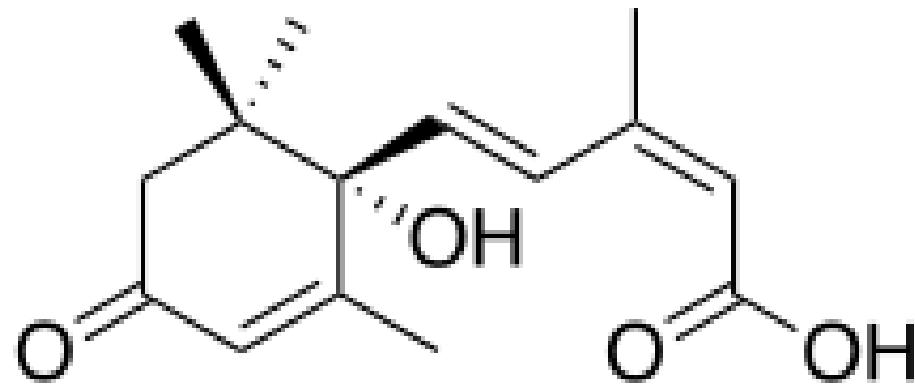


Abscisic acid



Main functions:

- Induction of stomatal closure, decrease of transpiration, reduction of water loss
- Inhibition of fruit ripening
- Inhibition of cell growth and division (seed dormancy, inhibition of seed germination)

In general: abiotic (water) and biotic (pathogens) stress hormone

Biosynthesis

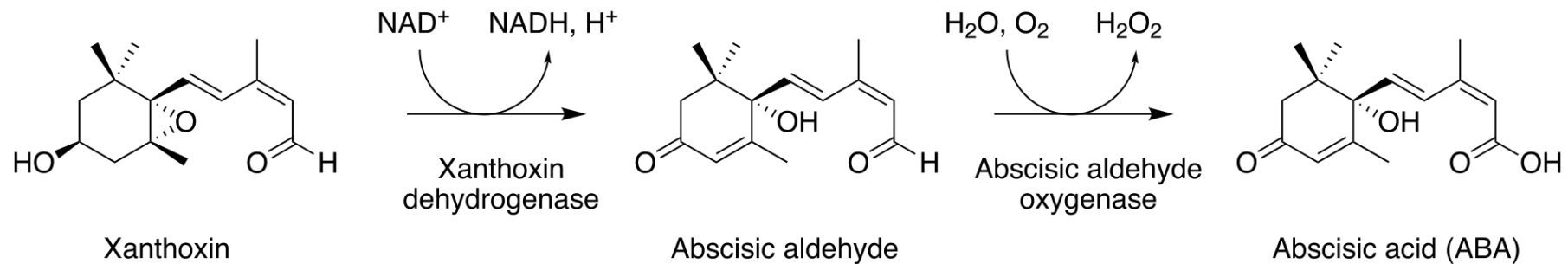
Isoprenoid hormone with C₁₅ backbone

Start: plastids

- 2-C-methyl-D-erythritol-4-phosphate (MEP) pathway for isoprenoid biosynthesis
- Zeaxanthin epoxidations and isomerizations ' violaxanthin,
- cleavage of C₄₀ carotenoid by a dioxygenation reaction ' C₁₅ ABA precursor xanthoxin,

Final steps: at the ER

-
- oxidized to ABA via abscisic aldehyde



Biosynthesis

- Stress hormone (induction by heat, water stress, salt, pathogen attack)
- During desiccation of the vegetative tissues and stress to roots
- Before winter period
- During seed ripening, establishing dormancy

- Synthesized in all cells, mobile within the leaves, transport from roots ' leaves via xylem

