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# Plant resistance to insect pests

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# Natural Plant Defense Mechanisms

- **Salicylic acid pathway** – Induces SAR (systemic acquired resistance), a natural biological defense response to pathogen attack.
- **Jasmonic Acid Pathway** - Induces the production of disease and insect defense compounds.
- **Shikimic acid pathway**

# Salicylic Acid Pathway

- Production of active oxygen (hydrogen peroxide, peroxidase)
  - Peroxidases have been associated with fungal cell wall degradation and pathogen defense signaling
- Thickening plant cell wall
  - Increasing lignification
  - Production of phenolic esters that strengthen cross linking

# Salicylic Acid Pathway

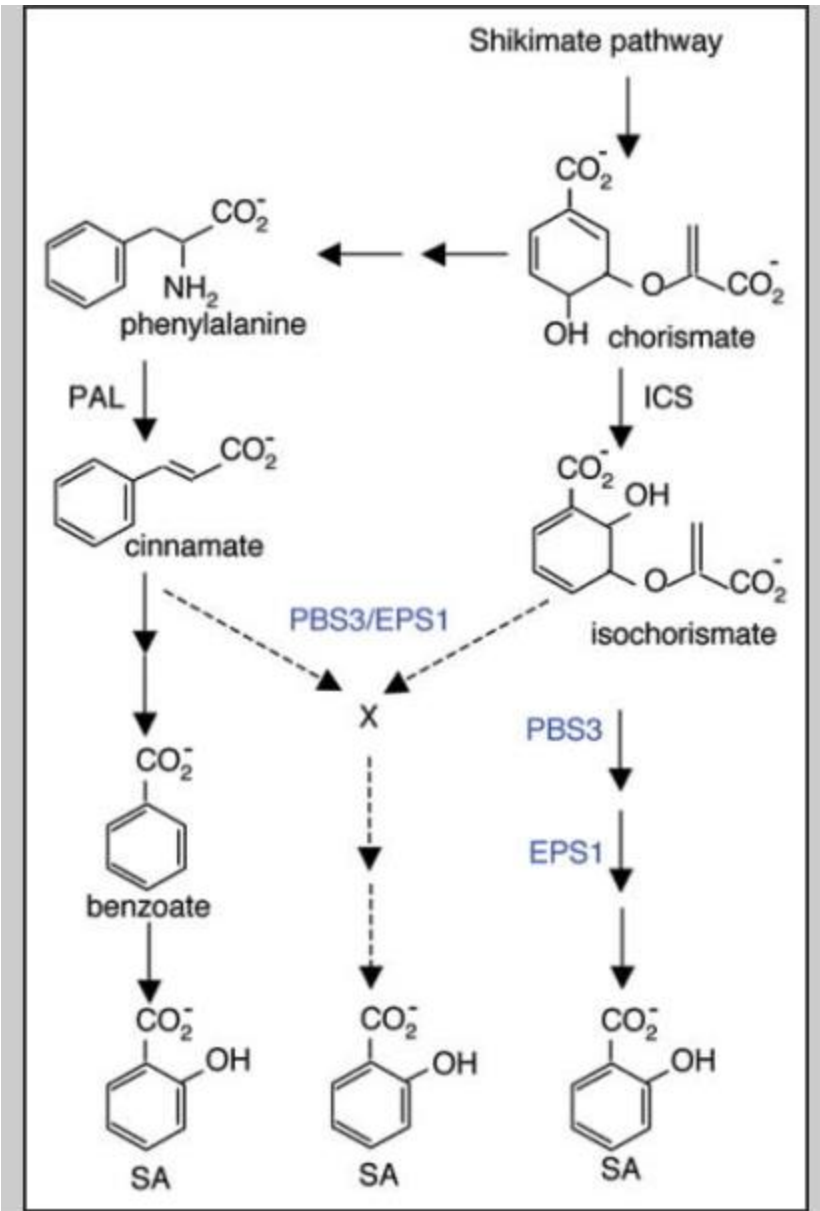
- Systemic and local accumulation of Pathogenesis Related Proteins (PR-Proteins)
  - chitinases
  - $\beta$ -1,3 Glucanase
- Systemic accumulation of anti-microbial compounds called **phytoalexins**.

# Chitinases

- Chitin is the major component of all fungal cell walls except for the **Oomycetes**
- Chitinases break down **fungal cell walls**
- Chitinases can break down **insect exo-skeletons**
- Activity is greatly enhanced by **Glucanase**

# $\beta$ -1,3 Glucanases

- Glucans and cellulose are the major components of **Oomycete cell walls**
- Antifungal activity is most often in combination with **Chitinase**
  - **Direct defense**: Degrade fungal cell walls
  - **Indirect defense**: Promoting the release of oligosaccharides that act as elicitors of defense reactions



- Salicylic acid (SA) is an important signal molecule in plants. Two pathways of SA biosynthesis have been proposed in plants. Biochemical studies using isotope feeding have suggested that plants synthesize SA from cinnamate produced by the activity of phenylalanine ammonia lyase (PAL). Silencing of PAL genes in tobacco or chemical inhibition of PAL activity in Arabidopsis, cucumber and potato reduces pathogen-induced SA accumulation.



