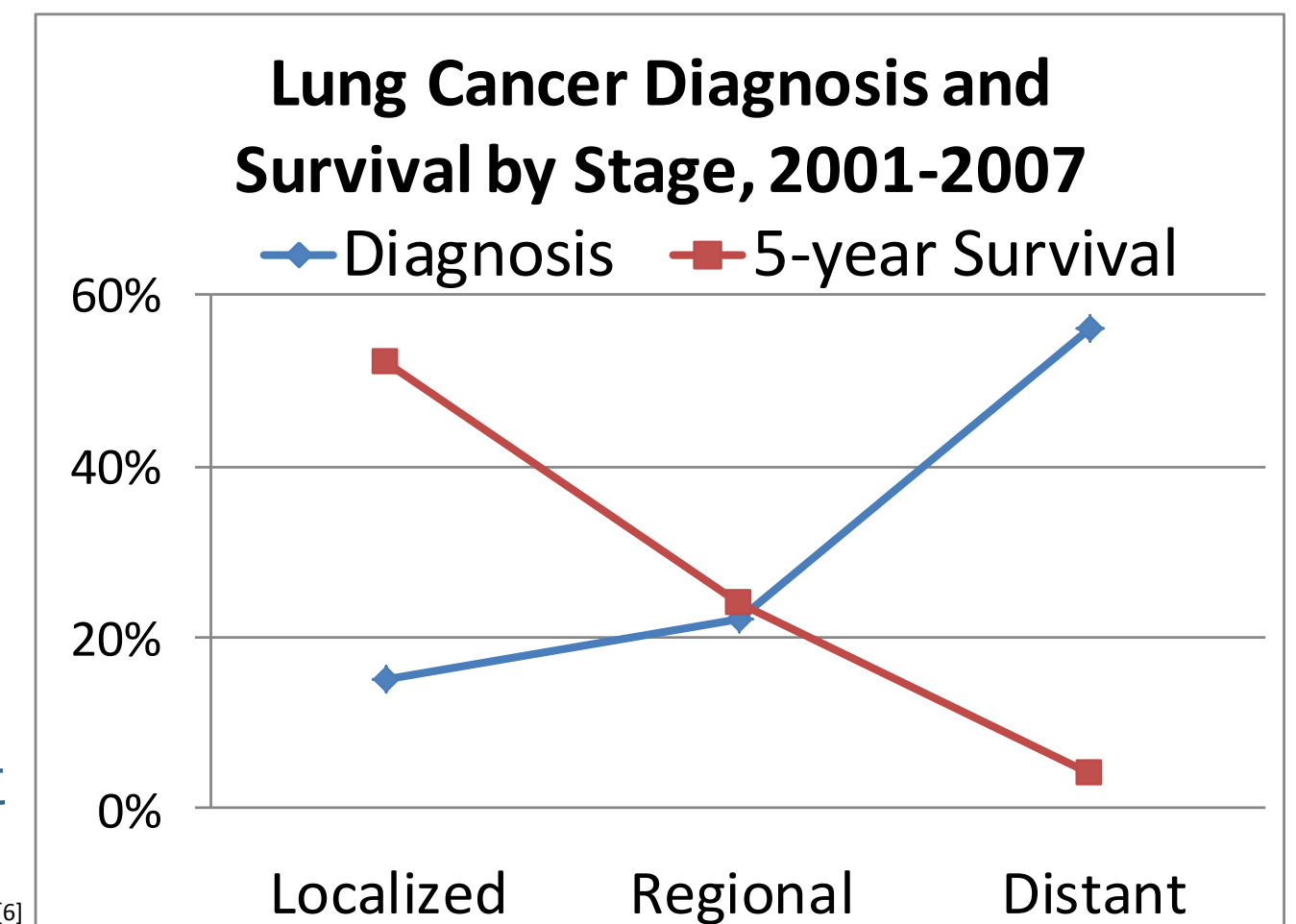


Project Goal

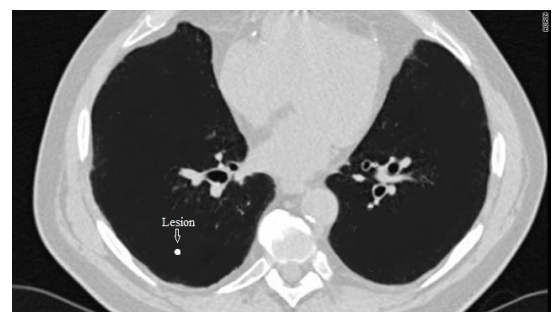
Develop and test a device that distinguishes lesions from surrounding lung tissue on-site and real-time during bronchoscopic procedures.