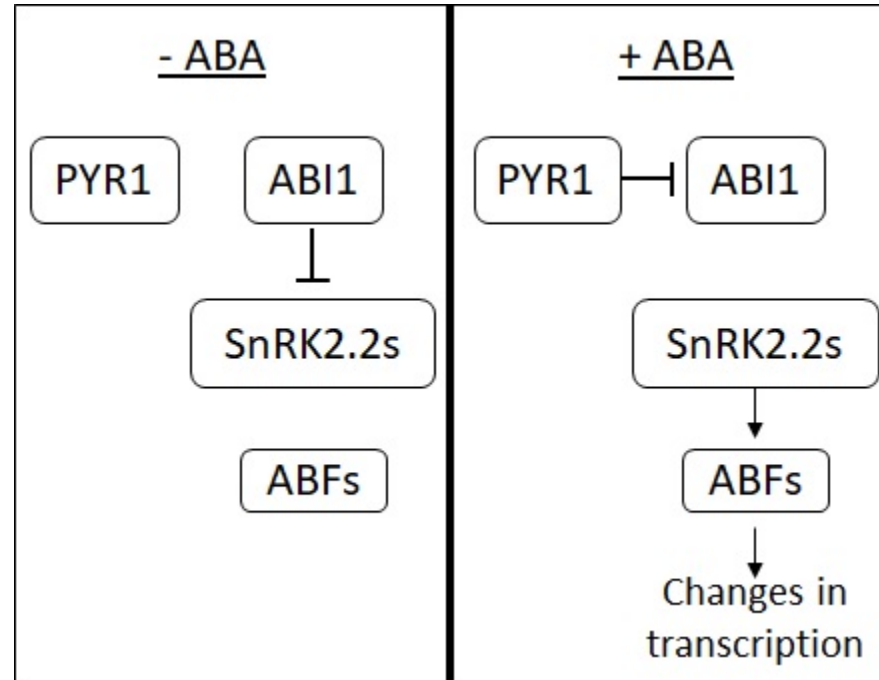
Inactivation

- Via CYP707As (P450 enzymes at ER)
- Reversible inactivation by glucose conjugation (ABA-glucose ester).
- Catabolism via the CYP707As is very important for ABA homeostasis, and mutants in those genes accumulate high levels of ABA

Signal transduction of ABA

Without ABA:

- ABI1 inhibits SnRK2 kinases



With ABA:

