

# Bronchoscopy Training

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THE AUSTRALIAN eHEALTH RESEARCH CENTRE

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# Training the medical workforce

## Why Medical Training ?

- Proliferation of technology in the OR
- No obsolete methods
- New errors:
  - Poor design of technology ,
  - Rapidly changing technology ,
  - Insufficient knowledge or training
- General public awareness

## Better use of existing resources

- Long life training
- Productivity
- Confidence of the workforce with tech.

## Patient Safety (Off-patient training)



Open Surgery



Endoscopy



Laparoscopy

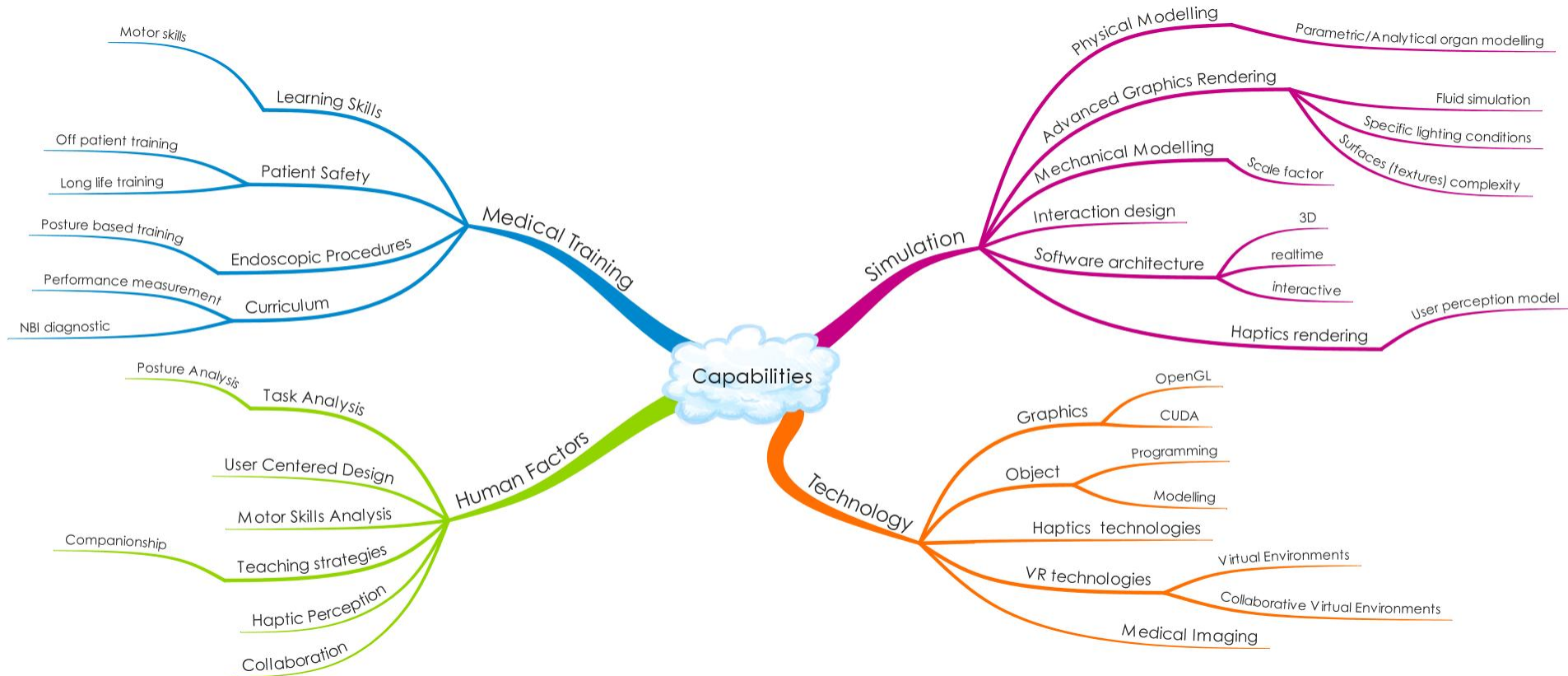


NOTES



Robotic assisted surgery

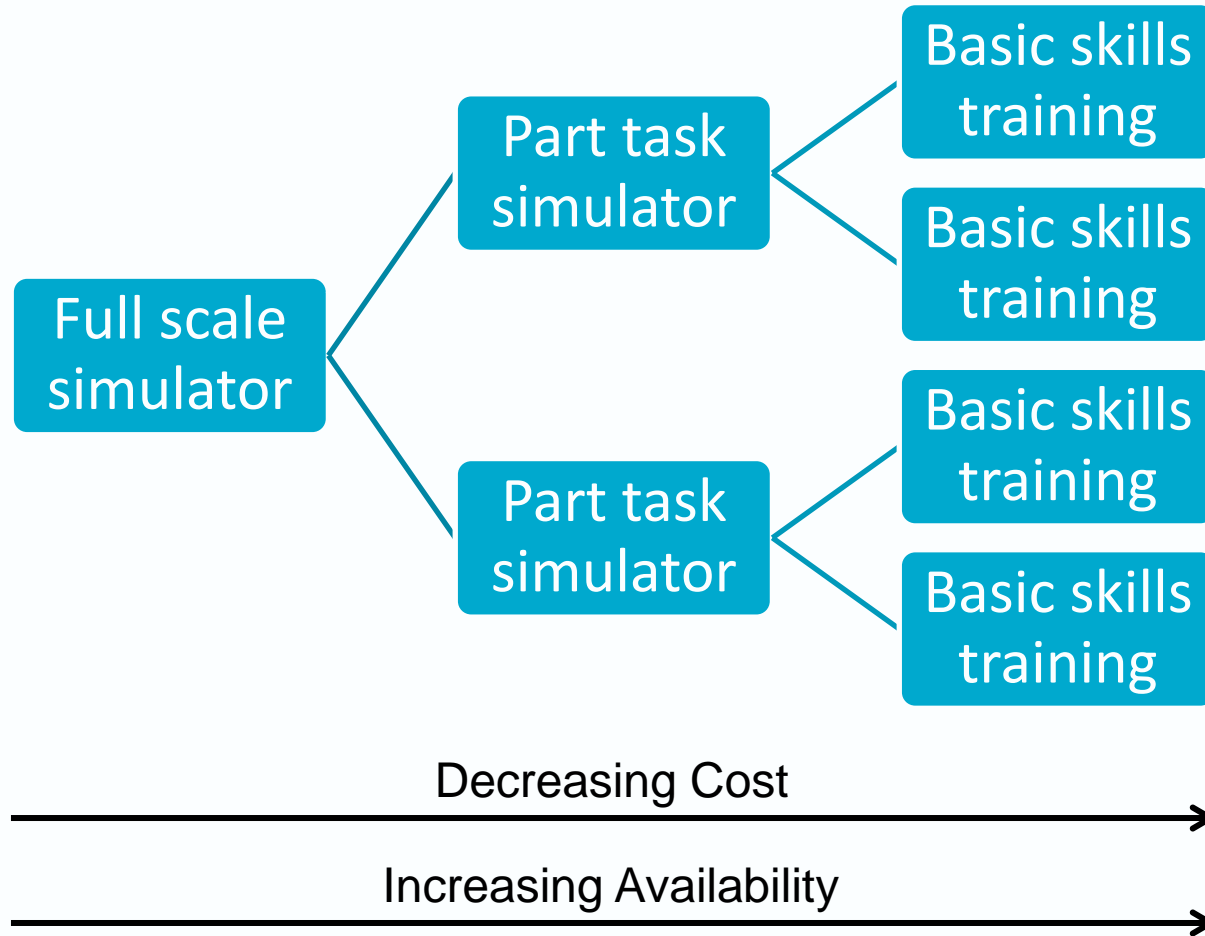
# Surgical Simulation and Assistance team