Lung cancer causes 1.3 million deaths annually worldwide. Amongst cancer, it is the leading killer of both men and women in the United States. Currently, most diagnoses are late stage, which correlates to a low 5-year survival rate. However, Low-Dose CT (LDCT) is quickly becoming a standard screening procedure. [1] Scans reveal lesions in lung tissue but cannot determine whether lesions are cancerous. The current diagnostic procedure is shown below.



Current Diagnostic Procedure

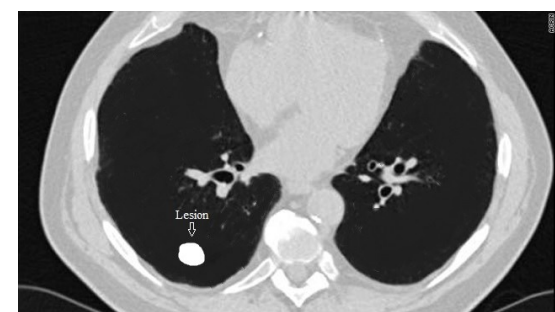
Low Risk Patient



Lesion <8mm
Lesion often in distal regions

Physician waits for development of lesion

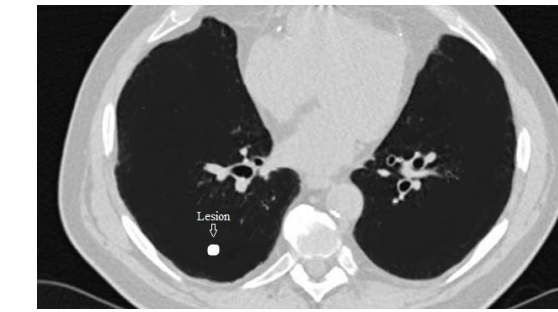
High Risk Patient



Lesion >20mm
Lesion often in major airways

Physician proceeds with lesion biopsy using bronchoscope

Medium Risk Patient



Lesion 8-20 mm
Lesion often in distal regions[2]

- Navigate through proximal bronchioles with video bronchoscope using LDCT as a guide
- CT scan does not reflect patient movement

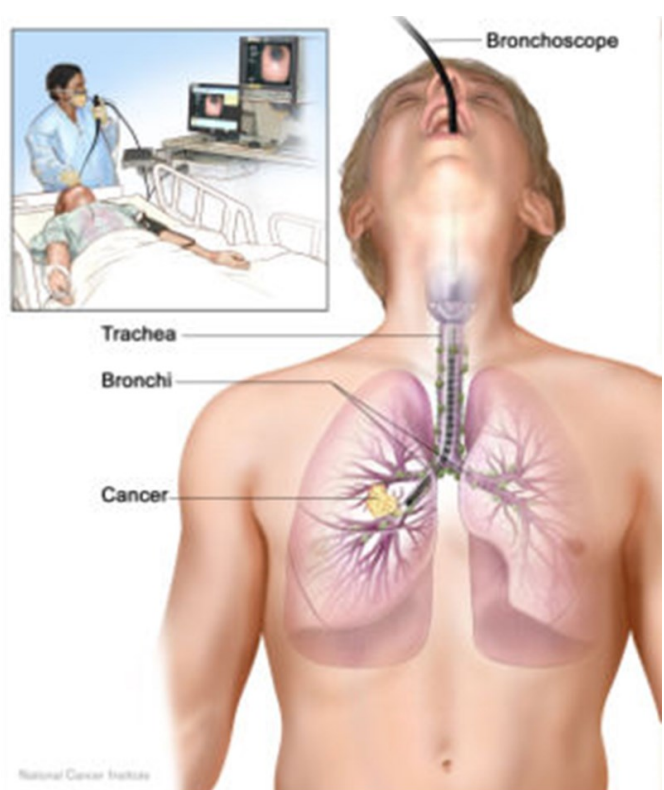
- Navigate to lesion site in distal bronchioles using smaller, non-visual probe through sheath