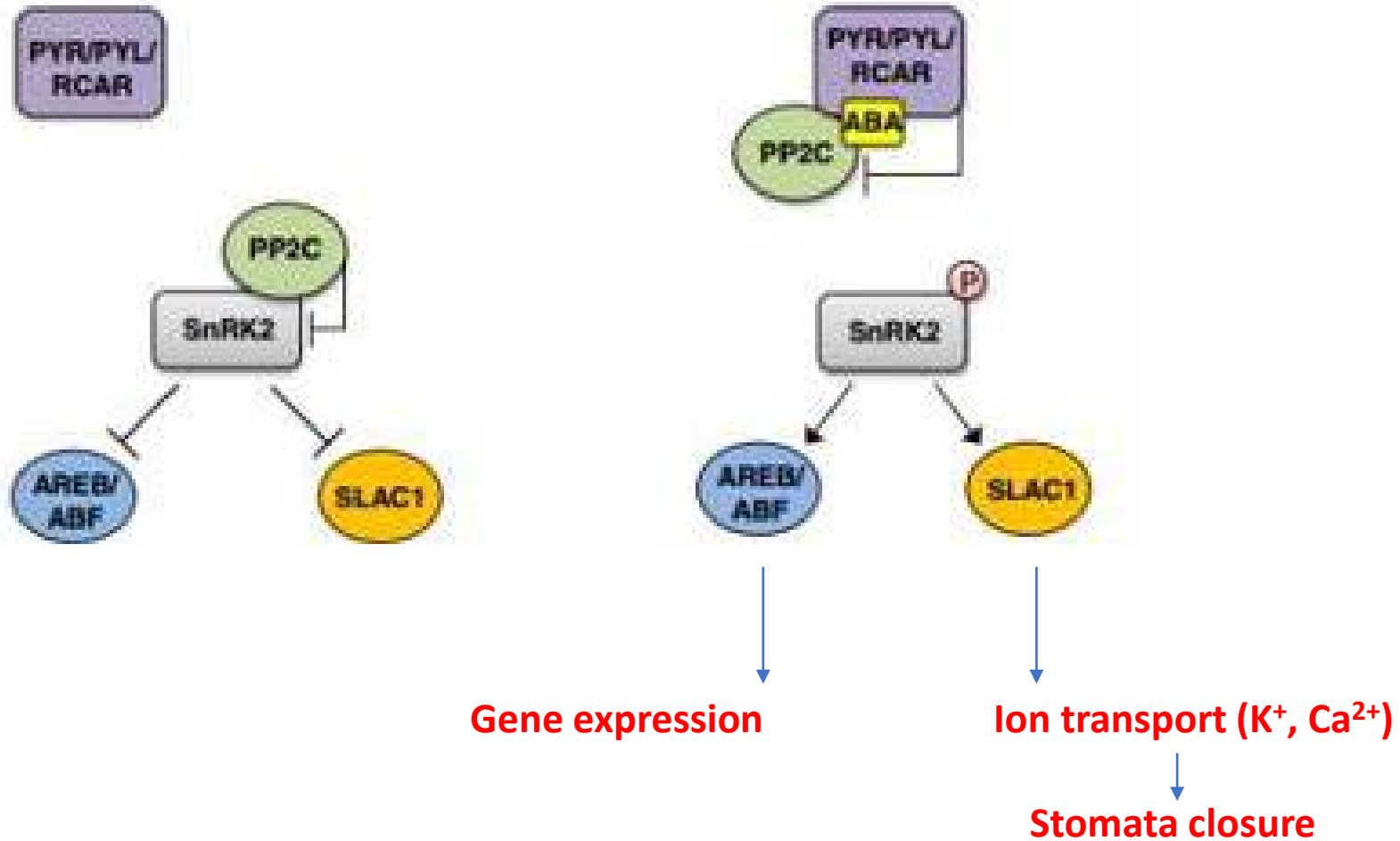
- PYR1 binds and inhibits ABI1

(-ABA) The phosphatase ABI1-INSENSITIVE1 (ABI1) inhibits the action of SNF1-related protein [kinases](#) (subfamily 2) (SnRK2s).

