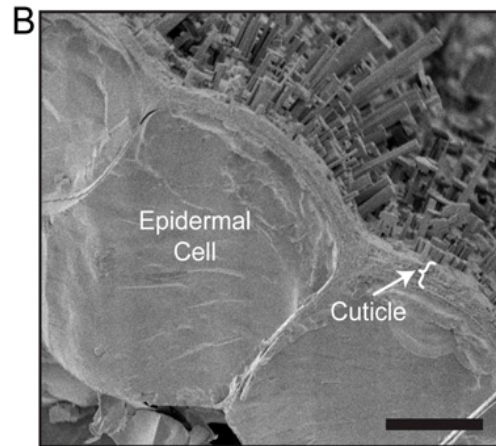
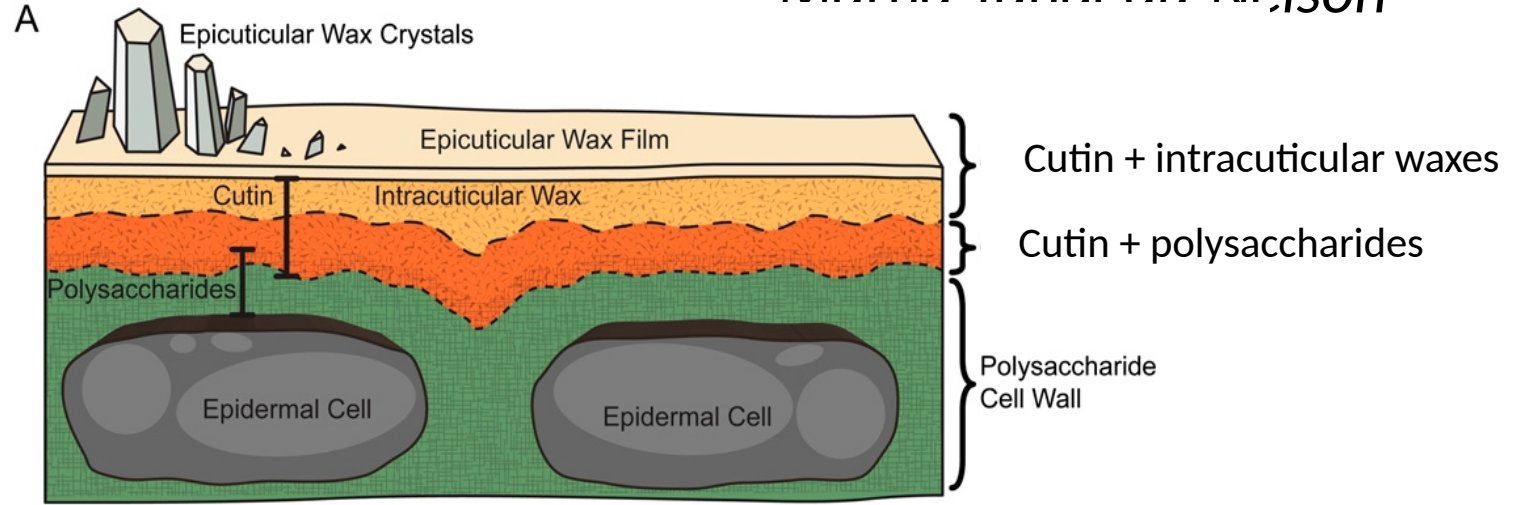
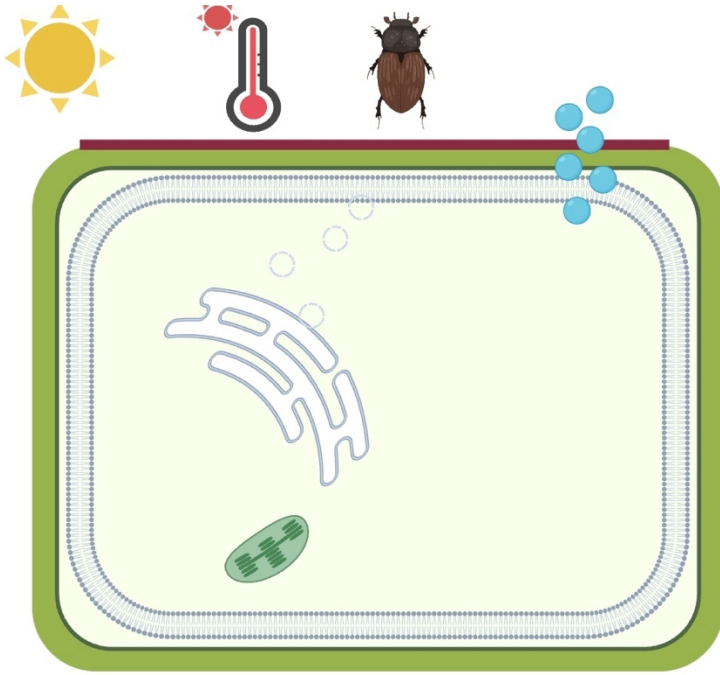
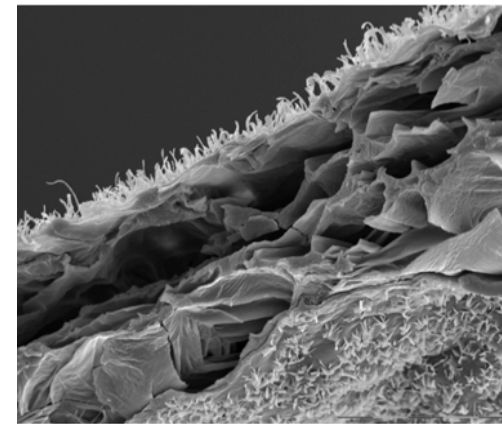


