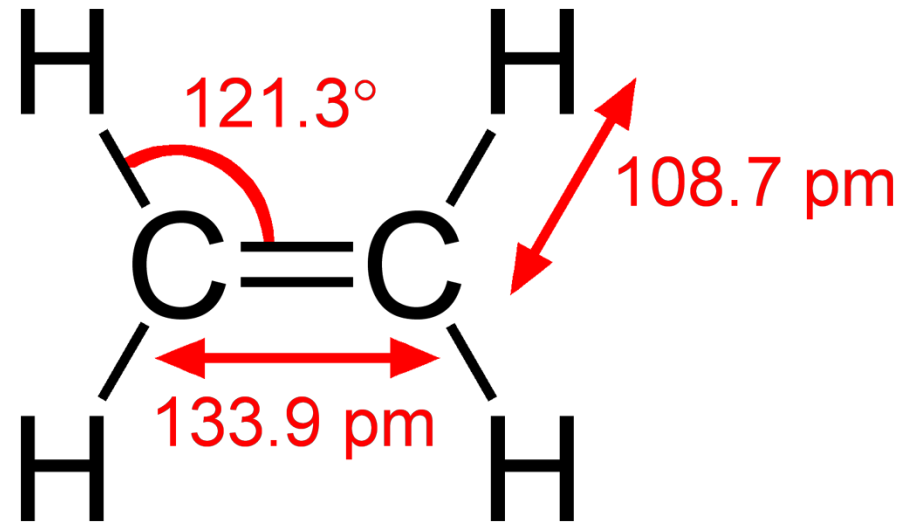


# Ethylen



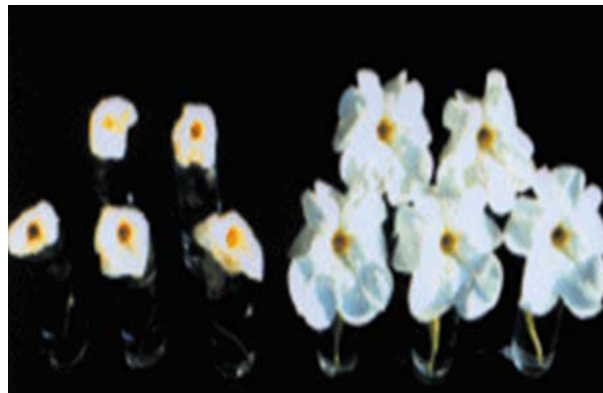
- gas
- no degradation
- communication between organs and **community members**

## Function of ethylene

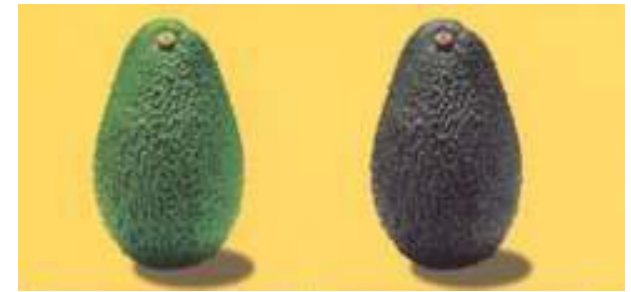
- **Senescence**
- **Ripening (e.g. fruits)**
- **Local responses vs. systemic responses**
- **Defense: in cooperation with jasmonic acid**
- **Abiotic stress: flooding of rice seedlings**
- **Development: seed ripening**



