

Linking Continued Exposure to E-Cigarette Vapor Constituents with Chronic Obstructive Pulmonary Disease

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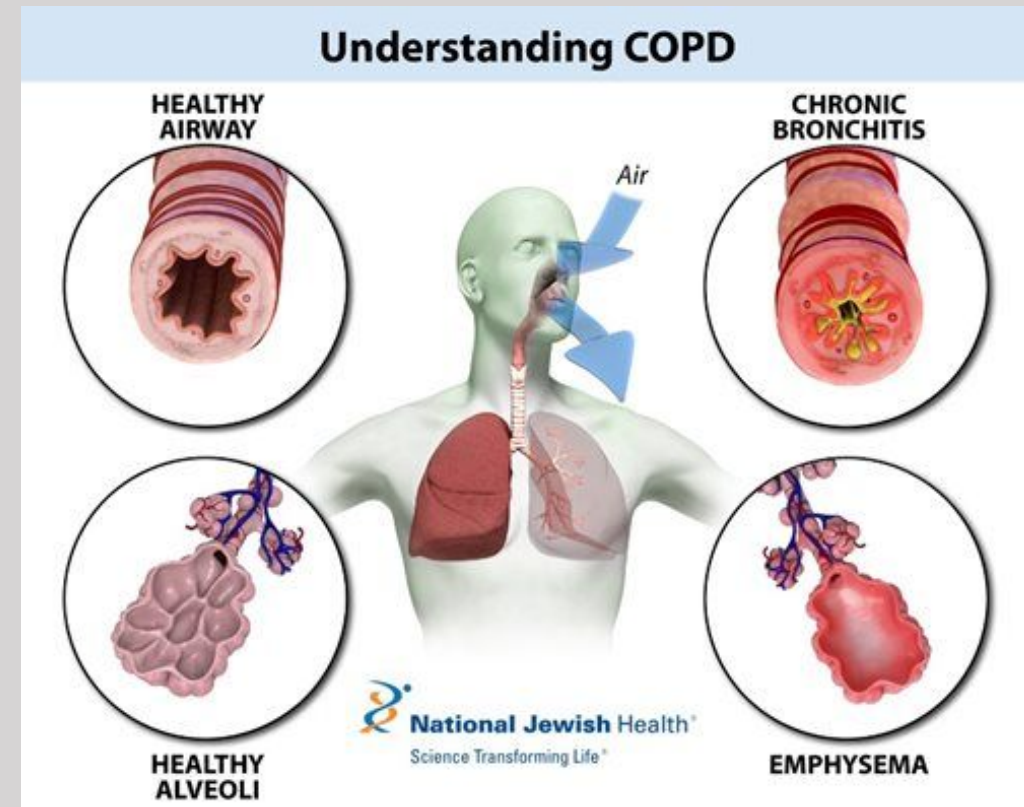
Introduction: E-Cigarettes

- First introduced in 2009
- Advertised as a safe alternative to tobacco smoking
- In 1976, 28.8% of high schoolers smoked on a daily basis, but in 2004 this number dropped to 15.6%
- E-cigarettes are not FDA regulated
- In 2018, 37.3% of high schoolers had tried e-cigarettes, 66% of teenagers believe e-cigarettes only contain flavoring



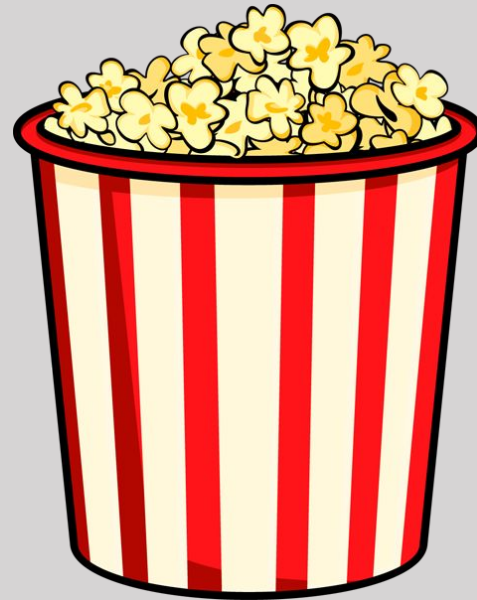
Introduction: Chronic Obstructive Pulmonary Disease (COPD)