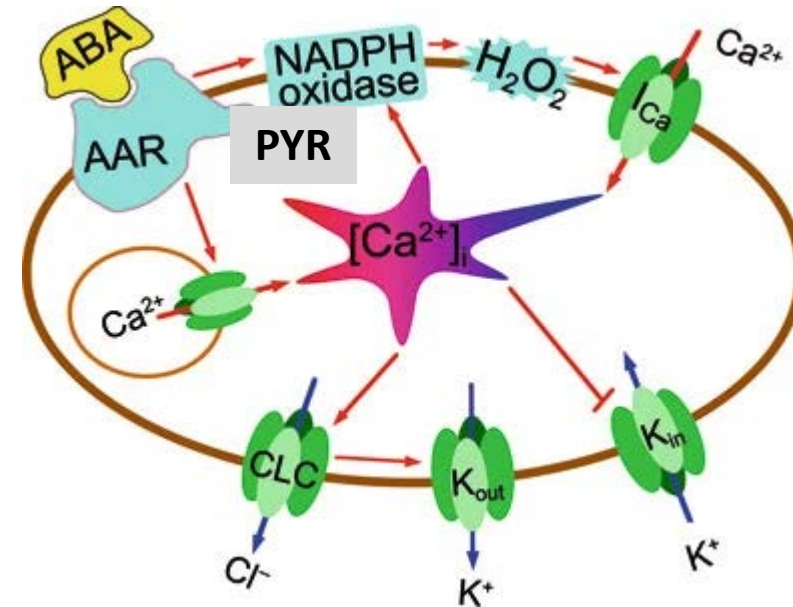
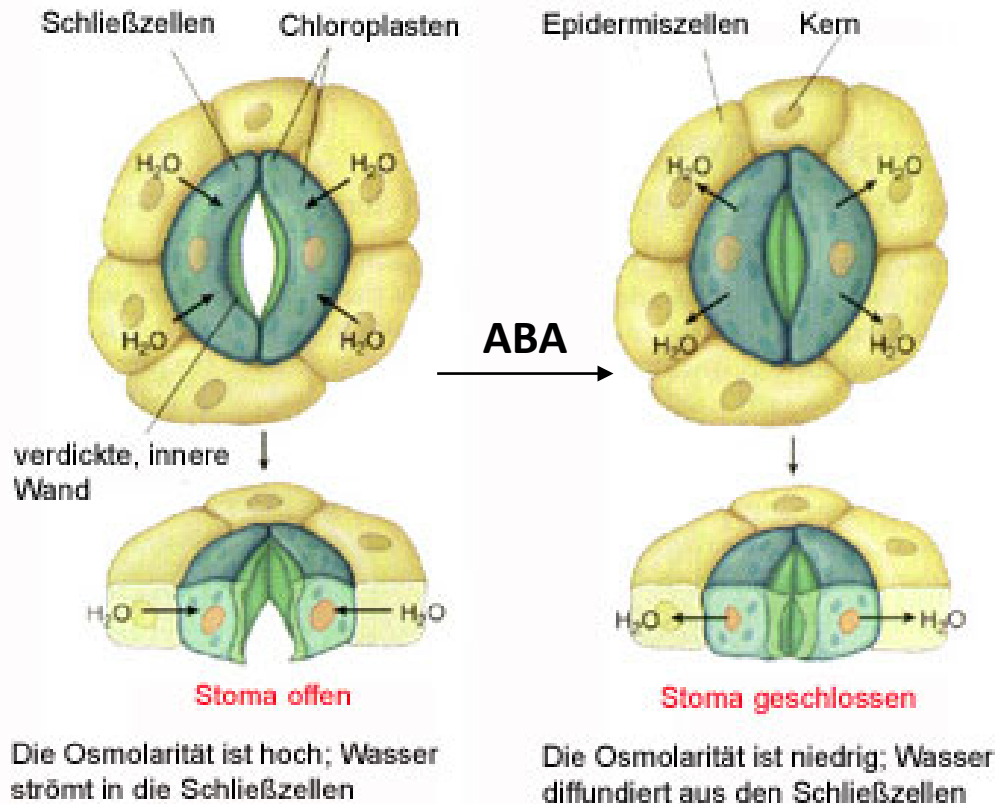
(+ABA) ABA perception by PYRABACTIN RESISTANCE 1 (PYR1) membrane proteins. PYR1 binds to and inhibits ABI1. SnRK2s are released and activate ABA RESPONSIVE ELEMENT-BINDING FACTORS (ABFs). ABFs are transcription factors.

Around 10% of plant genes are regulated by ABA.