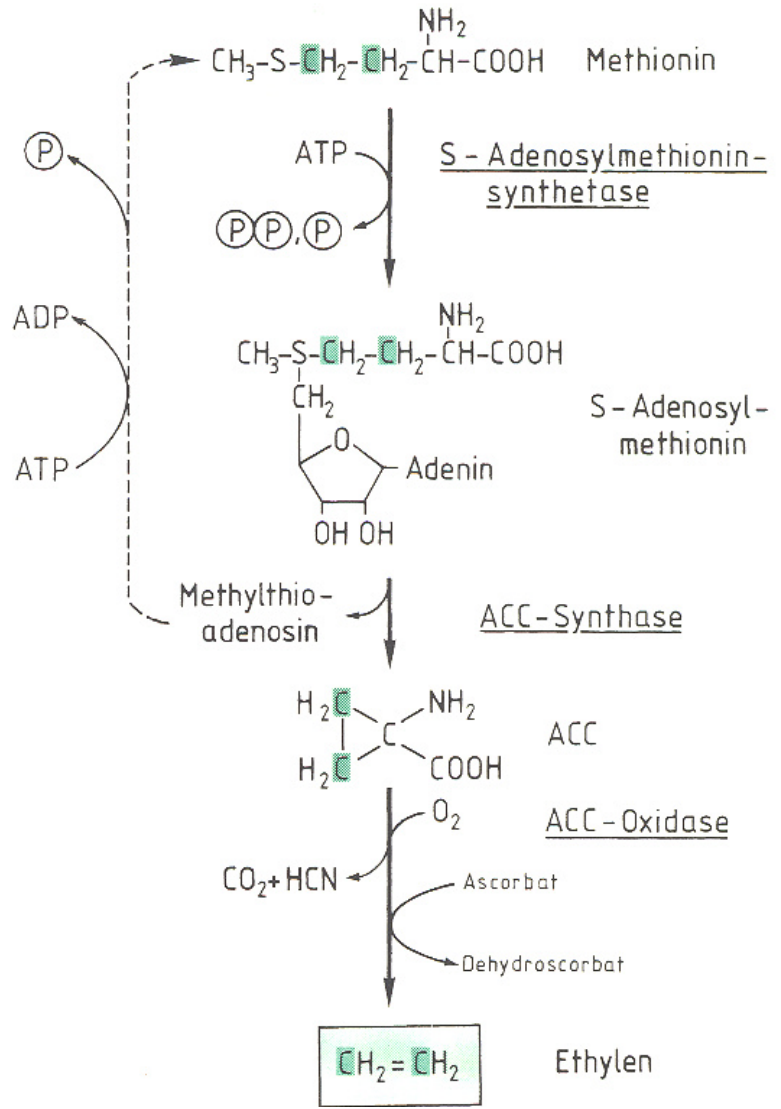
Application in green house



..... during transport

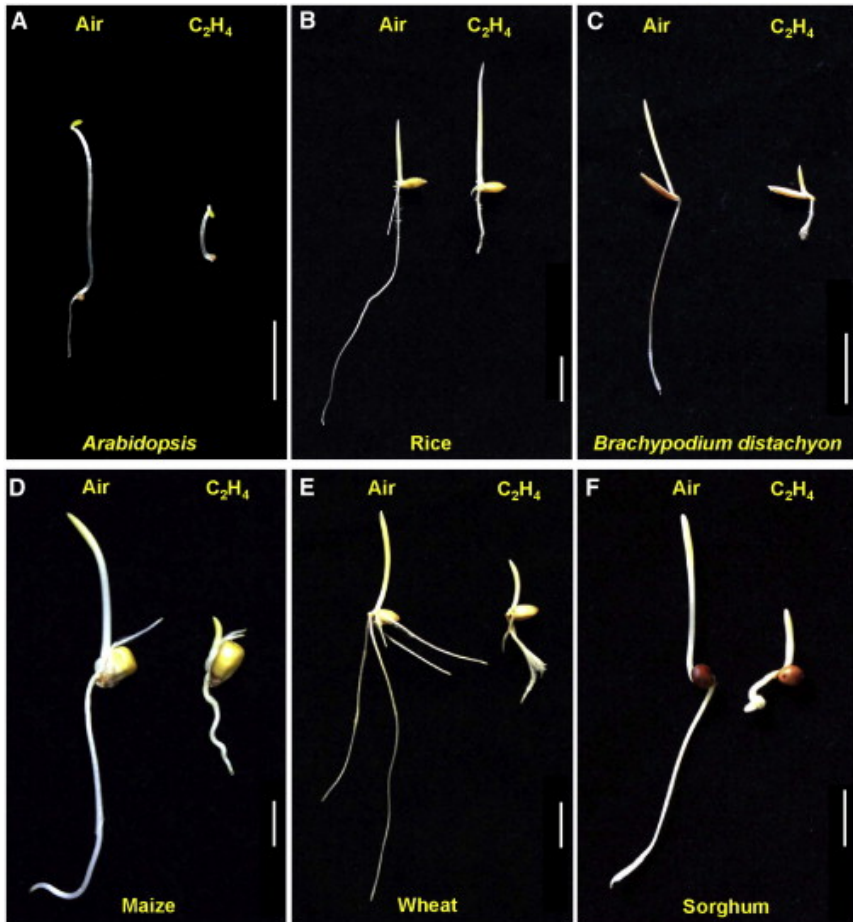


# Biosynthesis of ethylene



- Simple pathway
- Easy to manipulate with molecular tools
- gene knock-out or overexpression