- Group of lung diseases characterized by airflow blockage and difficulty breathing
- Caused by increased mucus
- Fourth leading cause of death worldwide
- 24 million cases in the United States



Introduction: Bronchiolitis Obliterans

- Informally known as popcorn lung
- Irreversible scarring and narrowing of the bronchial tubes
- Only treatment is lung transplant



GC-FID Analysis of E-Cigarette Pod Liquid Content

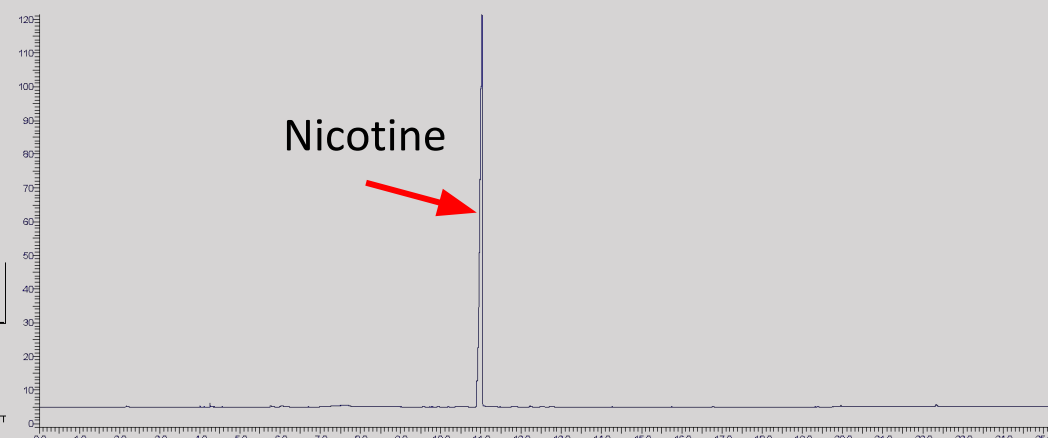
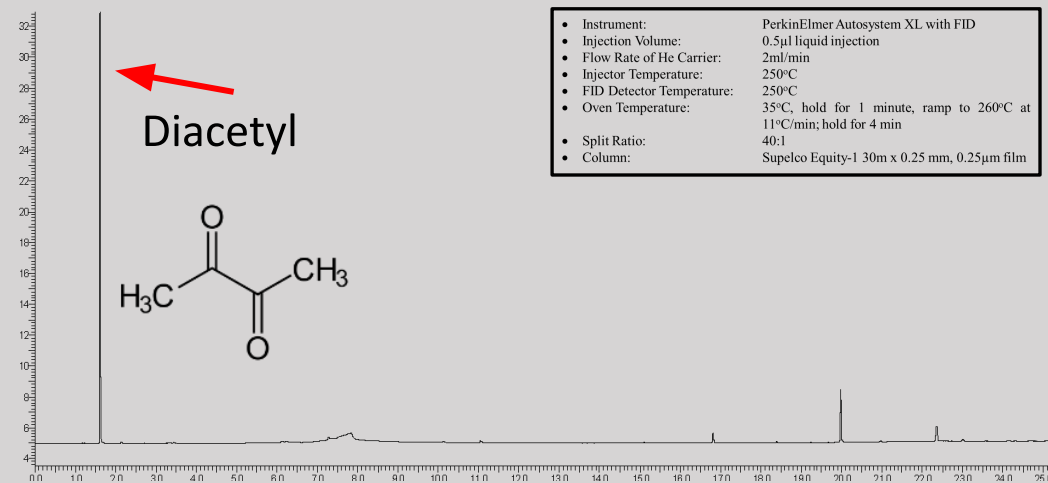
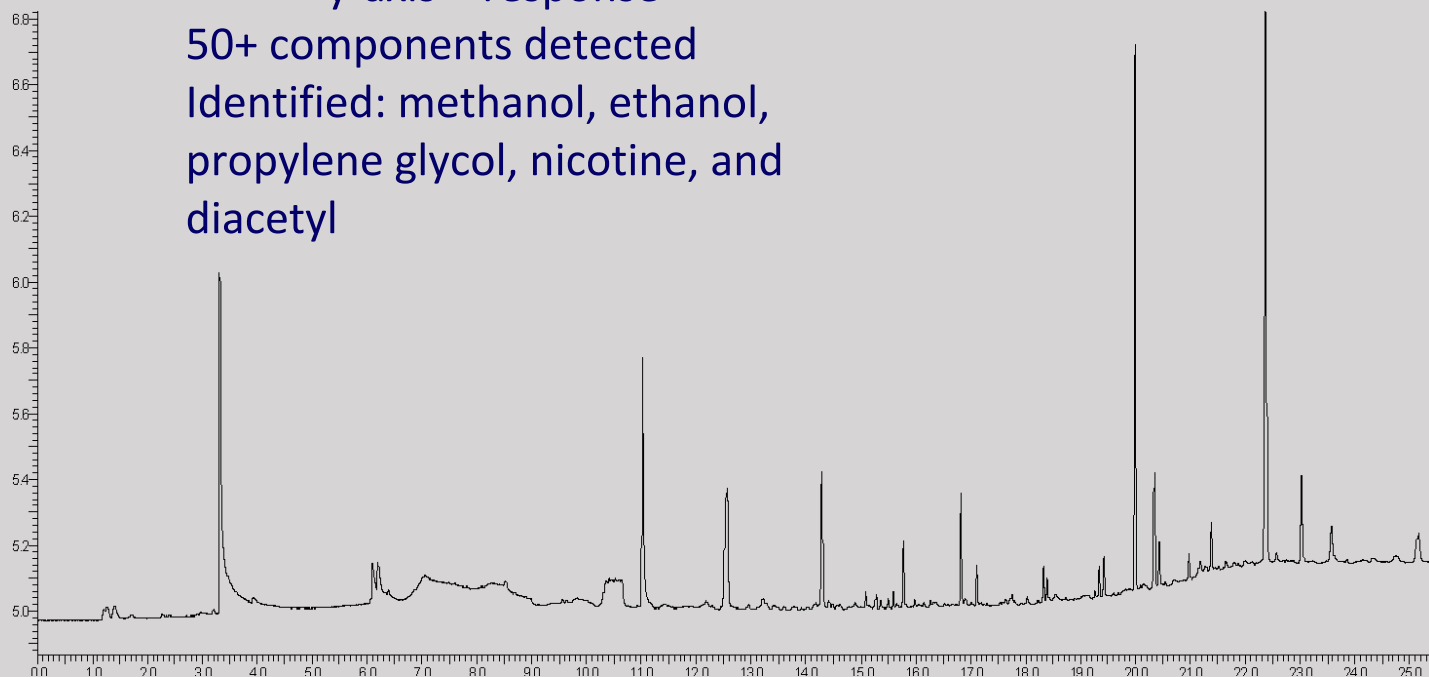
Gas Chromatograph with Flame Ionization Detector

