 3.应考虑其他家族受体作为PRK6共受体的可能性。

**Thanks!**