



NEAT Team

New Effusion Alternative Test Team

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Point of Interest

- Client Information
- Background
- Problem Statement
- Competition
- Alternative Designs
- Design Matrix
- Final Design
- Future Work
- Conclusions
- Questions

Client Information

- Dr. Steven Yale
- Marshfield Clinic
 - Director of Clinical Research
 - Specializes in Internal Medicine
 - Interested in pleural effusion



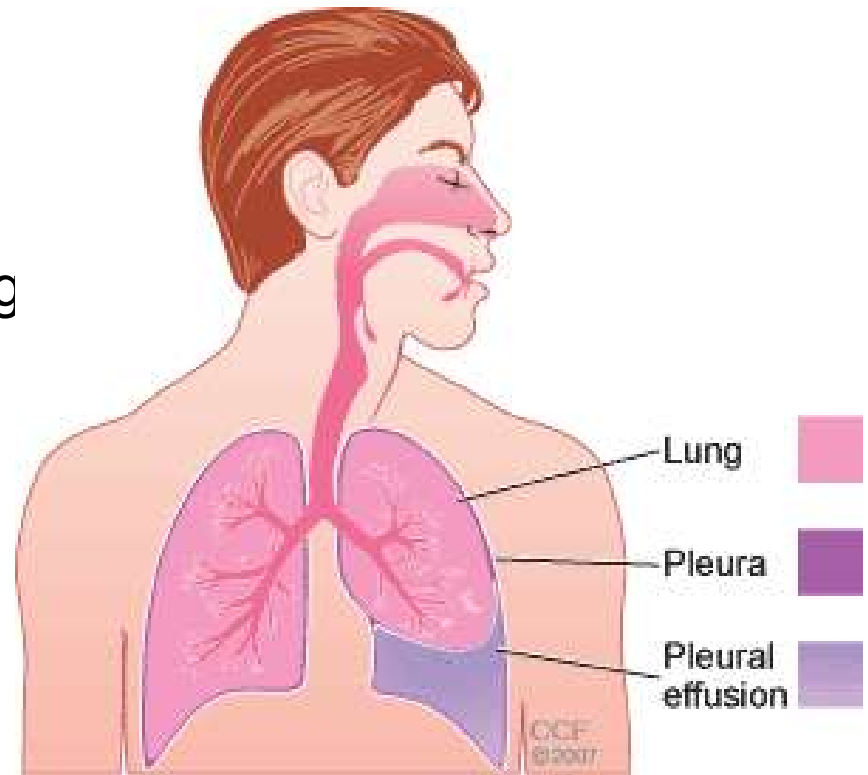
Marshfield Clinic®

Don't just live. Shine.

<http://www.marshfieldclinic.org/patients/images/logo.gif>

Background

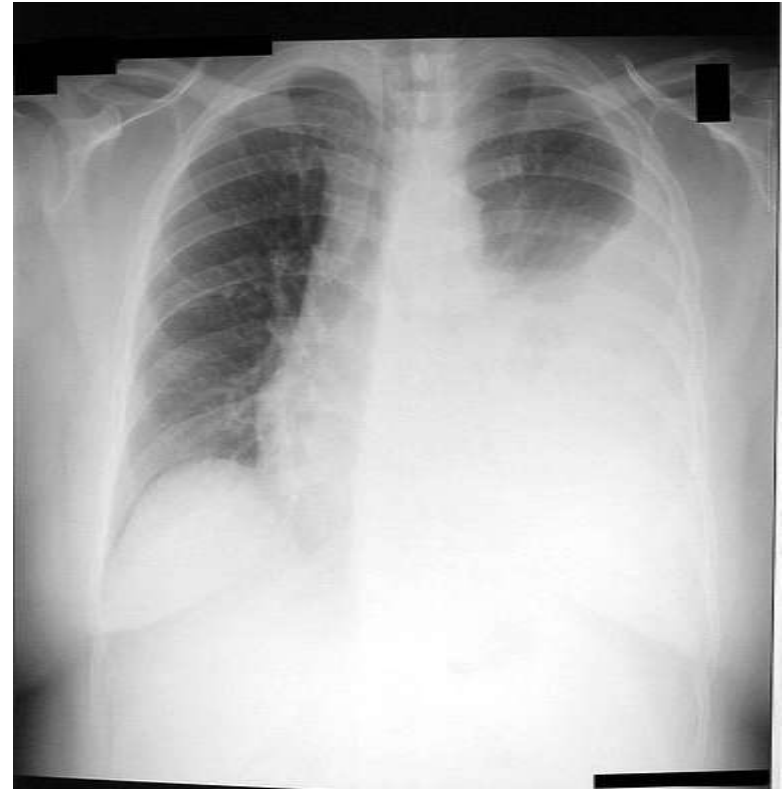
- Pleural effusion
 - Excess fluid in the pleural space
 - Can restrict breathing
 - Two types
 - Transudative
 - Exudative
- Diagnosis
- Thoracentesis – process of fluid drawn from pleural space