Graph: x-axis = retention time

y-axis = response

50+ components detected

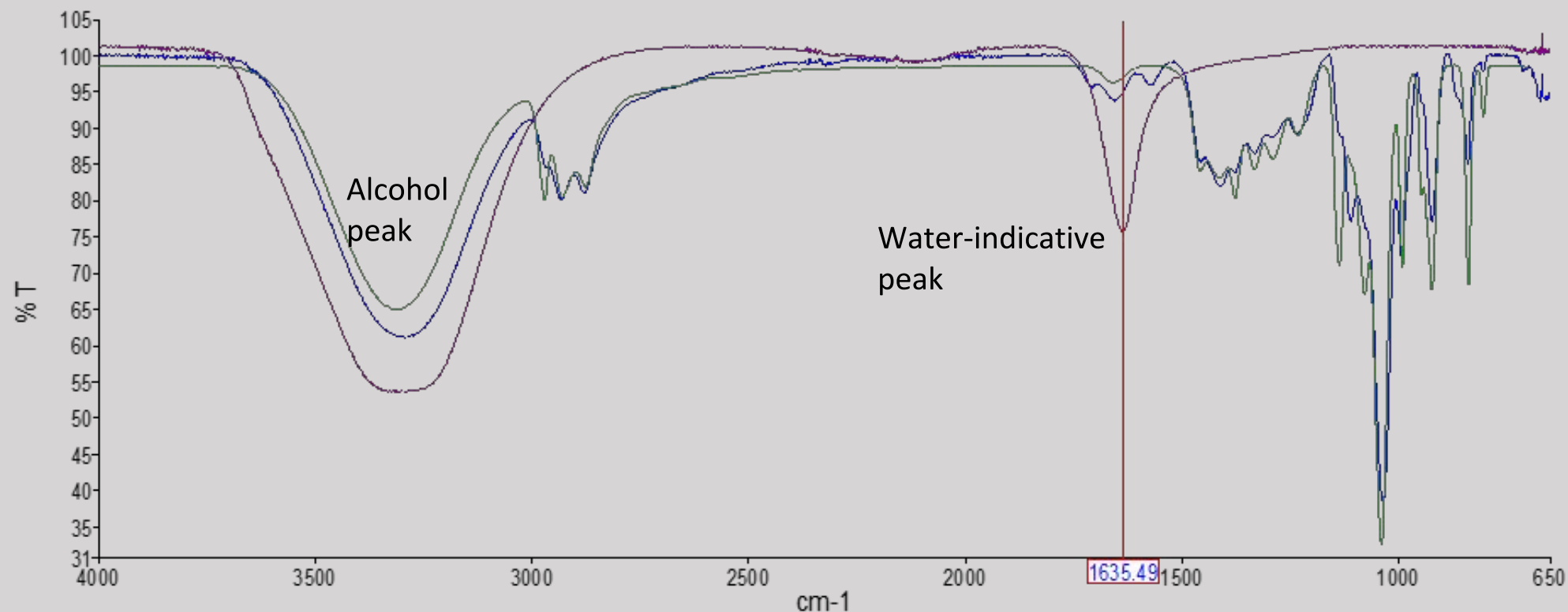
Identified: methanol, ethanol, propylene glycol, nicotine, and diacetyl



