Machine learning to predict extracellular vesicle properties for drug delivery applications

Robert D. Kirian

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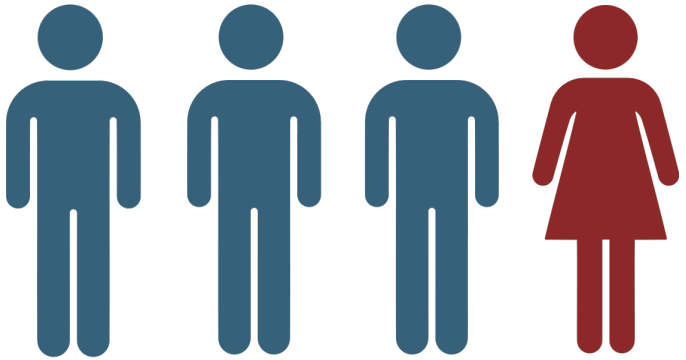
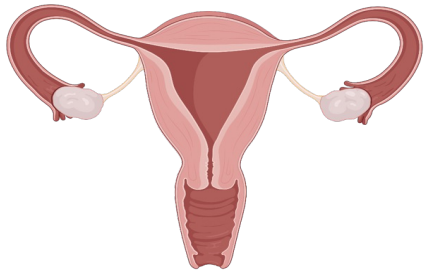
Unmet opportunity to develop drug delivery technologies for women's health

75% of funding allocated to male-specific disorders



Swingle et al, *Nature Reviews*, 2021.

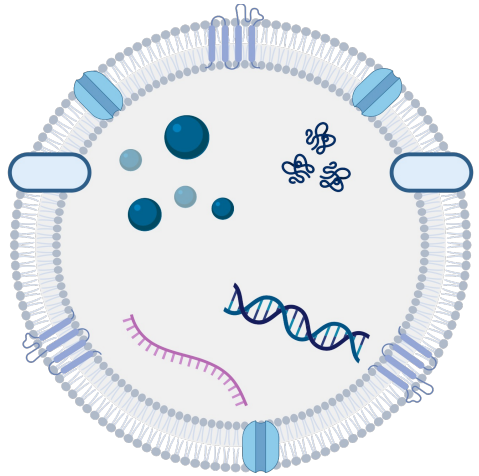
Vaginal drug delivery is an optimal method



- ✓ Avoids gastrointestinal environment
- ✓ Avoids hepatic "first-pass"
- ✓ Enables uterine "first-pass"

Zierden, et al. *Trends Mol Med,* 2021

Extracellular vesicles as therapeutic carriers



Kirian, et al. *Theranostics,* 2024

Hypothesis: Tuning culture parameters will enable control of EV characteristics

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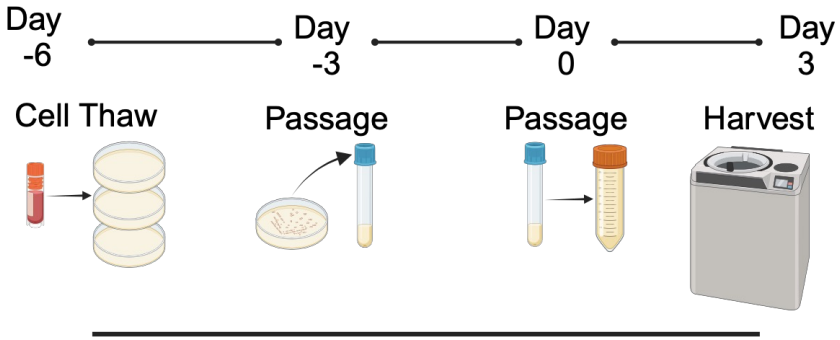
Culture parameters affect EV properties

Experiment Overview



Analysis

Colony Forming Unit (**CFU**) Analysis

Nanoparticle Tracking Analysis (**NTA**)

Evaluate:

- Size distribution (**nm**)
- Concentration (**particles/mL**)
- ζ-potential (**mV**)