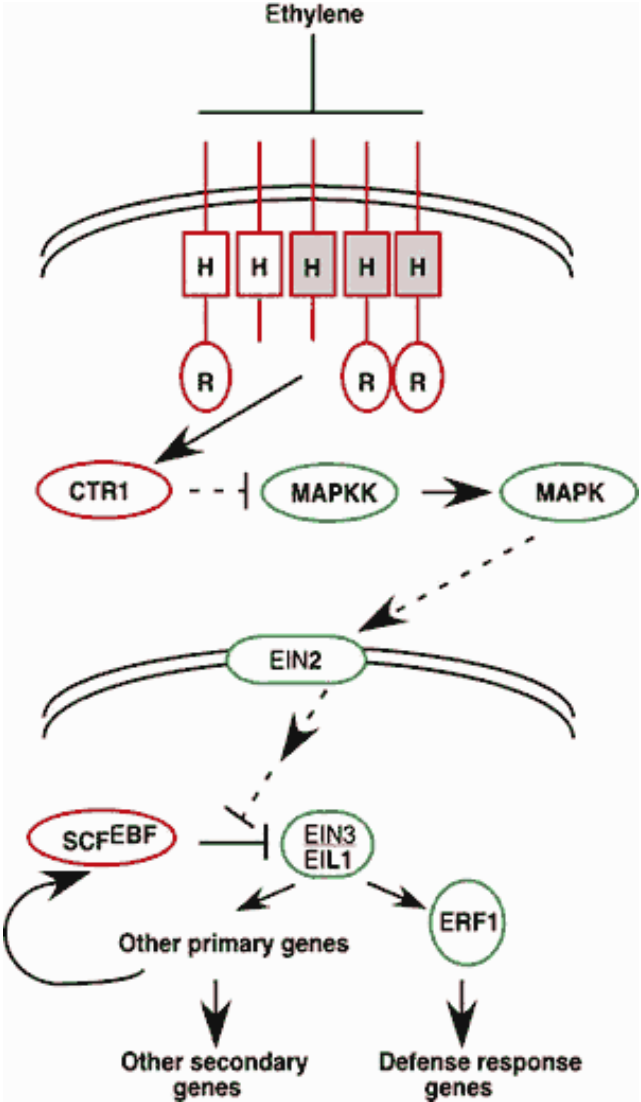
# Triple response mutants in Arabidopsis