FTIR Analysis of E-Cigarette Pod Liquid Content

E-cigarettes are not water vapor, contrary to popular belief!

Fourier Transform Infrared Spectroscopy



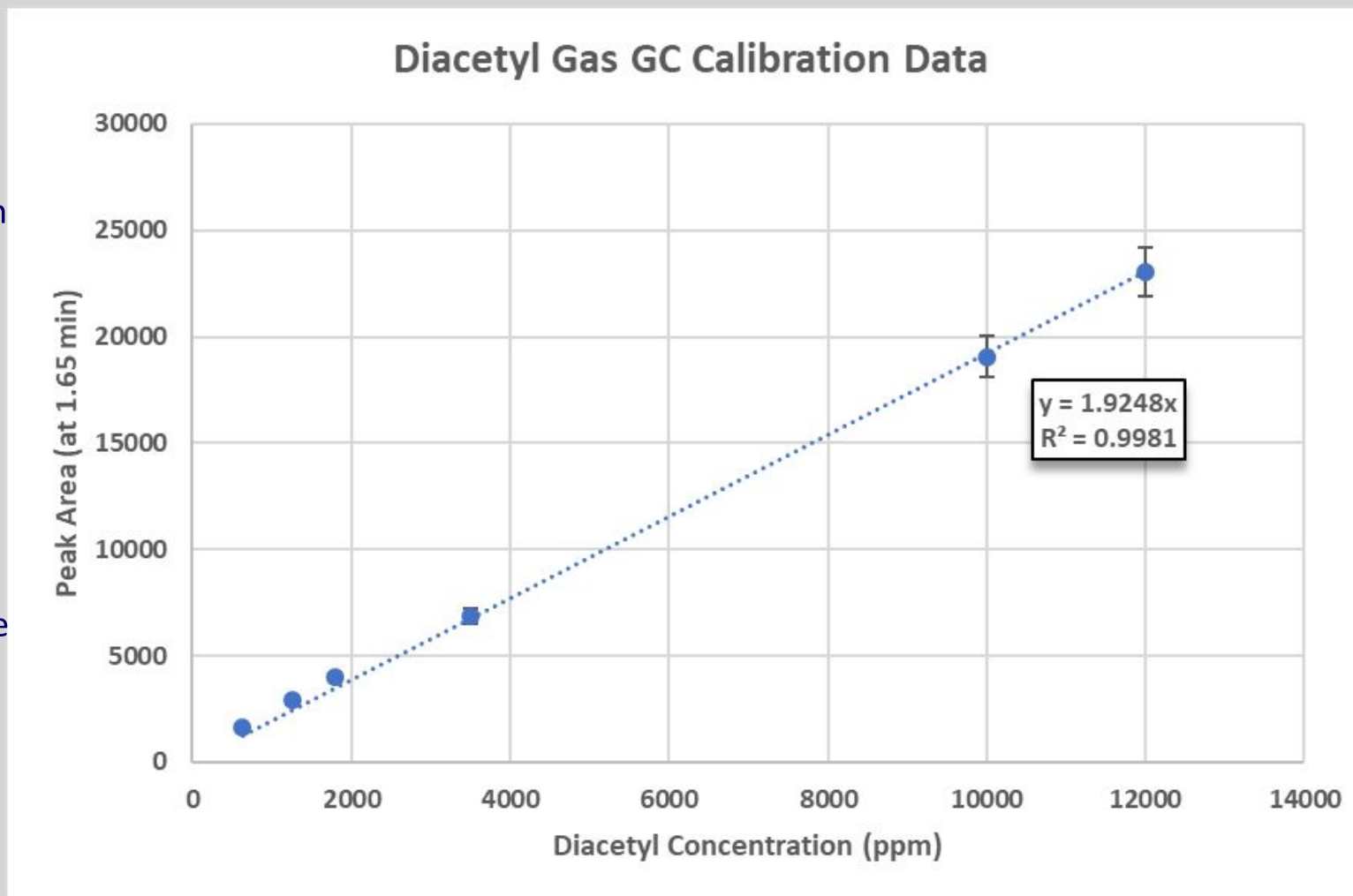
	Name	Cursor	Description
—	Kiwiberries Ice	95.052 %T	Sample 324 By Administrator Date Tuesday, February 20 2018
—	Propylene Glycol	97.112 %T	Sample 182 By Administrator Date Thursday, October 19 2017
—	water	75.58 %T	Sample 325 By Administrator Date Tuesday, February 20 2018

