SENSING LUNG INJURY VIA EXHALED BREATH CONDENSATE

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The Lung is the Only Internal Organ that is in Constant Contact with the Environment
Does the Air we Breathe Out Reflect our “Inside” Environment
Does Exhaled Breath Contain Proteins or Other Markers that Reflect the Microenvironment in the Lung
Hypothesis

• People from an urban area demonstrate perturbations in their lung microenvironment as measured by MS proteomics on exhaled breath condensate compared to people from a rural area.
Collecting Exhaled Breath Condensate

Assembly ready for EBC collection
The EBC is Collected and Analysed in The Laboratory
Collecting Exhaled Breath Far More Comfortable than Drawing Blood
Sample Collection

Urban

Rural

UAB Medicine
Pulmonary, Allergy & Critical Care
Sample Collection
Samples brought to laboratory and subjected to Mass Spectroscopy.

What is Mass Spectroscopy?
Emerging droplets are sampling events occurring in the lung.

Precipitating the proteins:

Breath condensate proteins:
- Blue
- Yellow
- Orange
- Purple
- Green

Mass spectrum of peptides:

Convert time to mass:

Nanosecond time-of-flight:
Mass spectrum of peptides

Select Peptide

Fragment peptide

Detect Fragments

TOF MS/MS Spectrum

Masses of the peptide fragments compared to those in the human tryptidome database

**LLQDSVDFSLADAINEFK**

gi|62414289 – human vimentin
Samples 1-11

- XIC from 001.wiff (sample 1) - 1. Experiment 1, +TOF MS (350 - 1250): 709.364 +/- 0.025 Da
- XIC from 002.wiff (sample 1) - 2. Experiment 1, +TOF MS (350 - 1250): 709.364 +/- 0.025 Da
- XIC from 004.wiff (sample 1) - 4. Experiment 1, +TOF MS (350 - 1250): 709.364 +/- 0.025 Da
- XIC from 005.wiff (sample 1) - 5. Experiment 1, +TOF MS (350 - 1250): 709.364 +/- 0.025 Da
- XIC from 006.wiff (sample 1) - 6. Experiment 1, +TOF MS (350 - 1250): 709.364 +/- 0.025 Da
- XIC from 007.wiff (sample 1) - 7. Experiment 1, +TOF MS (350 - 1250): 709.364 +/- 0.025 Da
- XIC from 008.wiff (sample 1) - 9. Experiment 1, +TOF MS (350 - 1250): 709.364 +/- 0.025 Da
- XIC from 011.wiff (sample 1) - 11. Experiment 1, +TOF MS (350 - 1250): 709.364 +/- 0.025 Da

Time, min

Samples 12-18
Vimentin levels were significantly higher in people with chronic exposure.

![Diagram showing Vimentin Breathe Condensate Intensities](image)

Average Intensity-Vimentin

- **Chronic**
- **Acute**
- **Unexposed**

Exposure Groups

t-test: $1.2993 \times 10^{-5}$
What is Vimentin

Vimentin Fragment
LLQDSVDFSLADAINTEFK

• Vimentin fragments are a prognostic marker in synovial fluid of patients with Rheumatoid Arthritis.
• Vimentin fragments have been found in patients with exacerbations of Asthma.
• Vimentin fragments are an “eat me” signal when outside of cells.
• Vimentin fragments spearhead inflammation.
Conclusions

• Exhaled breath condensate is a non invasive method for evaluating lung sensing mechanisms against environmental injury

• The presence of Vimentin in EBC is a marker of lung responses to perturbations in its environment
Conclusions

• Cross disciplinary studies are critically needed to remove the artificial barriers of scientific silos.

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