# Modification of Poly(lactic) Acid *via* Electron Beam Radiation for Biodegradable, Shelf Life Extending Food Packaging

Chris Acha, Robert Blanchard, Jon Brodsky, Lilly Ding, Andrea Fox, Eleanor Grosvenor, Kalina Gibson, Annie Hoy, Justin Hughes, Kristen Lee, Olivia Mihok, Cade Stanfield, Ananya Uniyal, Sydney Whitaker

GEMSTONE Honors College
University of Maryland

## Current Problems and Background:

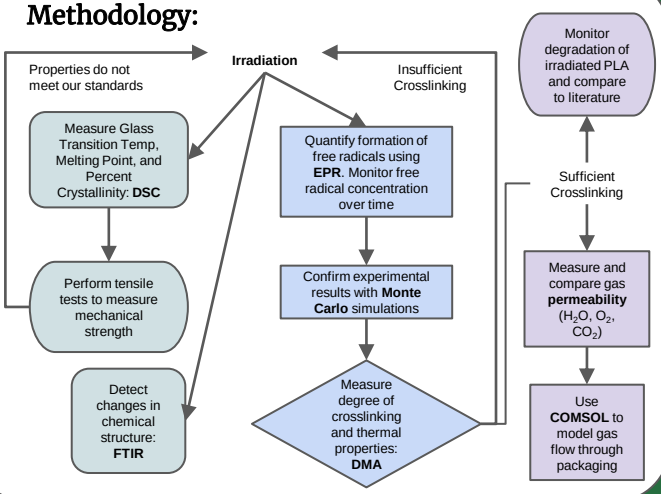
- 1.3 billion tons of food is wasted every year, much of which is lost in transit due to spoilage
- Packaging waste accounts for 29.5% of municipal solid waste in the U.S.
- Current packaging solutions focus on biodegradability or extending shelf-life, but not both
- PLA was chosen for its film-forming capabilities, FDA approval, and tendency to undergo crosslinking as opposed to chain scission
- Crosslinking to improve mechanical and diffusion properties

**Our Solution:** Modify PLA to improve produce shelf life and preserve biodegradability

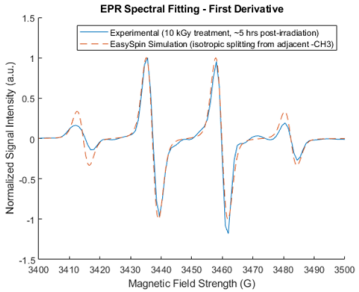
**Research Question:** Will modification of PLA using electron beam irradiation improve qualities of the polymer for food packaging?

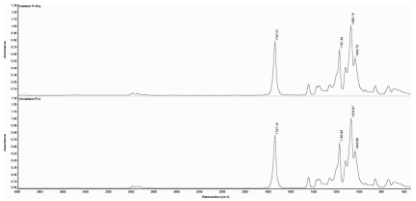
**Hypothesis:** Through irradiation of PLA, we will increase crosslinking density, increase the pathway tortuosity, and decrease gas permeability through the plastic

## Methodology:




From the EPR splitting pattern and agreement with our simulation, we have determined that the dominant reaction mechanism is hydrogen abstraction, which allows for crosslinking.



FTIR spectra indicate minimal structural change at low doses. Subsequent spectra will be taken for PLA irradiated at higher doses of irradiation.

## Results:

We conducted water vapor permeability tests in accordance with ASTM standard E96. The water vapor transpiration rate is 6.1909 g/m$^2$day.

Preliminary FTIR data confirms the viability of our methodology. We will use characterize unirradiated PLA and compare with irradiated samples.

## Future Research Goals:

- Analyze energy deposition and surface flux in MCNP to improve irradiation dosage
- Compare effects of different doses on mechanical properties

## Acknowledgements and References:

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