GC-FID Quantification of Diacetyl

Graph: x-axis = diacetyl concentration (ppm)
y-axis = peak area

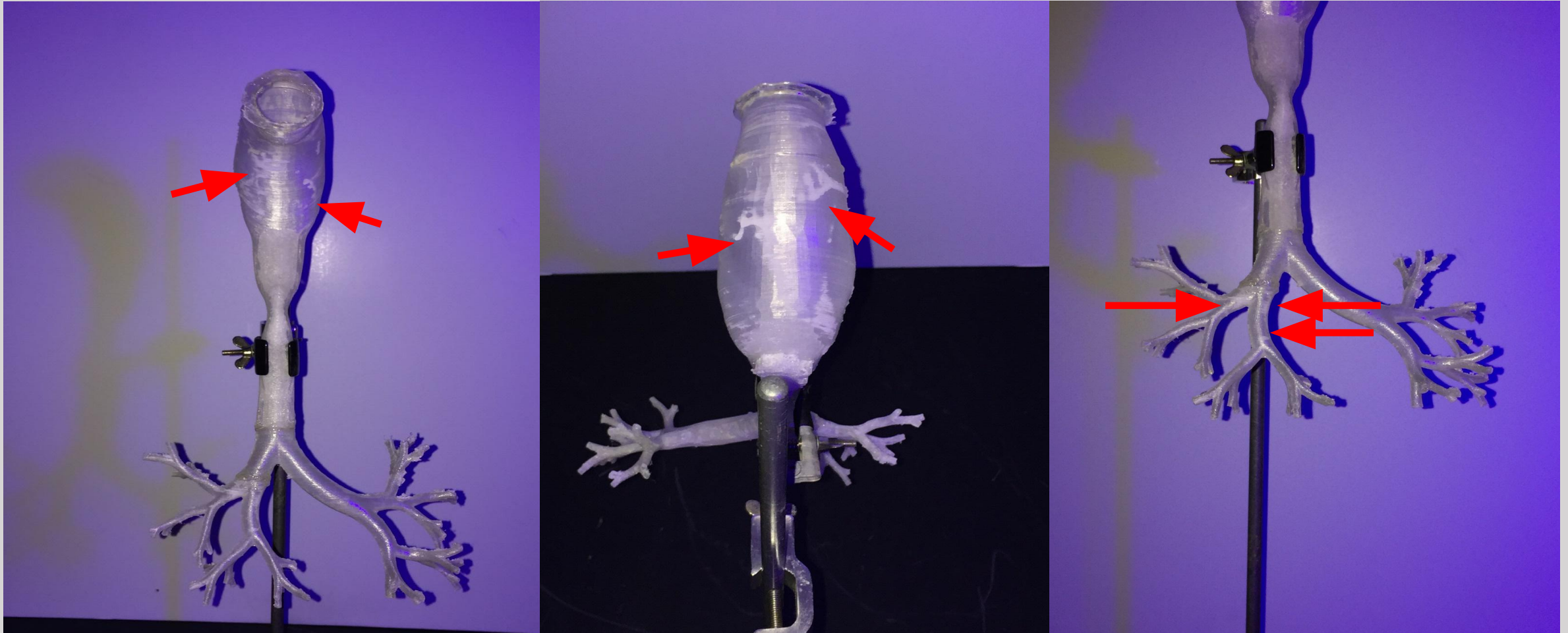
Findings: First-in-literature discovery that in 3 inhalations, user is exposed to 18 ppm of diacetyl
Clinical studies indicate 100 ppm causes respiratory disease
Thus, it is likely e-cigarettes can cause respiratory disease