# Signal transduction of ethylene

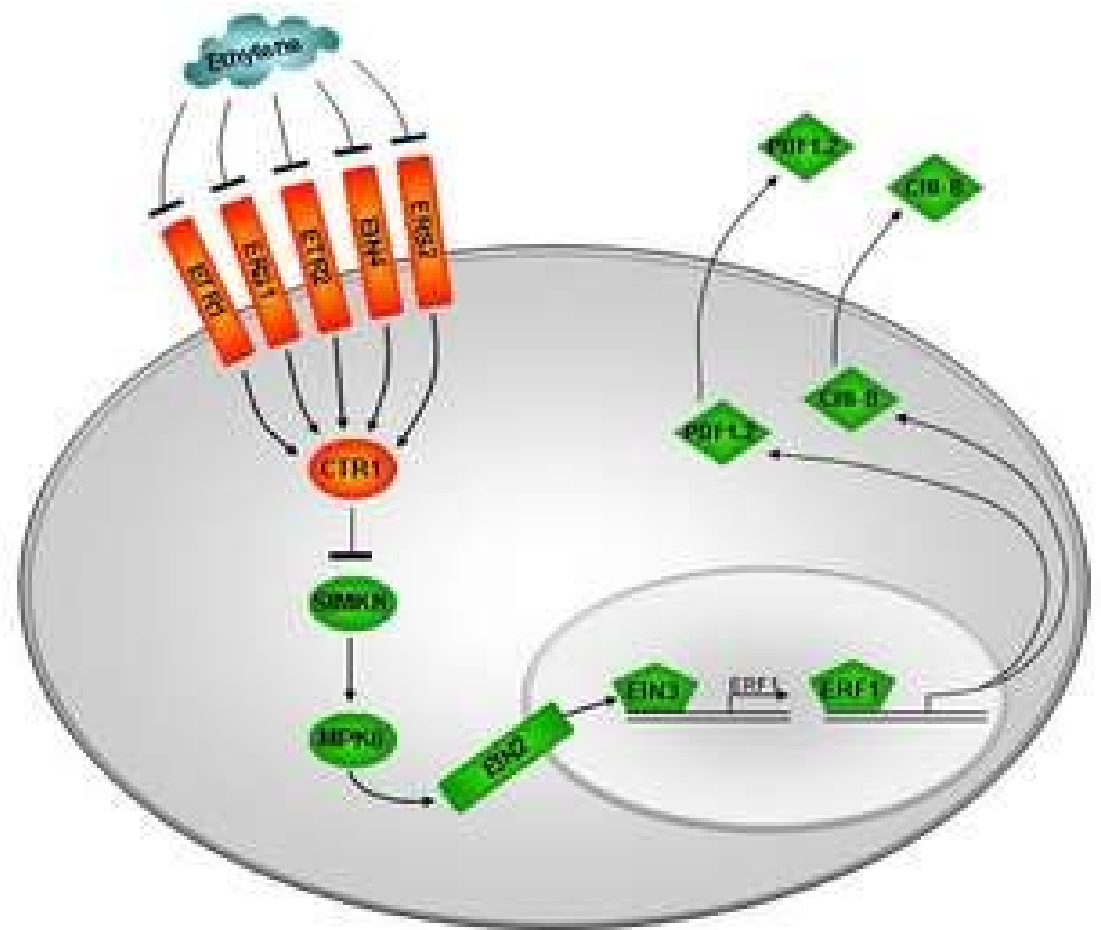
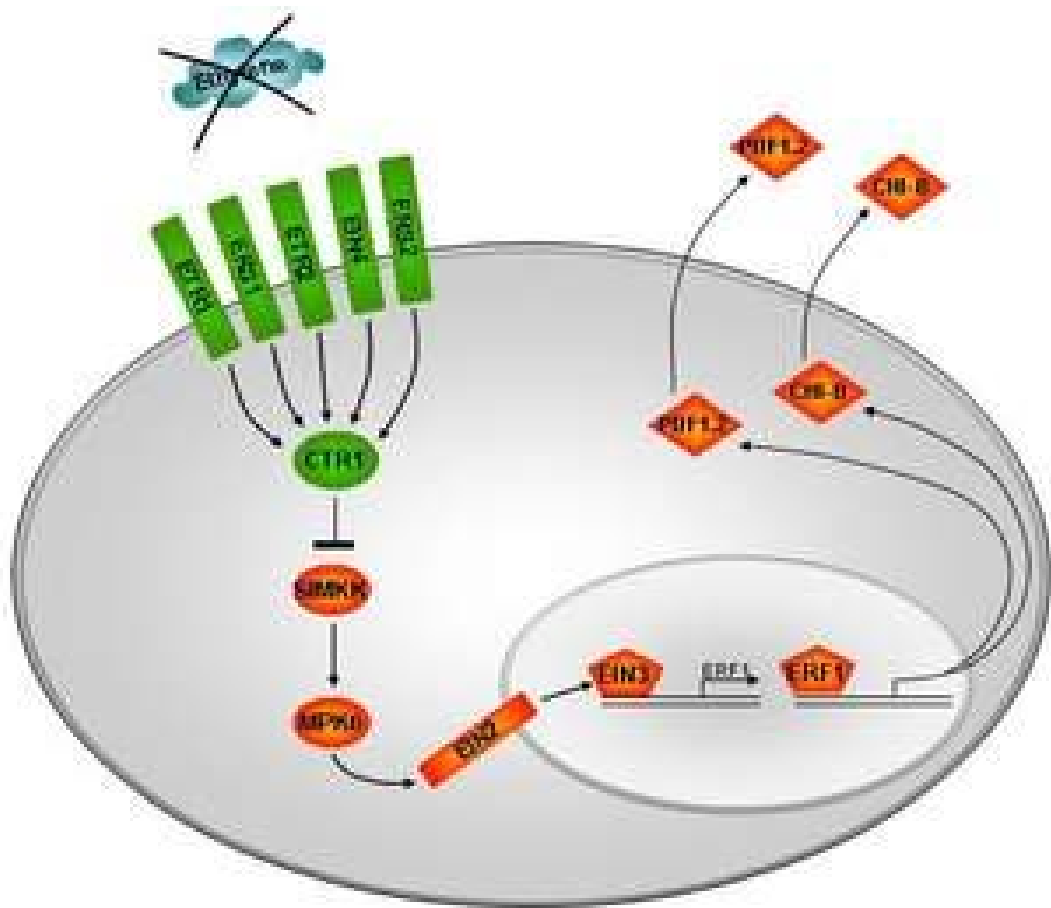
**Without ethylene:**

