THE PLANT CUTICLE: STRUCTURE, FUNCTION AND INSPIRATION

- 1st line of defense between the plant & its environment
- Provides drought & cold tolerance
- Protects against pathogens & UV radiation
- Mediates plant-insect & pollen-stigma interactions

**Cuticle:**
Cutin polyester matrix
Infused and laid atop with cuticular waxes

**Goal:** Breed/engineer for "designer" cuticles to protect against different stressors
**Cutin Structure is Elusive:**
Polyester matrix of
- Hydroxy-fatty acids
- Phenolics
- Epoxy-fatty acids
- Glycerol

Possible Structure
Li-Beisson, 2016

**Cuticular waxes (example):**

Wax composition drives crystalloid formation, and can impact function as water barrier

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**Cuticle-inspired product development**

*Fruit and vegetable coatings based on cuticle structure and function*

**Plant Cuticle-Inspired Polymers as Promising Green and Sustainable Polymer Materials**
Shuvra Singha, Vasantha Gowda, and Mikael S. Hedås

**All-Natural Sustainable Packaging Materials Inspired by Plant Cuticles**
José A. Heredia-Guerrero,* José J. Benitez, Pietro Cataldi, Uttam C. Paul, Roberto Cingolani, Ilker S. Bayer, Antonio Heredia, and Athanassia Athanassiou*

**Open Questions and Opportunities**

- What is the nanostructure of cutin and how do waxes intercalate & confer protection?
- **Nano-enabled agriculture:** nanoparticles (NP) to improve crop productivity, nanofertilizers, etc.
  - How do the cuticle and NPs interact and how does this impact plant uptake?
- Do we need to breed/engineer for cuticle compositions or specific “cuticle-friendly” NPs that support nano-enabled ag?