# Who and what needs training?

- Medical Students (needle insertion)
  - Generalised medical skills
- Specialising students (sophisticated interventions)
  - Specialised medical skills
- Experienced Practitioners (high level skills, new techniques)
  - Lifelong Learning
    - Skills refresh
    - Dissemination of new skills
- Medical Teams (team communication)
  - Team interaction

# Different types of training simulators



# Bronchoscopy

A diagnostic intervention used to investigate pulmonary conditions

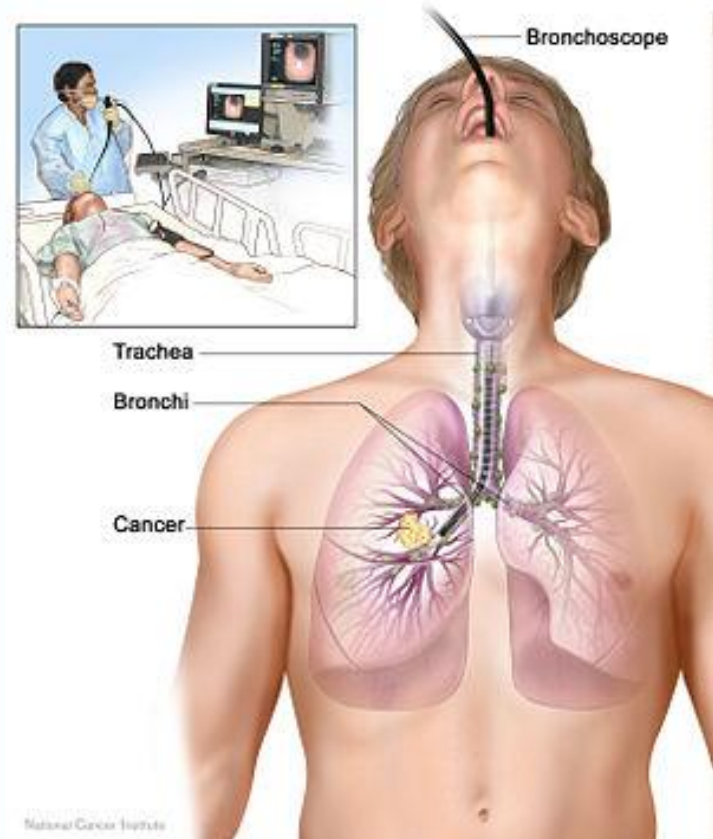
- Navigation of a flexible endoscope through a patient's tracheobronchial anatomy
- Locate and diagnose pathologies within the bronchial tree

## Imaging Methods;

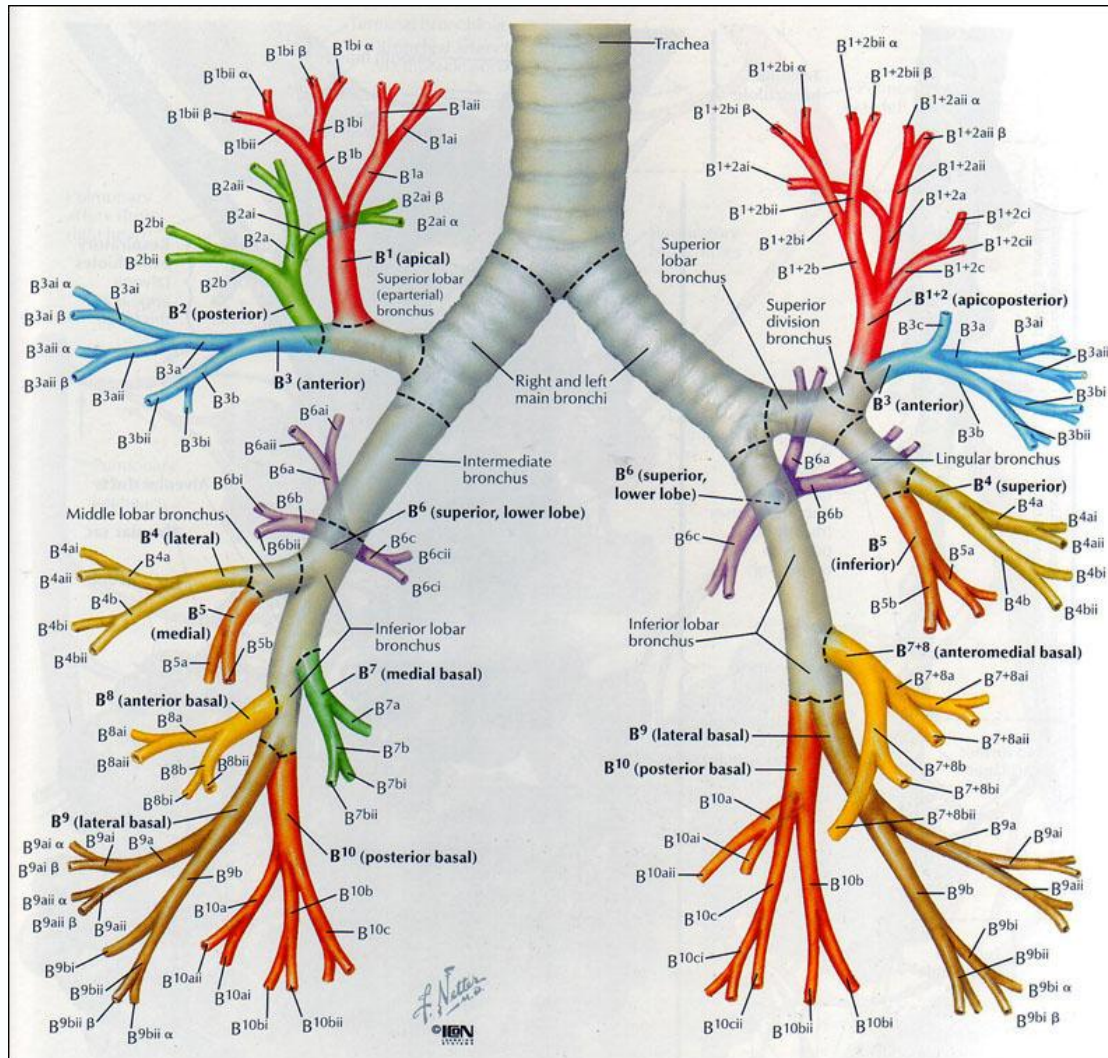
- White light, Autofluorescence, Narrow band, Ultrasound.