ABA responses: gene expression and ion transport



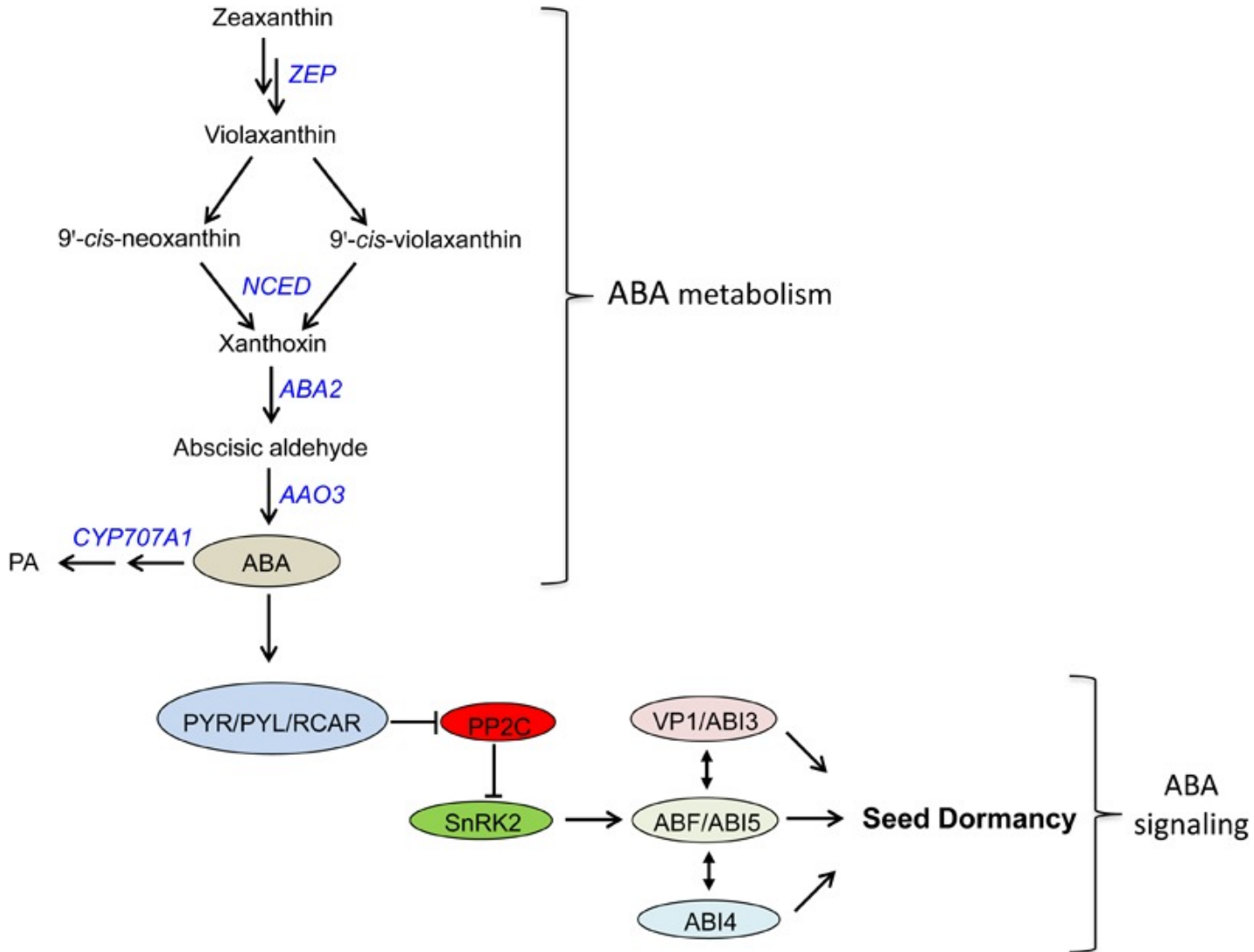
ABA induces stomata closure



Ca^{2+} into cell
 K^+ out of cell

ABA triggers $[Ca^{2+}]_i$ increases via H_2O_2 -activated Ca^{2+} influx channels (I_{Ca}) or Ca^{2+} release from internal stores. The elevated $[Ca^{2+}]_i$ induces further H_2O_2 production via NADPH oxidases, leading to a positive feedback of $[Ca^{2+}]_i$ increases. Anion channels (CLC) are activated by elevated $[Ca^{2+}]_i$, resulting in anion efflux and depolarization of the membrane potential. The depolarized membrane potential promotes K^+ efflux via K^+ outward channels (K_{out}) and inhibits K^+ influx from K^+ inward channels (K_{in}).

ABA mediates seed dormancy



Fresh seeds
high ABA levels

“

ABA degradation in seeds
(e.g. by soil bacteria or
diffusion out of the seeds)

“

GA biosynthesis
GA/ABA ratio increases

“

End of dormancy

ABA inhibits fruit ripening

Passion fruit