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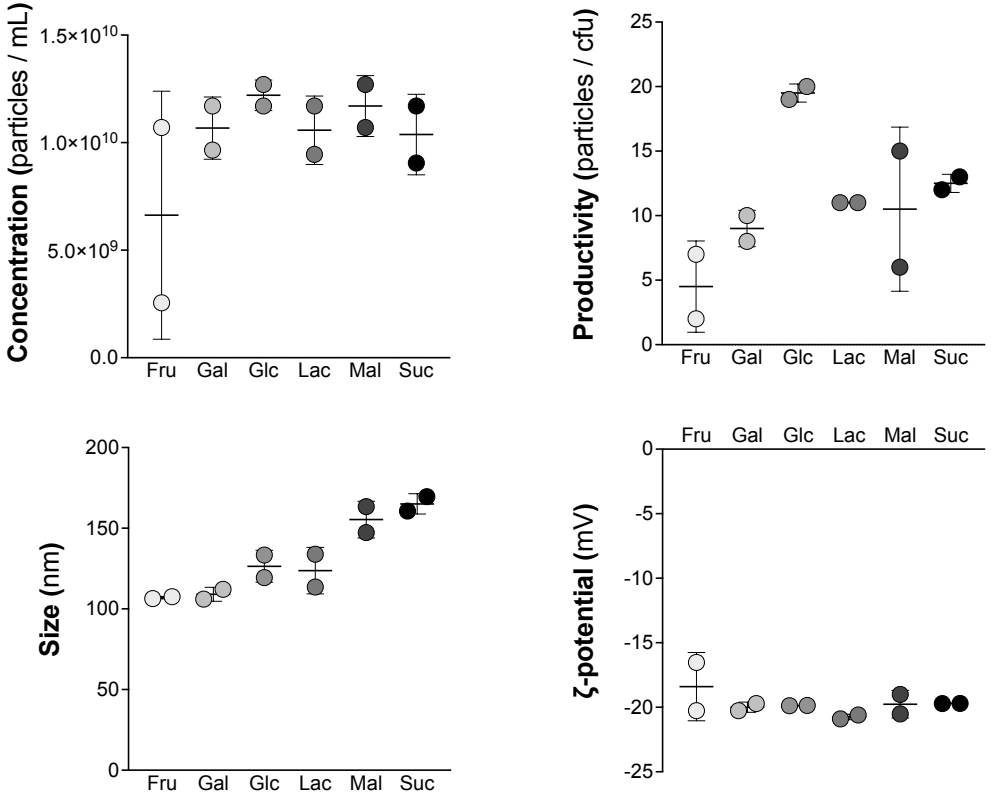
bEV characteristics with different carbon sources



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Experimental data can define boundaries for active learning


Traditional Trial and Error Methods

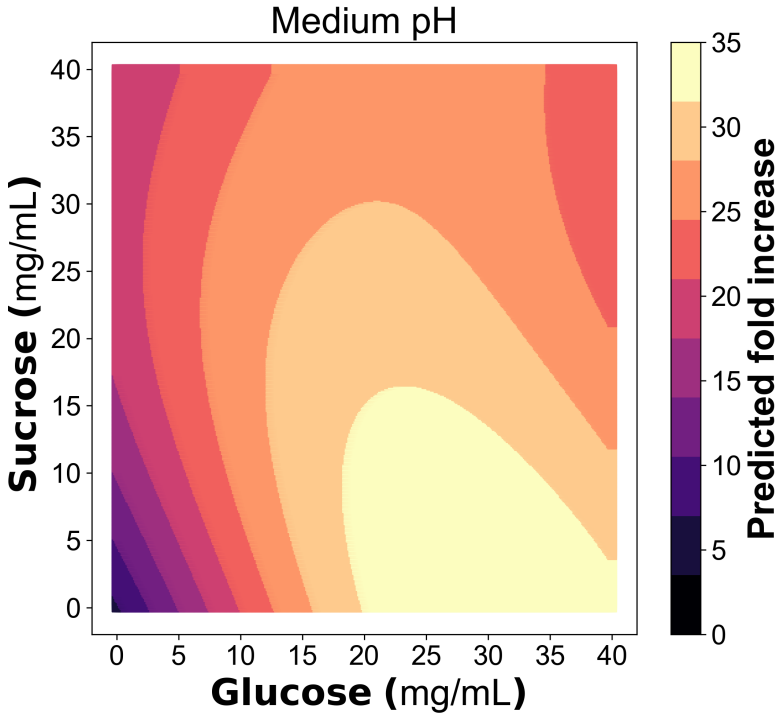
Culture parameters selected by trial and error approach

Fewer number of EVs produced

Predictive AI Machine Learning Model

Culture parameters picked by predictive AI model for clinical trials

Higher number of EVs produced



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Zierden Lab: Using biological nanoparticles to understand and treat human health

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