## Diagnostic and Therapeutic

- Tools introduced through channel in Bronchoscope to obtain specimens



# Lung Structure: External View



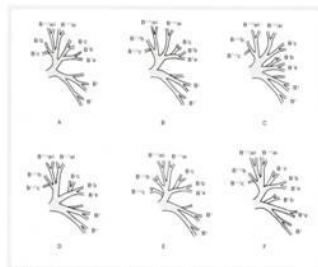
F. Netter MD, *Atlas of Human Anatomy*

# How people work? Learn?

# Task Analysis

- Literature
  - Books
  - Guidelines
- Existing training knowledge
  - Working with educators
    - Queensland Clinical Skills Development team
    - Expert thoracic mentors
- In vivo observations
  - Synchronised video recordings
  - Practitioner Interviews
- Controlled environment measurements
  - Detailed observations of training scenarios

# Books



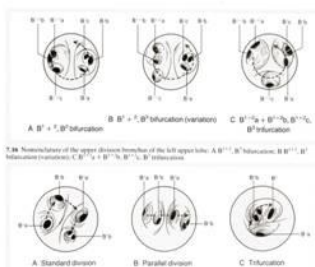
7.48 Various patterns of branching anomalies of the left upper limb branch (ulnar nerve)

### 5 Nomenclature of the branching of the left upper lobe bronchi

The upper lateral lobe branches, especially the superior division, exhibit numerous variations, and it is difficult to specify the nomenclature of this region. The pattern described in T.8.8 is modifications of those described in T.8.9 and T.8.10, and is a "standard" branching pattern. In B, the spiral bronchus divides into two branches, and the lower lateral lobe branch undergoes refraction in less than 27 per cent of the cases. The upper lobe branch: the pattern shown in C, and the spiral bronchus: the pattern shown in D, accounts for 27 per cent. In the remaining 6 per cent B\* forms the central bronchus (D), in the remaining 28 per cent of posterior segmental bronchi (B\*) is a bifurcated inferiorly, and the posterior bronchus is trifurcated superiorly. In F, B\* is a bifurcated inferiorly, and the posterior bronchus from the lingular bronchus, creating a mediobasal pattern similar to that of the right middle lobe. This branching pattern is found in 17 per cent.

Figure 7.86 shows Dr. Obe's nomenclature of the bronchus of the upper lobe. The pattern of points shows how B\*+D\* differs. The pattern of

per cent B<sup>1</sup> forms the central branch (D). In E the horizontal branch of the posterior segmental bronchus (B<sup>1+2</sup>) is duplicated inferiorly, and the apicoposterior bronchus is trifurcated superiorly. In F B<sup>3</sup> is duplicated superiorly, and arises directly from the lingular bronchus, creating a mediolateral pattern similar to that of the right middle lobe. This branching pattern is found in 15 per cent.

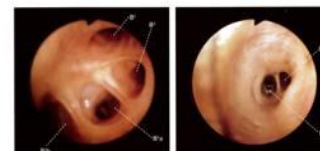


**7.40** Nomenclature of the upper (divisor) bromides of the left upper table: A  $\text{Br}^{1+}$ , B<sup>+</sup> halocarbon, B  $\text{Br}^{1+}$ , B<sup>+</sup> halocarbon (analogous), C  $\text{Br}^{1+}$ , A + B<sup>+</sup> to B<sup>+</sup>, B<sup>+</sup>, B<sup>+</sup> trihalocarbon.

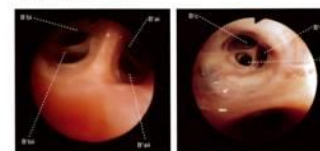
7.47. Nomenclature of the lower division branches: A standard division; B parallel division; C bifurcation

Information into  $B^{1/2}$  and  $B^2$  occurs in 72 per cent of the remainder.  $B^{1/2}$  branches directly across the apical division boundary. A shows a pattern of bifurcation into  $B^{1/2}$  and  $B^2$  with  $B^{1/2}$  branching peripherally. B shows bifurcation into  $B^{1/2}$  and  $B^2$  with  $B^2$  branching from the apical division boundary. C shows bifurcation into  $B^{1/2}$  +  $B^2$  +  $B^3$  +  $B^4$  and  $B^5$ . The nomenclature of the lower division diagrams of the left upper lobe is shown in T, U, V diagrams and B is lacking to De Olco,

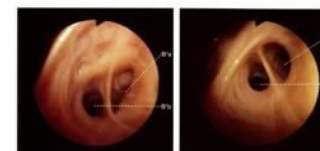
The nomenclature of the lower division branches of the left upper lobe is shown in 7.47. Diagrams A and B belong to De Olier,



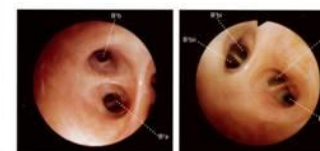
**7.47** Right upper lobe bronchus; parallel quadrilateral type. A sub type of the quadrilateral type of the right upper lobe bronchus. Segmental bronchi B' and B'' and subsegmental bronchi B' and B'' with similar size and/or are located almost linearly. In this case, B' is located slightly above the linear arrangement. This type is rare among quadrilateral types.



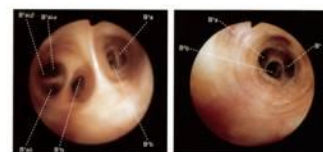
**7.49** Right upper lobe segmental bronchus B' (B'a, B'at, B'bc, B'bw). In this case, B'a and B'bc behave as B'a and B'at and B'bw and B'bc at the orifice.



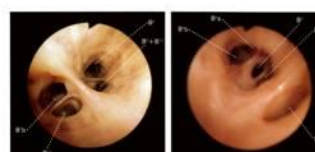
7.84 Right upper lobe segmental bronchus B<sup>2</sup>, standard type. The right upper lobe segmental bronchus B<sup>2</sup> bifurcates into B<sup>3</sup>a and B<sup>3</sup>b. Each diameter at its orifice is similar.



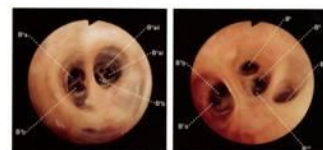
**7.53** Right upper lobe segmental bronchus B<sup>5</sup>, standard type. The right upper lobe segmental bronchus B<sup>5</sup> bifurcates into B<sup>5a</sup> and B<sup>5b</sup> at its origin. The bifurcation is oblique.



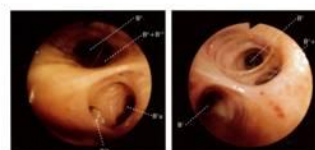
7.71 Middle lobe branches: parallel trifurcation type. From the left,  $H^1a$ ,  $H^1b$  and  $H^1c$  are almost parallel.



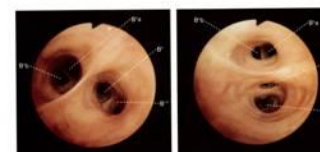
7.75 Right basal lobe bronchus.  $H^1$  arises at an angle of about 45 degrees with the line connecting  $W^1$ ,  $H^2$  and  $H^3$ .  $H^2$  arises at an angle of about 120° with the line connecting  $W^1$ ,  $H^1$  and  $H^3$ .



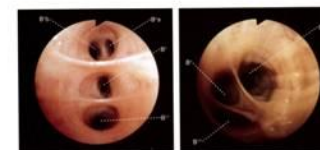
**5.73** Middle lobe bronchus. Bifurcation type. The middle lobe bronchus bifurcates into  $W'$  and  $W''$ . Each bronchus divides into three subsegmental bronchi.