http://www.clevelandclinic.org/THORACIC/Chest/imgages/pleural-effusion_airway.gif

Problem Statement

- Clinical method for the characterization of the pleural fluid properties
 - Cost efficient
 - Convenient
 - Quick
 - Determination of transudative or exudative



http://t3.gstatic.com/images?q=tbn:ANd9GcQZFTh97Z1QqTWJAp0vxXZg3ohVSS-60YgXZZLeL7KKU_fx6d8&t=1&usg=__FNLoAC6HR14Vpts6QvU16y2gDc4=

Competition



<http://www.acssurgery.com/acs/thumbs/F321377T.gif>



http://www.bayareachest.com/PS_Pictures/ultrasound.png

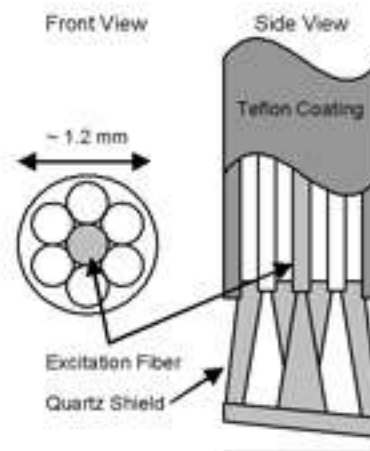


<http://www.microbiologylaboratory.biz/untitled.jpg>

- Magnetic resonance spectroscopy (MRS)
- Ultrasound
- Pleural fluid analysis

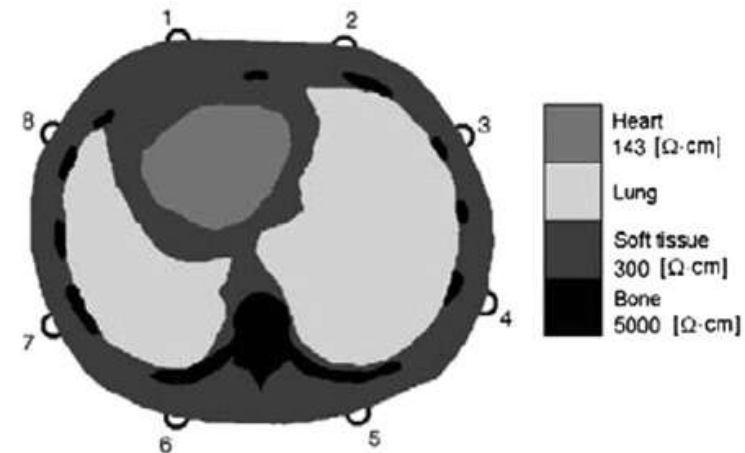
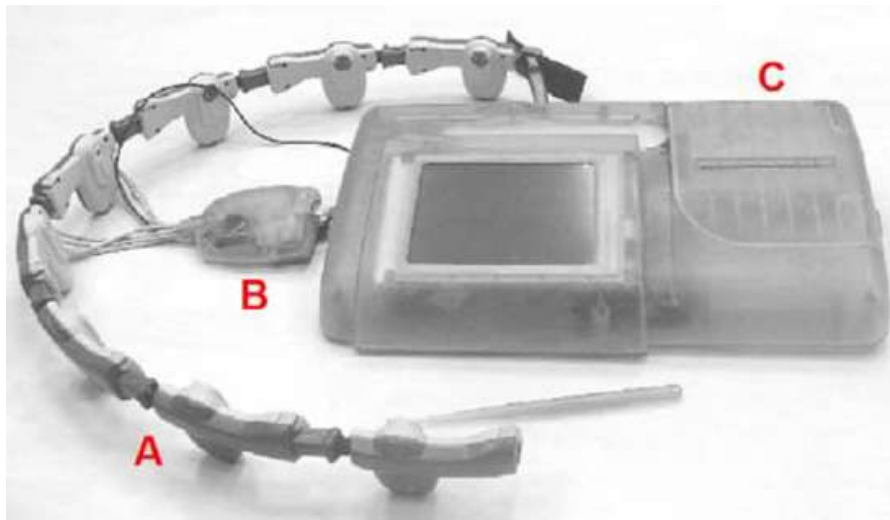
Fast EEM Probe