- receptor on
- CTR1 active
- inhibits MAPKK

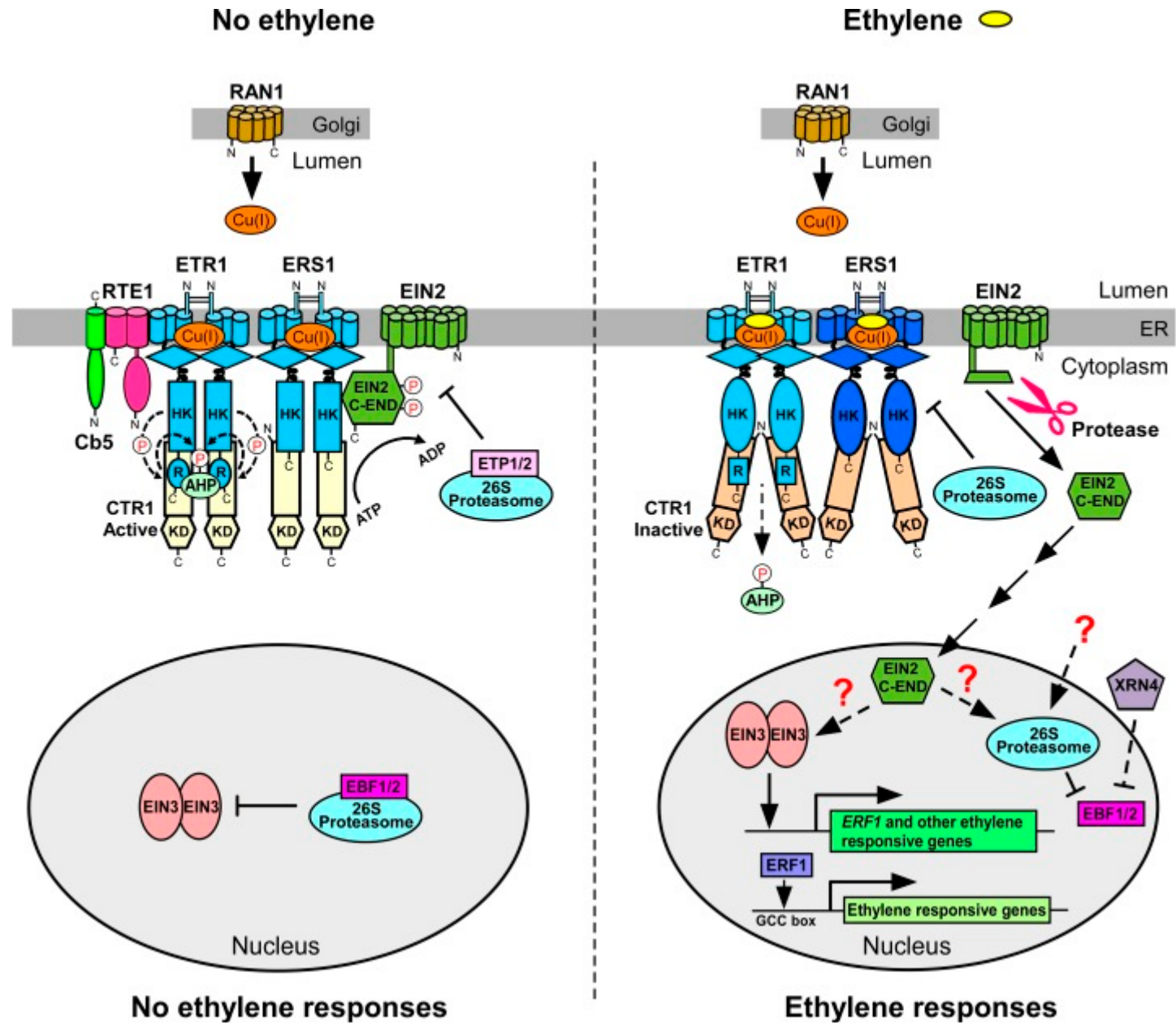


**With ethylene:**

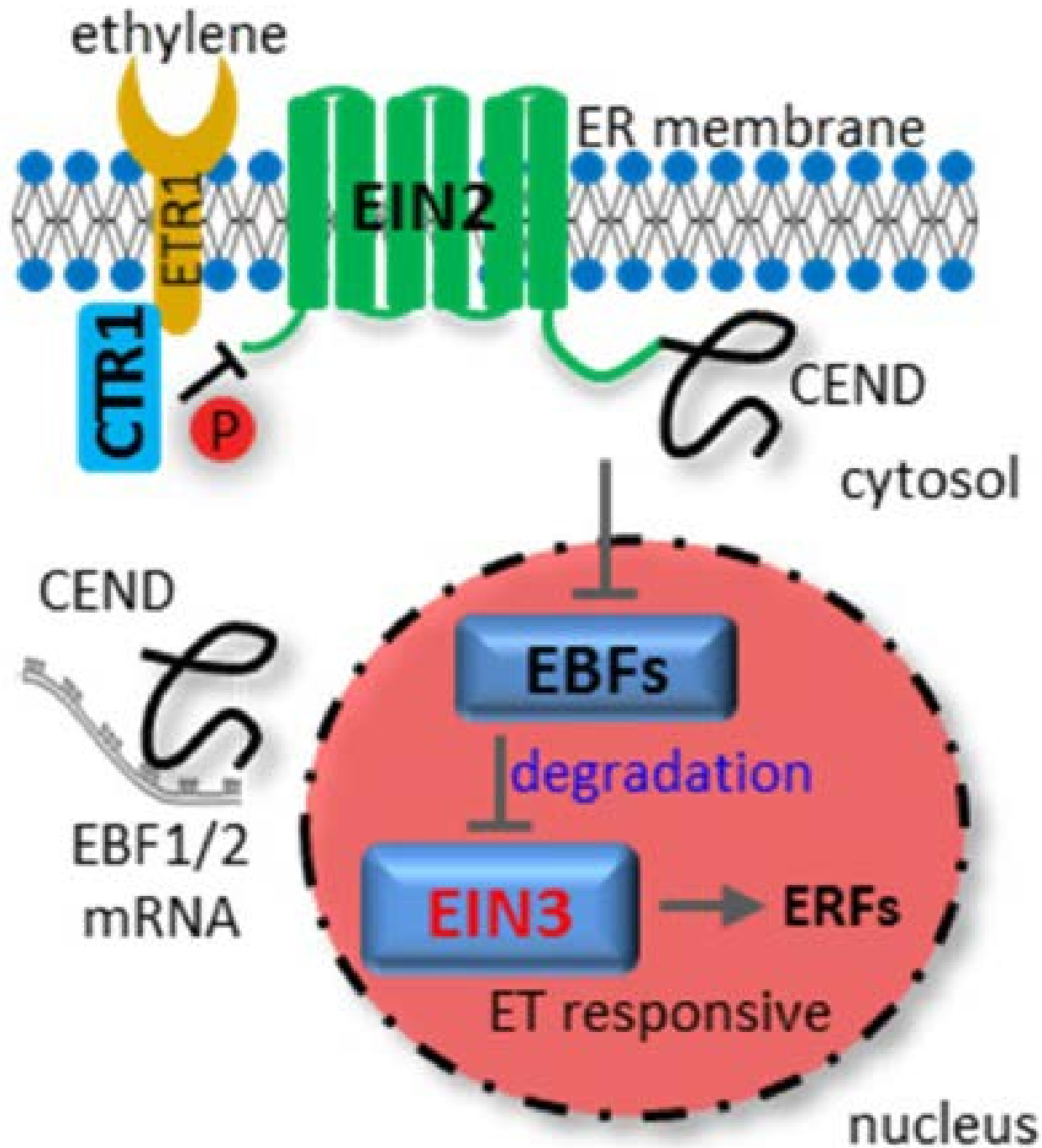
- receptor off
- CTR1 inactive
- MAPKK active



Red: stop!; green: go!







## ET signaling cascade

(-) ET.

CTR1 phosphorylates EIN2 and the ET pathway is blocked.