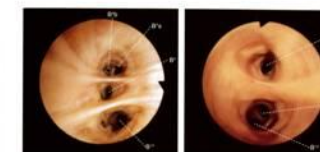
7.77 Right  $B'$ . Subgenital bristle branch off from  $B'$  in opposite directions at an acute angle.



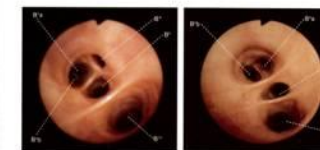
**7.79** Right basal lobe branches:  $H^1$ ,  $H^2 + H^{12}$ . The bronchial surface in the right basal segments are absent. From the top,  $H^1$ 's,  $H^2$ 's,  $H^3$ 's,  $H^4$ 's and  $H^{12}$



**3.82** Right basal lobe branches:  $H^1, H^2, H^3, H^4$  and  $H^5$  are situated on a vertical line with similar size profiles.



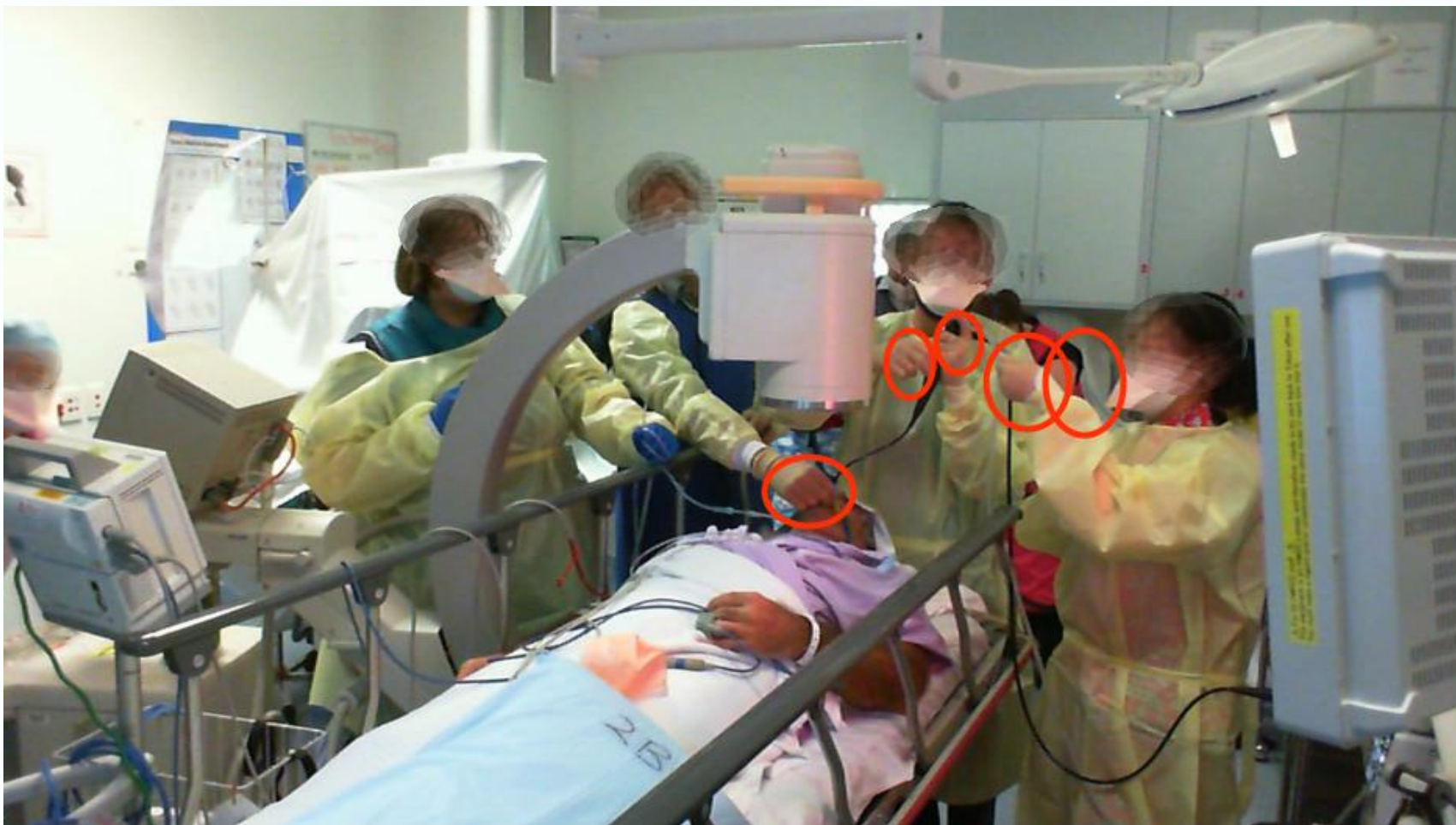
**7.83** Right basal lobe bronchus:  $B^2 + B^3, B^{10}$ . From the top,  $B^2, B^3$  and  $B^{10}$  are present on a line. There is a thick mucosal fold between  $B^2$  and  $B^3$ .



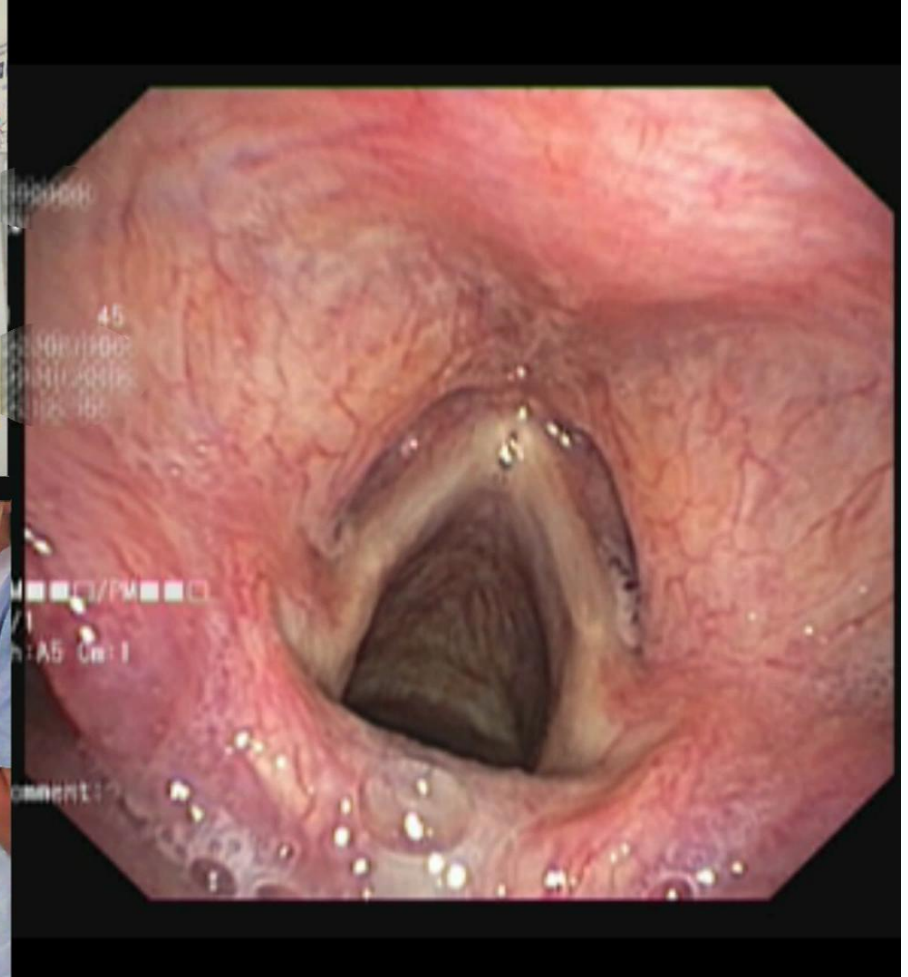
**7.60** Right basal lobe branches.  $B^+$  +  $B^-$ ,  $B^{++}$ ,  $B^{--}$ ,  $B^+$  and  $B^-$  are linear.  $B^{++}$  is observed beyond a thick medial fold.  $B^{--}$  is observed in the lateral wall of the orifices of  $B^+$  +  $B^-$ .