# THE PLANT CUTICLE: STRUCTURE, FUNCTION AND INSPIRATION

Marna Vandeuil-Nelson



Yeats & Rose, Plant Physiol, 2013



Dr. Hilal Ilarslan

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

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

**Goal:** Breed/engineer for “designer” cuticles to protect against different stressors

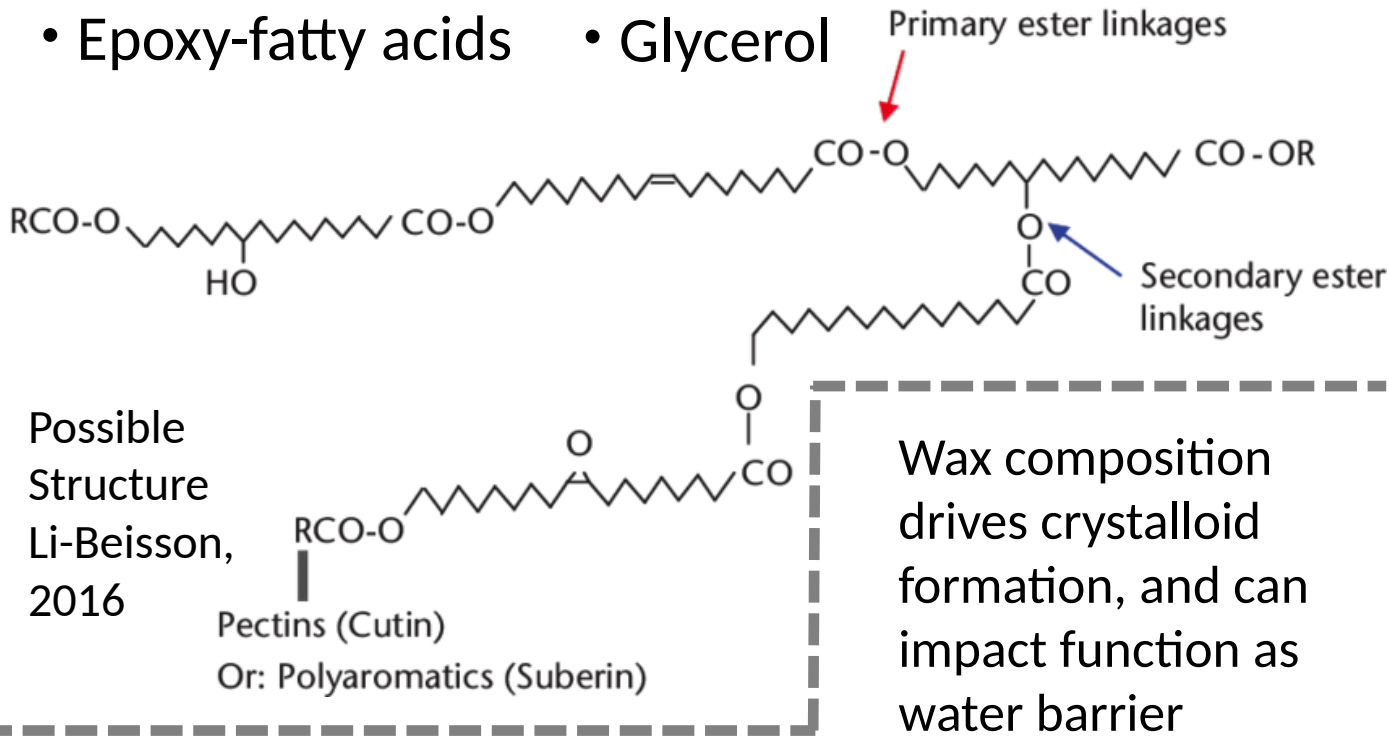
The Lotus Effect  
ProPERLA.uk.co



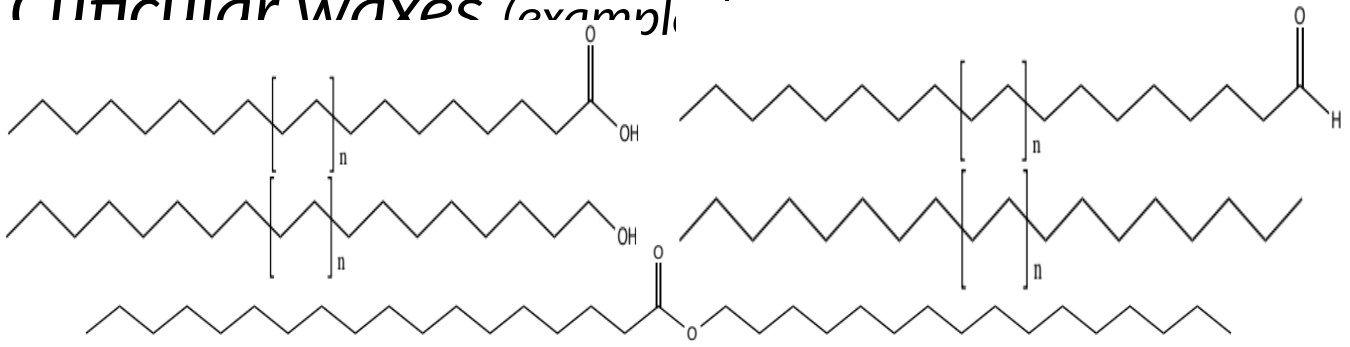
# Cutin Structure is Elusive:

Polyester matrix of

- Hydroxy-fatty acids
- Phenolics
- Epoxy-fatty acids
- Glycerol



## Cuticular waxes (exemplar)



# Cuticle-inspired product development



Fruit and vegetable coatings based on cuticle structure and function

## Plant Cuticle-Inspired Polyesters as Promising Green and Sustainable Polymer Materials

Shuvra Singha, Vasantha Gowda, and Mikael S. Heden



## All-Natural Sustainable Packaging Materials Inspired by Plant Cuticles

José A. Heredia-Guerrero,\* José J. Benítez, Pietro Cataldi, Uttam C. Pal, 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?