(+) ET.

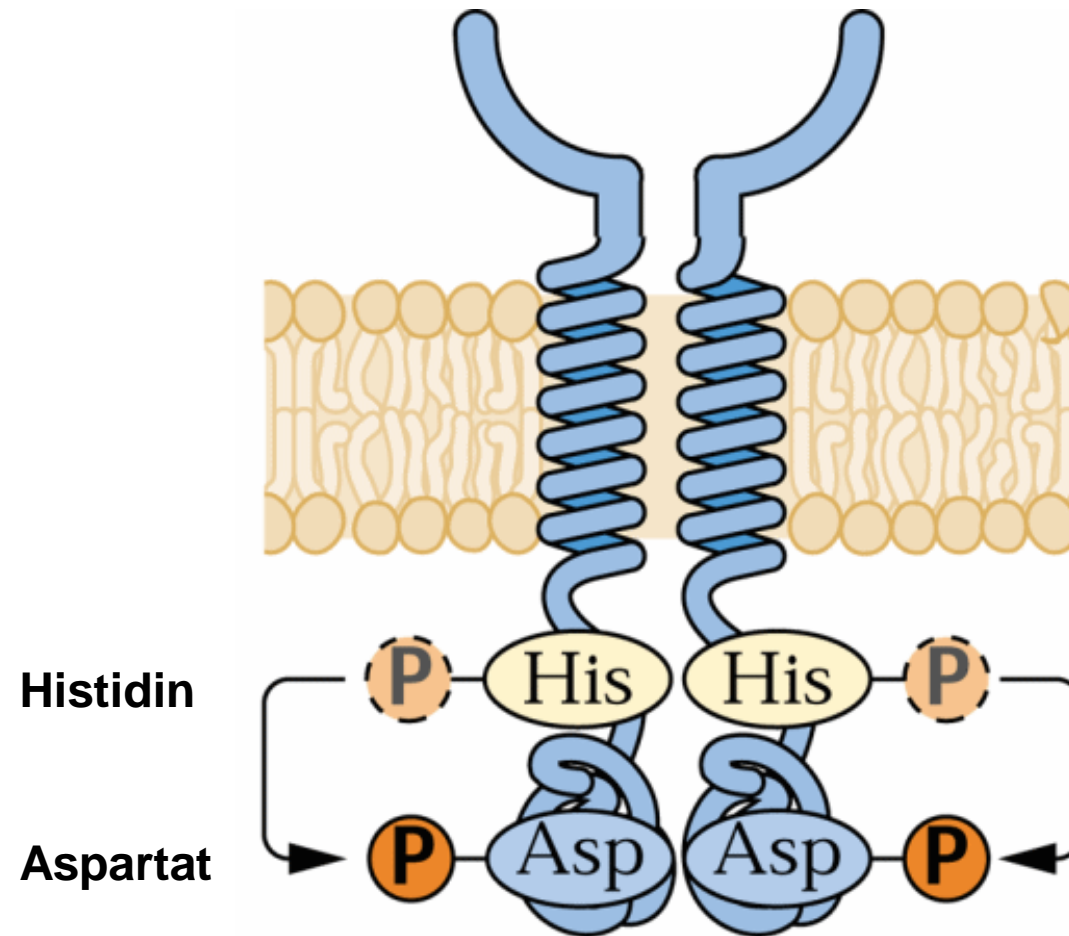
When ET is perceived by ETR1, the kinase activity of CTR1 is inactivated, the EIN2 CEND becomes dephosphorylated and cleaved. CEND subsequently translocates into the nucleus to attenuate EBFs E3 ligase function.

Stabilized EIN3 protein then activates ERF transcription.