Satoshi Kitamura. *Clinical Application of Fiberoptic Bronchoscopy*





# *In vivo* Video analysis

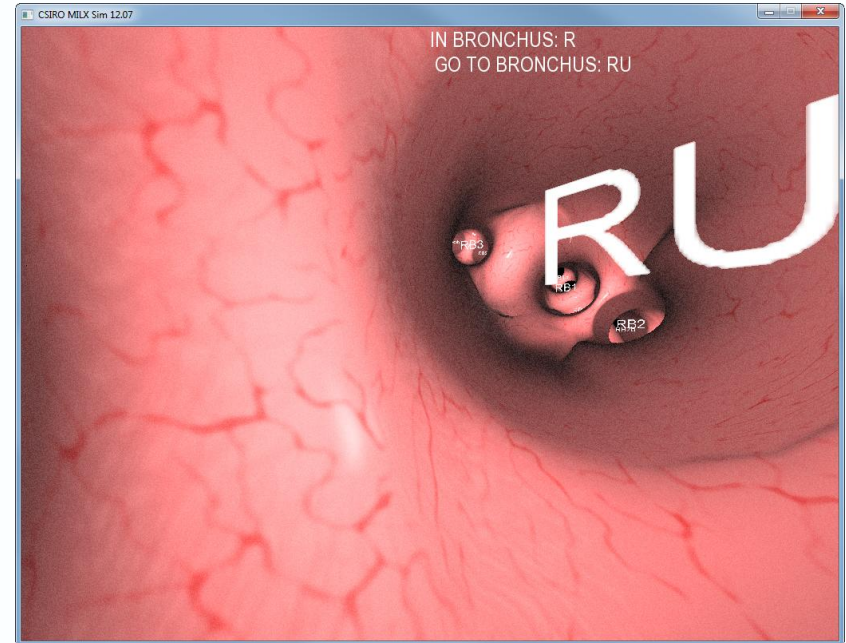
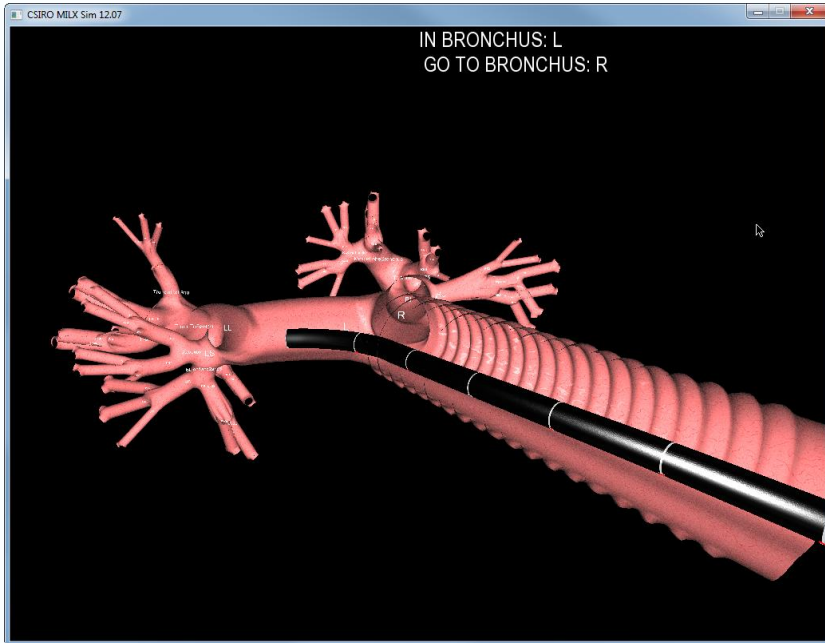


# Interview

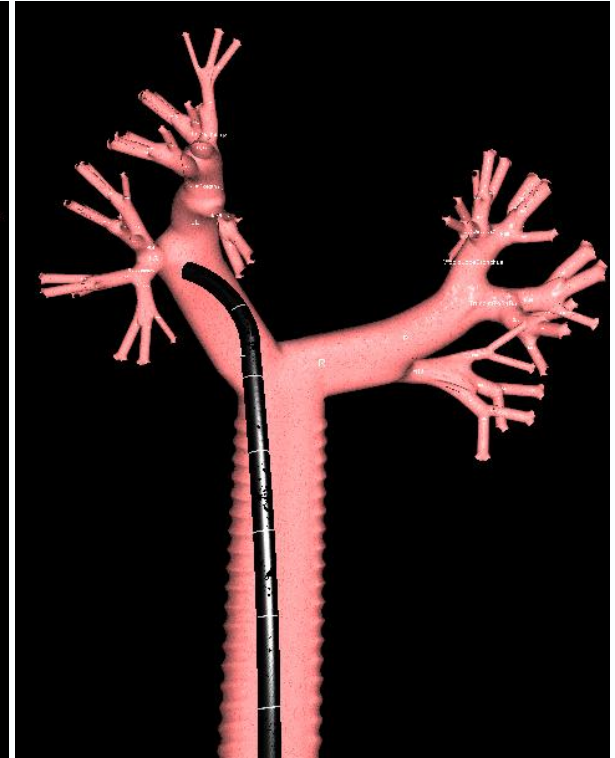
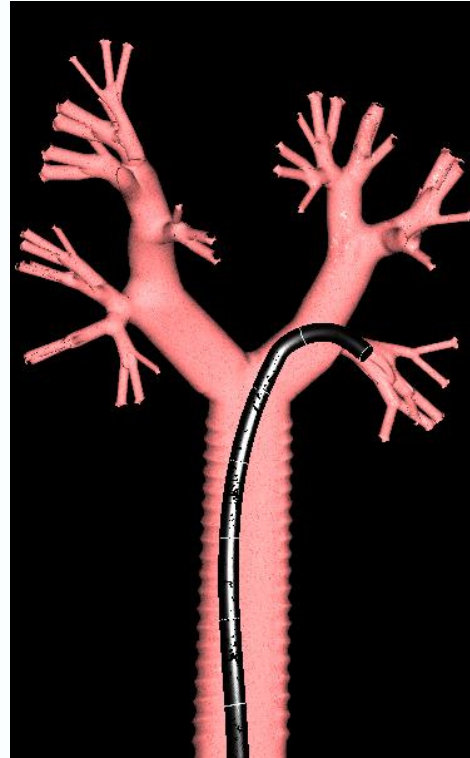
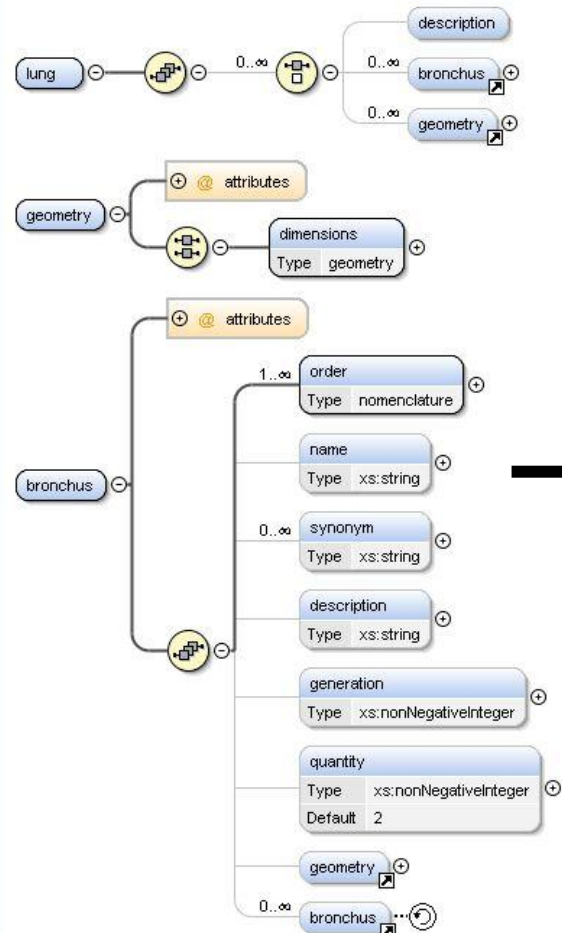