- Reflectance spectrofluorimeter
 - Ten laser pulses
 - Two white light pulses
- Fiber optic probe
- Excitation and emission wavelengths differ for various molecules
- Cons: expensive, requires data analysis and hardware



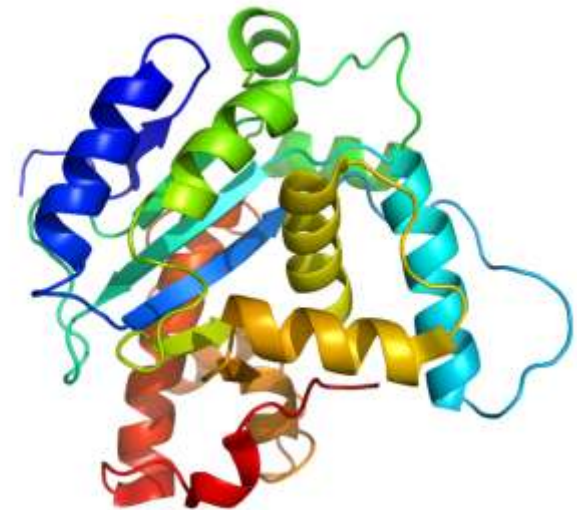
EIT Belt

- Eight electrode thoracic belt
- Measures resistivity
- PulmoTracePro program uses algorithm to determine resistivity values and plot
- Cons: measurements can be skewed by edema, no compartmentalization of resistivity, cannot characterize fluid



Protein Analysis

- Use bedside test to determine protein concentrations
- Assay and quantification
- Analyze results using Lights criteria
- Cons: Invasive, not feasible, time consuming, requires lab equipment



Rapid Bedside Test

- Combine multiple test into one
 - pH
 - Glucose
 - Hydrogen Peroxide
- Conduct test quickly at the bedside
- Pros: Feasible, low cost, portable, easy to analyze



http://upload.wikimedia.org/wikipedia/commons/2/24/Electroporation_Cuvettes.jpg



<http://www.nationalscrubs.com/ProductImages/Medline09/Optium%20New%20High.jpg>

Design Matrix

	Weight	Fast EEM/Ramen Probe	EIT Belt	Rapid Bedside Test	Bedside Protein Analysis
Sensitivity	1	7	2	6	7
Ease of Use	0.75	7	7	9	9
Feasibility	0.5	5	8	10	7
Size	0.5	7	7	9	8
Invasiveness	0.5	8	10	5	5
Cost	0.25	4	6	9	8
Total	3.5	23.25	21.25	27	25.75

Design Specifications

- 3 cuvettes 40x20x16.7 mm (7.1 mL)
- Over all dimensions 4 x 2 x 10 cm
- Connected and set into a base
- Cover will be designed to seal all cuvettes
- Fluid will be inserted into cuvettes via an attachment that allows the syringe to be screwed onto the cover

Tests

- Glucose
 - Glucose meter will be attached to an external cuvette in an enclosed case
 - Clear, visible digital display
- pH
 - Diagnostic test strips will be used to identify pH
- Hydrogen Peroxide
 - 10 microliters of 30% hydrogen peroxide will be pre-packaged in a sealed cuvette
 - A minimum of 200 microliters of pleural fluid will be needed for a conclusive test

Future Work



<http://intensivecare.hsnet.nsw.gov.au/five/images/pleural%20effusion%20CXR%202.jpg>

- Finalize design logistics
 - Materials
 - Additional tests (albumin, LDH, cholesterol)
- Test Device
 - Predesigned fluids
 - Sensitivity and specificity
- Integrate with thoracentesis kit

Conclusions

- Improve clinical experience
 - Eliminate need for lab work
 - Minimize diagnostic time
 - Increase accuracy
- Suitable for less equipped hospitals
- Clear and simple results



<http://www.alternativelearninglane.com/Career%20Transition/careertransition.htm>

Acknowledgements

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- Dr. Steven Yale – Marshfield Clinic Research Foundation
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- Professor John Webster – BME Department

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Questions