- Remove non-visual probe through sheath
- Replace with biopsy device
- Sheath movements affect device positioning

- Take four to six tissue samples
- Several samples required
- High rate of false negatives

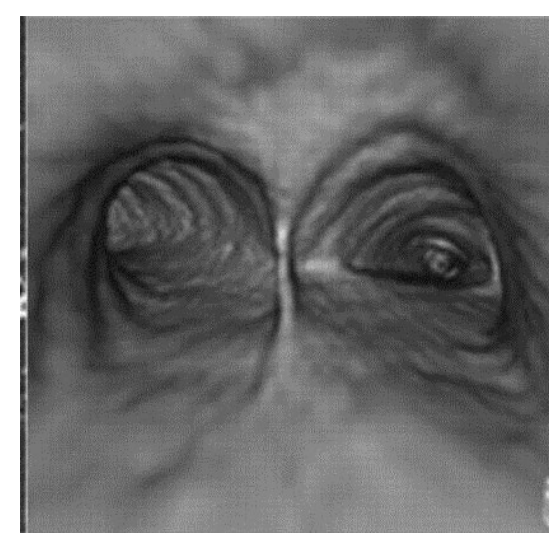
The SCOPE team's device addresses these problems by improving biopsy site precision, ensuring that the tissue collected is from the lesion.

Bronchoscopic Procedure



In a bronchoscopy, a thin, flexible tube called a bronchoscope is threaded down the patient's trachea and into the lungs. A camera at the end of the bronchoscope helps physicians navigate to a lesion site. In distal airways, however, a smaller, non-visual probe must be used to navigate to the lesion.