# Example training applications

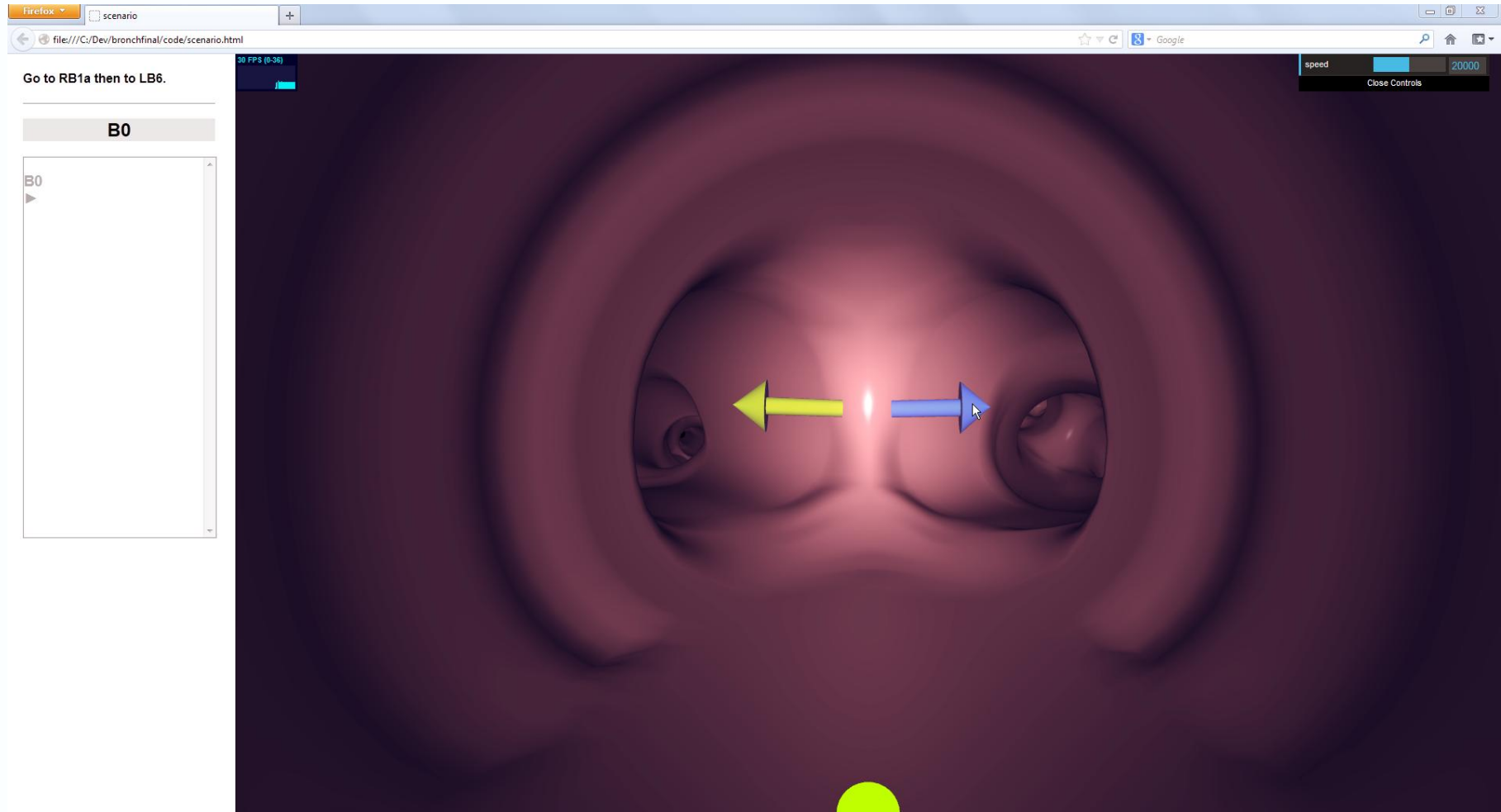
# Full Procedure and Part Task Simulation



# Flexible Data Representation



# Part Task Training: Bronchi Navigation and Nomenclature



# Part Task Training: Narrow Band Imaging

Lifelong learning

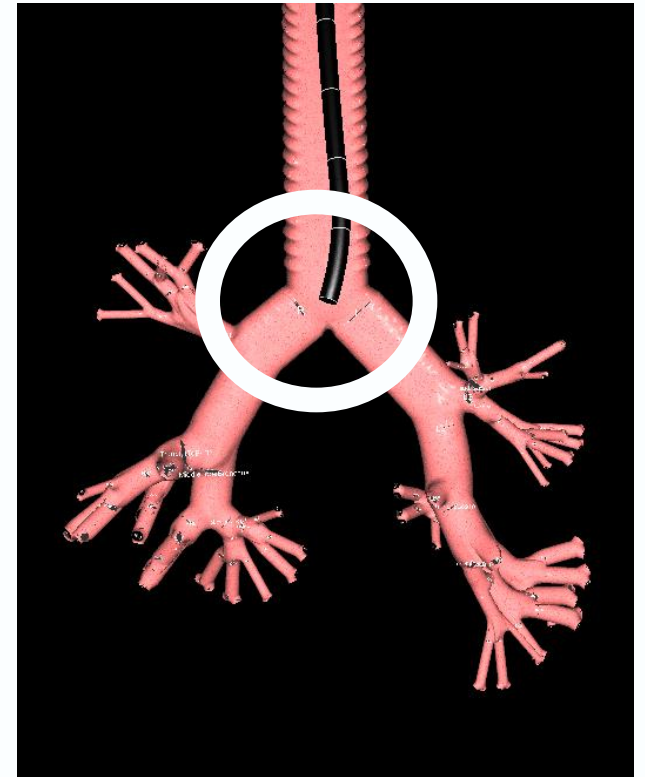
Knowledge evaluation

- Test NBI knowledge
- Online image labeling tool
- Identify biopsy sites
- Expert answer comparison
- Scoring
- Complements Image atlases