Diacetyl is the chemical that causes irreversible popcorn lung

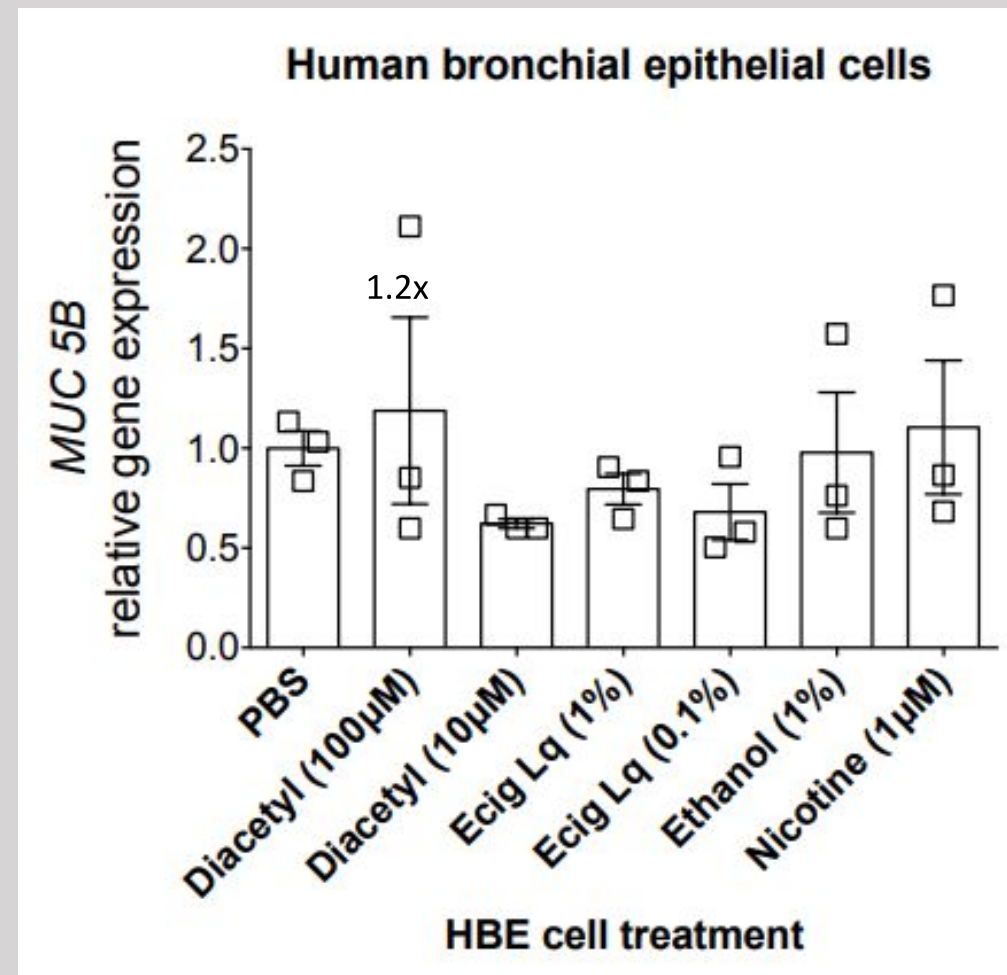
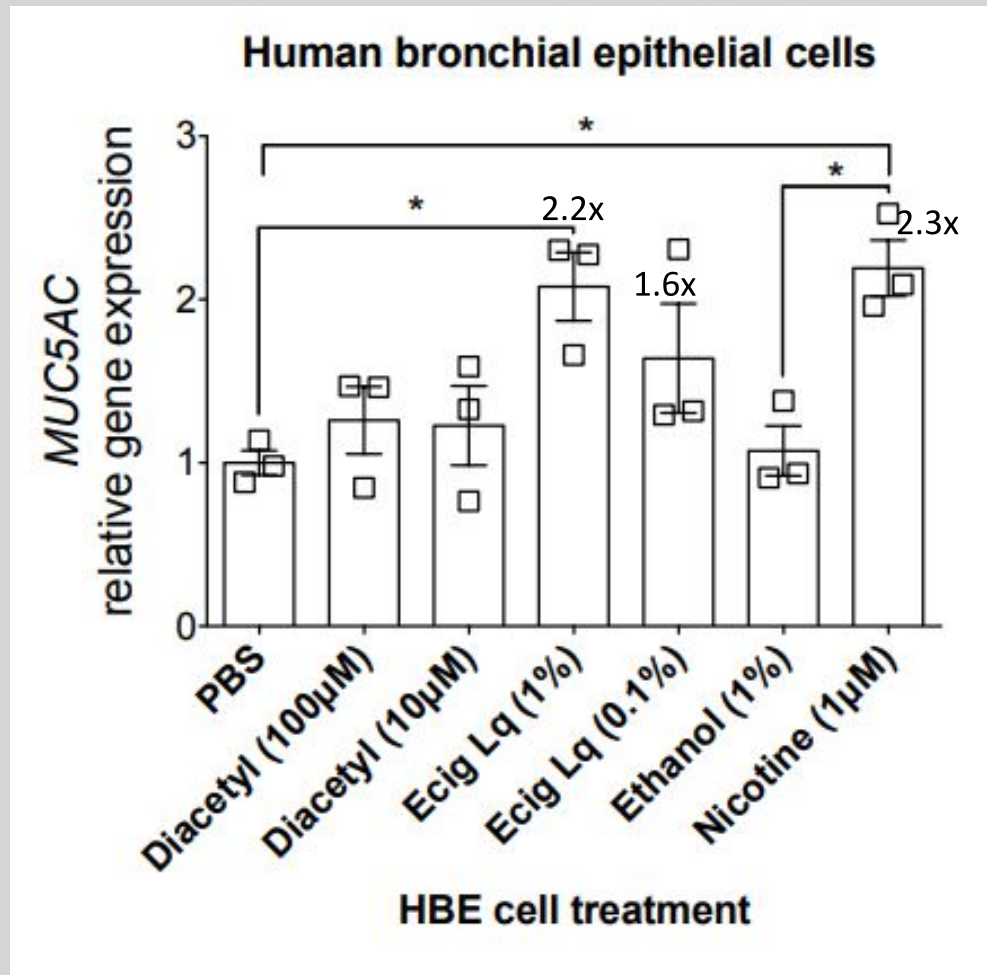