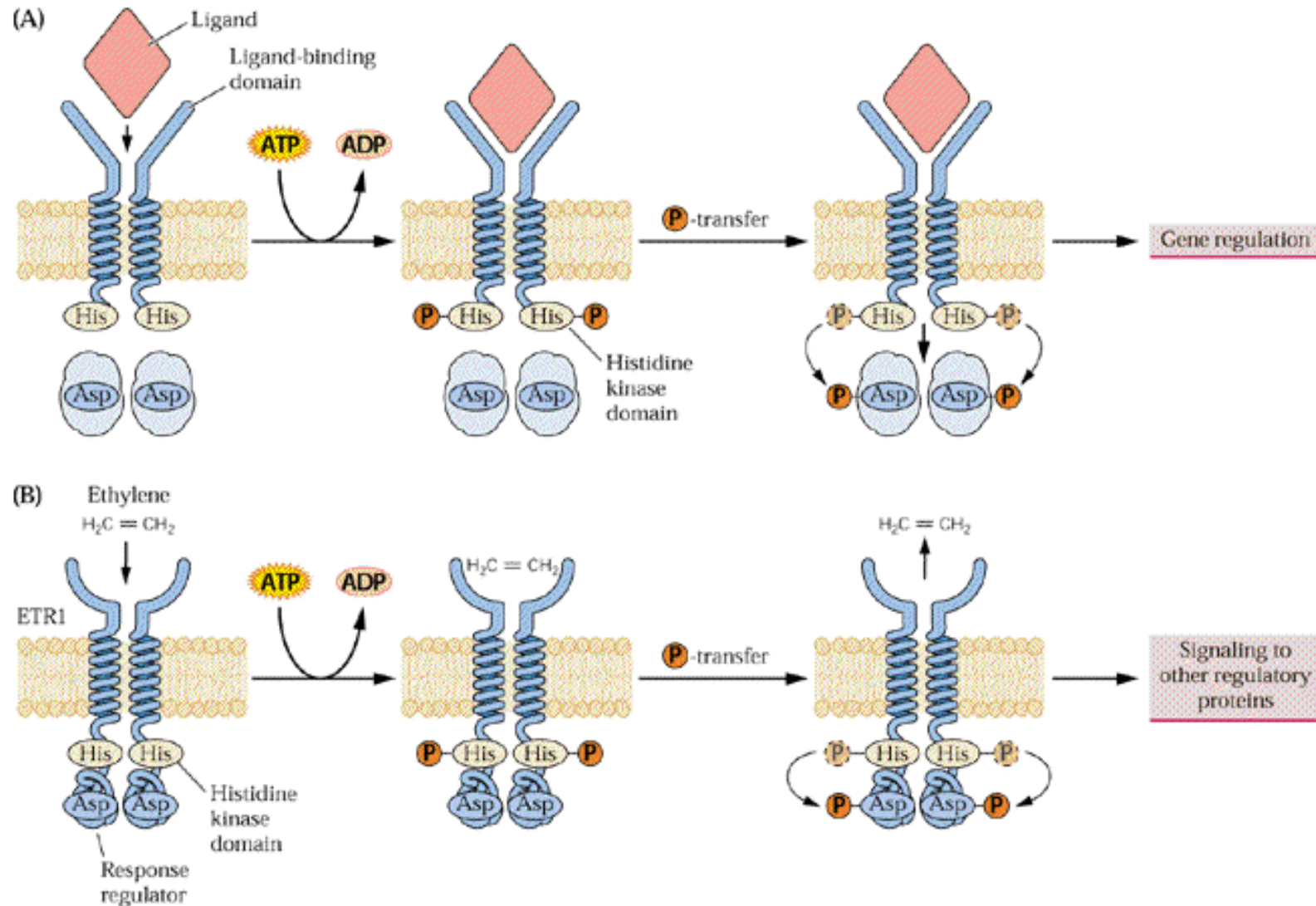
Abbreviations: ACC, 1-Aminocyclopropane-1-carboxylic acid; ACO, ACC-oxidase; ACS, ACC synthase; CEND, C-terminal end of EIN2; CTR1, constitutive triple response 1; EBF1/2, EIN3-binding F-Box 1/2; EIN, ethylene insensitive; ER, endoplasmic reticulum; ERF, ethylene-response factor; ET, ethylene; ETR1: ethylene-resistant 1; MTA, methylthioadenosine; SAM, S-adenosyl methionine; SAMS, SAM synthase.



# Ethylene receptor, a two-component system



# The two-component system is of procaryotic origin



Ethylene and cytokinin are perceived by receptors belonging to the two-component system

Ethylene

Receptor in ER

Ethylene binding requires  $\text{Cu}^{2+}$

Without hormone: receptor is on

Cytokinin

Receptor in plasmamembrane

no ion requirement

hormone activates receptor

# Tomato industry



Manipulation of ethylene biosynthesis or signaling affects tomato fruit ripening.

Application of ethylene promotes fruit ripening (greenhouses).



Ripening fruit produces ethylene and promotes ripening of neighbors.