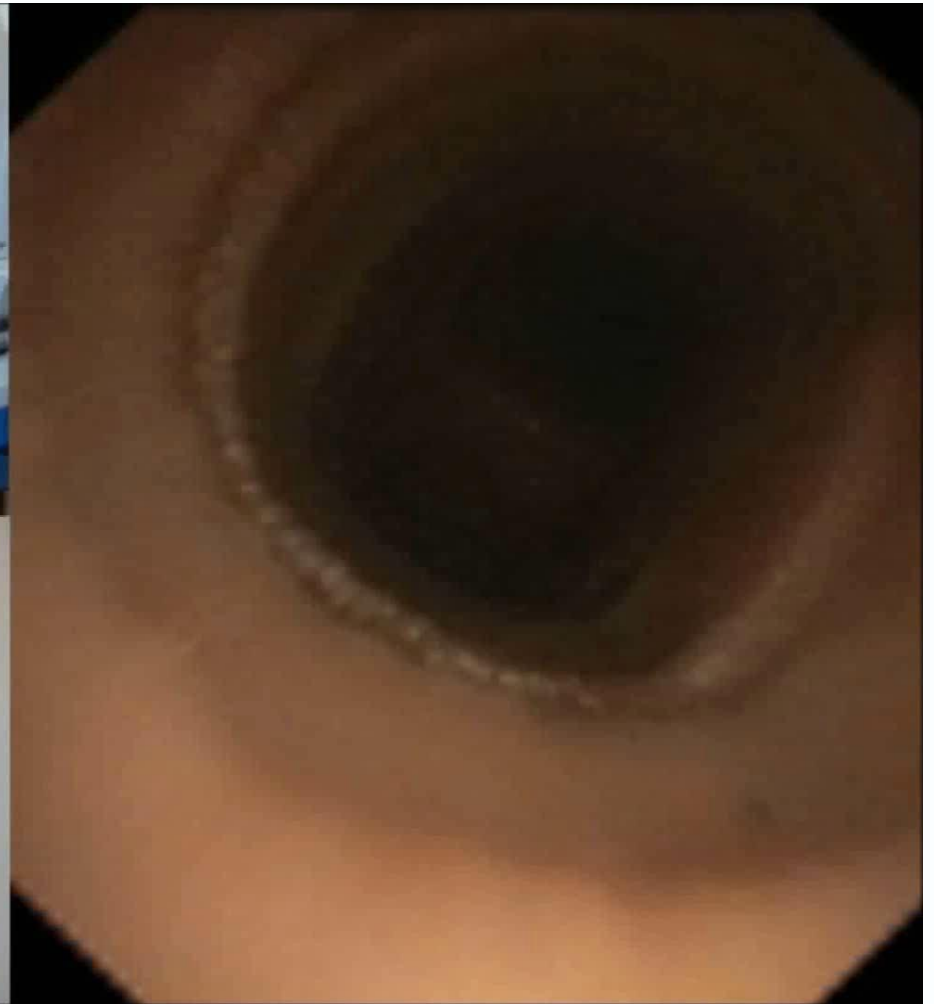


# Posture

## Evaluation of the bronchoscope camera / tip



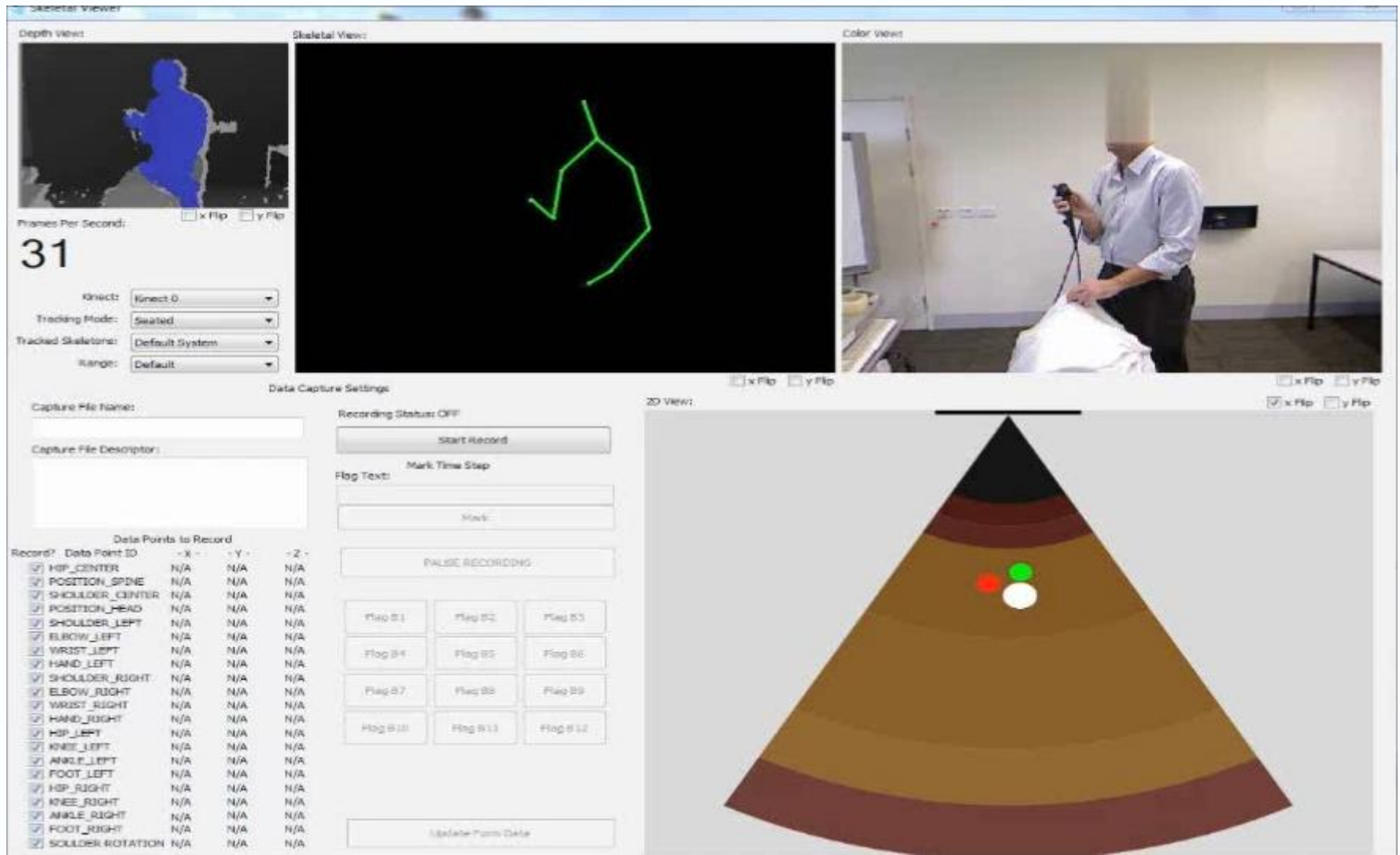
# Video - Mannequin task analysis



# 3D Tracking



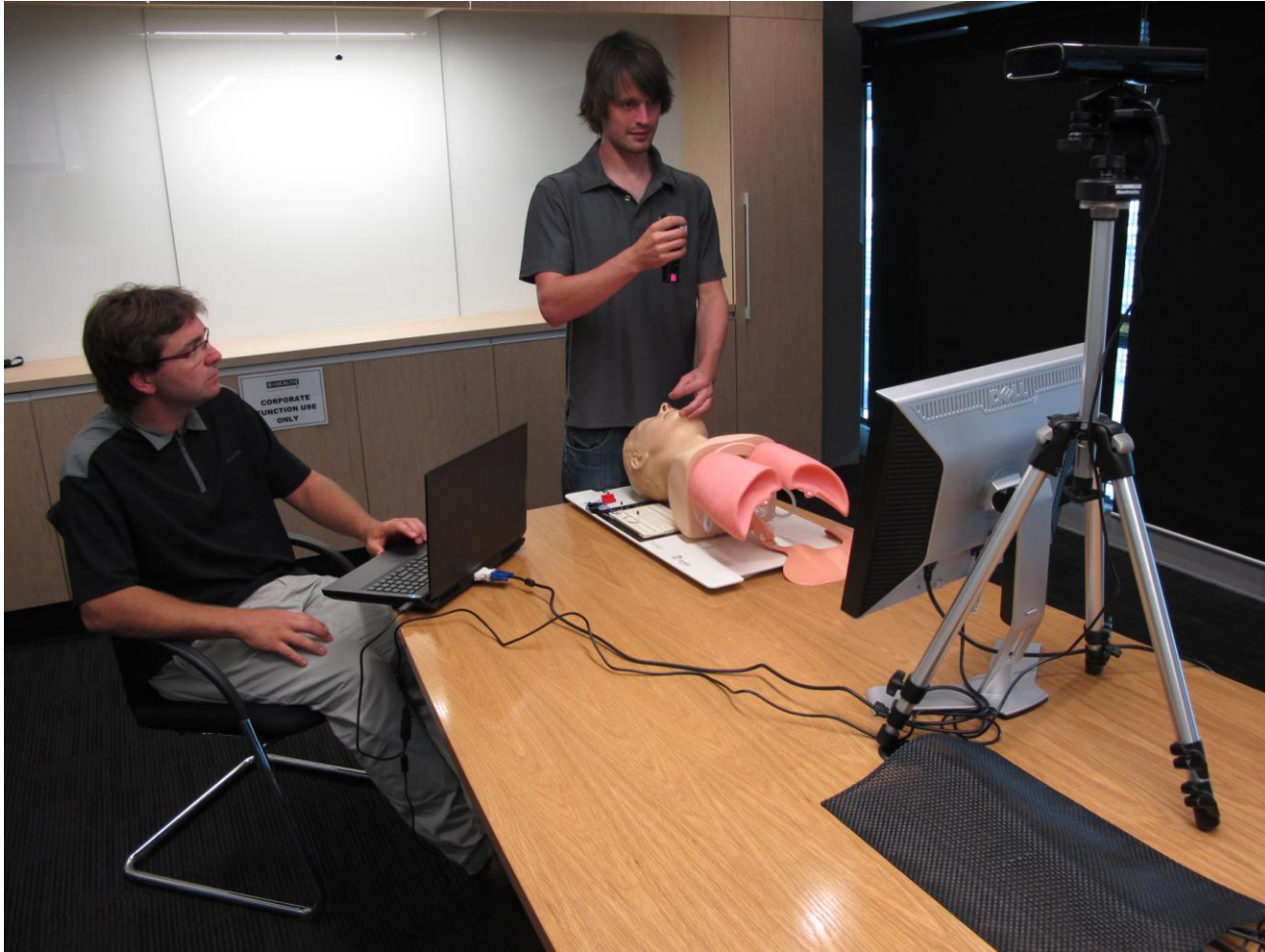
# Video – 3D task analysis



# Task analysis