Non-Visual Probes

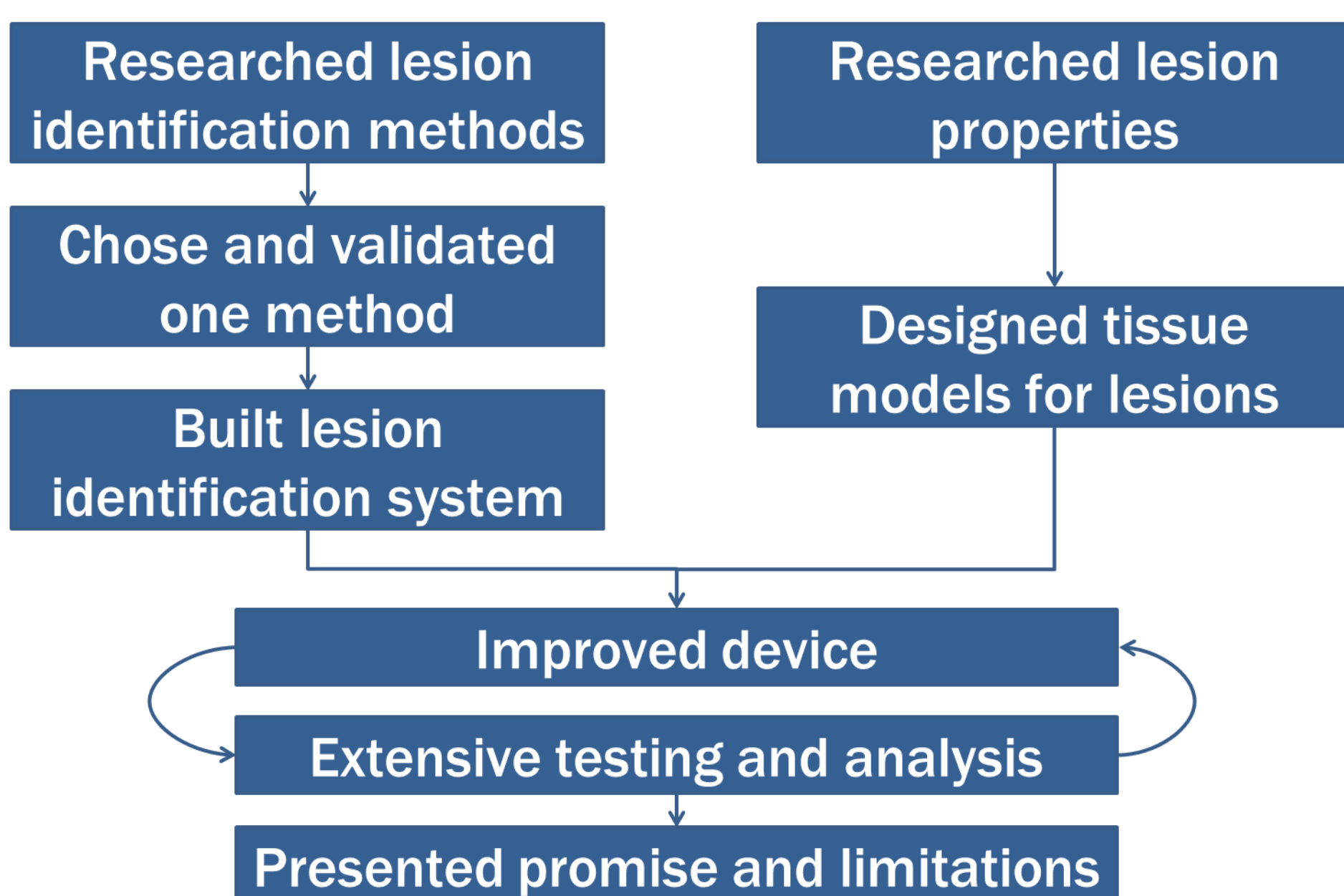


Electromagnetic Navigation Bronchoscopy (ENB): 3D map is generated from LDCT. Probe has location sensor on tip. [4]



Endobronchial Ultrasound (EBUS): Ultrasound probe makes comparisons based on density. [5]

Designing and Testing our Device



Variables Tested	Significance
Depth	Lesions can protrude into the bronchiole or can be located between bronchioles
Location	Lesions can be located in distal or proximal regions
Inter-patient Differences	Biological properties often vary widely between individuals, and patient-to-patient calibration is time consuming and difficult

Our device can be used to accurately detect lesions at various depths and locations in the lung, and may not need to be calibrated for each patient individually. Further *in vivo* testing will be necessary.

Our team strongly suggests that Boston Scientific move forward with device development. We believe it could assist physicians in accurately diagnosing medium risk patients by improving reliability of biopsies.



Team: Larissa Little, Lisa Park, Jea Young Park, Jennifer McConnell, Ashley Guertin
Advisor: Rebecca Christianson
Liaison: Gary Leanna

Acknowledgements: Bradley Minch, Alisha Sarang-Sieminski, Debbie Chachra, Garland O'Connell, Jose Oscar Mur-Miranda, Kevin McCarthy, John Hutchens

References:
[1] American Lung Association, "Lung Cancer Fact Sheet - American Lung Association." [Online]. Available: <http://www.lung.org/lung-disease/lung-cancer/resources/facts-figures/lung-cancer-fact-sheet.html>. [Accessed Dec 2013].
[2] CNN Health, "CT scans show promise for lung cancer screening." 2011. [Online]. Available: <http://2.cdn.turner.com/cnn/2011/images/06/29/t1larg.helical.ct.jpg>. [Accessed May 2014].
[3] Olympus, "Electrosurgery." 2013. [Online]. Available: http://www.olympus.ni/medical/en/medical_systems/applications/pulmonology/therapeutic_bronchoscopy/electrosurgery/electrosurgery_2.html. [Accessed April 2014].
[4] Godoy et al. Utility of Virtual Bronchoscopy-Guided Transbronchial Biopsy for the Diagnosis of Pulmonary Sarcoidosis: Report of Two Cases. Chest. 2008;134(3):630-636. <http://journal.publications.chestnet.org/article.aspx?articleid=1086045>. [Accessed April 2014].
[5] The Lung Consultant, "Endobronchial Ultrasound." 2012. [Online]. Available: <http://thelungconsultant.co.uk/respiratory-medicine/endobronchial-ultrasound/>. [Accessed April 2014].
[6] National Cancer Institute, "SEER Cancer Statistics Review 1975-2008". [Online]. Available: http://seer.cancer.gov/archive/csr/1975_2008/results_merged/sect_15_lung_bronchus.pdf. [Accessed May 2014].