Deposition of E-Cigarette Vapor in Artificial Mouth-Lung Model

This shows some of the areas that re-condensed e-cigarette gas can end up in the lungs

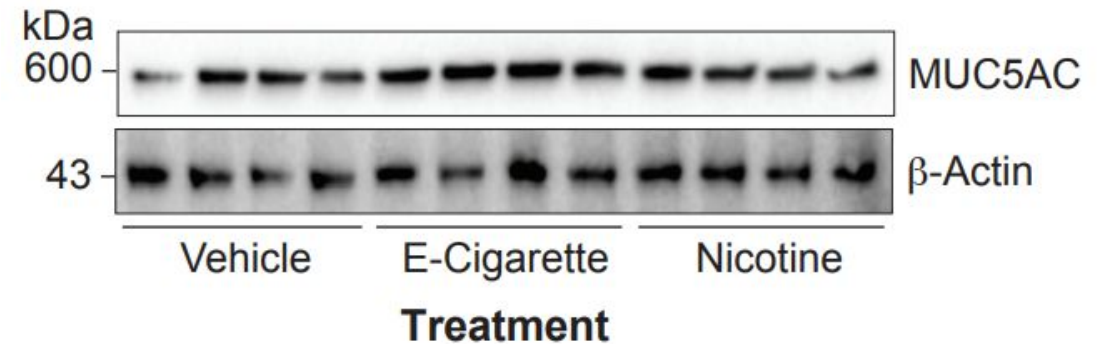
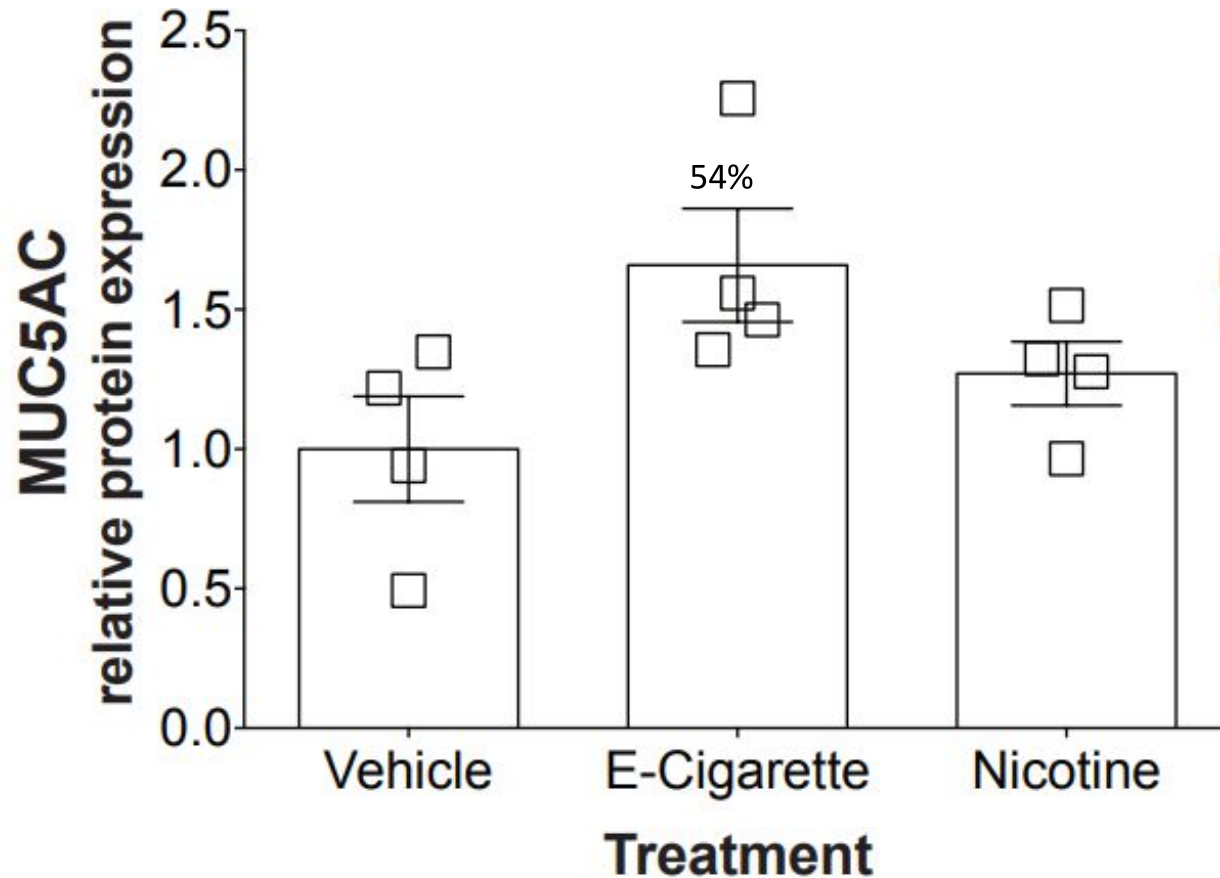


Measure of Mucin Production to Evaluate E-Cigarette Induced Risk for COPD



Analysis of HBE Proteins Using a Western Immunoblot

Along with the previous slide, this data shows that vaping can cause COPD, which is one of the leading causes of death worldwide



Conclusions

- E-cigarette pod liquid and nebulized vapor contain 50+ components
- In 3 inhalations, the user is exposed to 18 ppm of diacetyl
- Recondensed liquid deposits throughout the lung
- Diacetyl and e-cigarette liquid cause increased LDH
- 1% e-cigarette liquid, 1 μ M nicotine, and 100 μ M diacetyl cause combined increases in MUC5AC and MUC5B genes
- E-cigarette liquid caused a significant increase in MUC5AC protein expression

Please reach out with any
additional questions!

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