tools



# Example posture usage



# Thanks to our partners:

QH Clinical Skills Development Service  
RBWH Thoracic Department

## AEHRC

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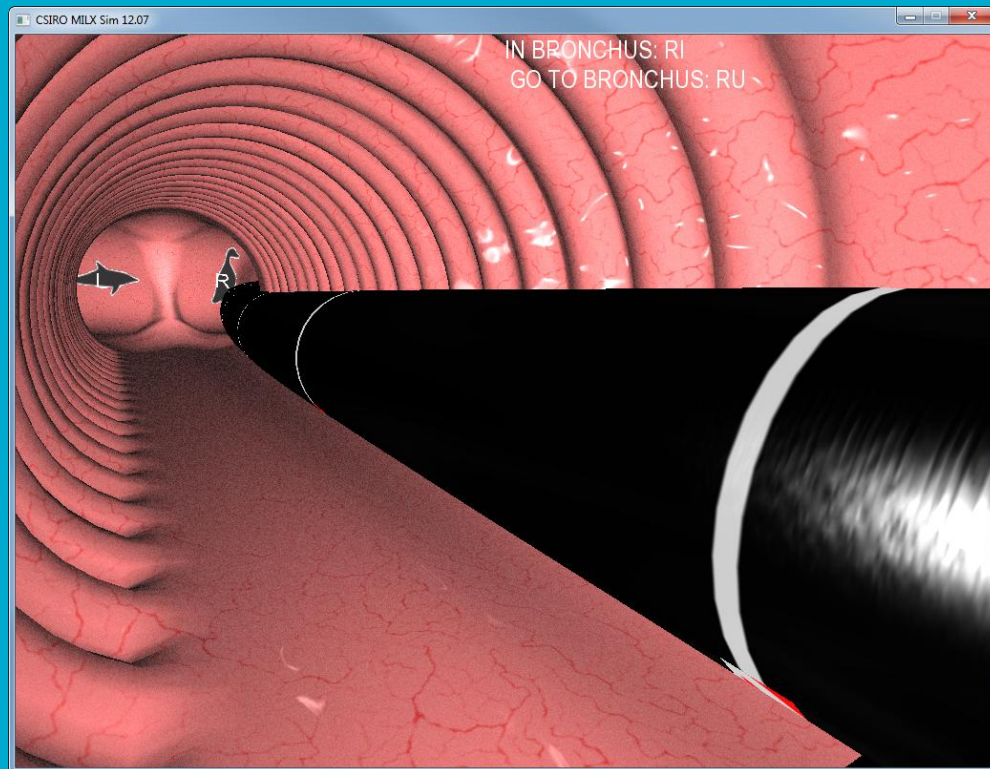
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