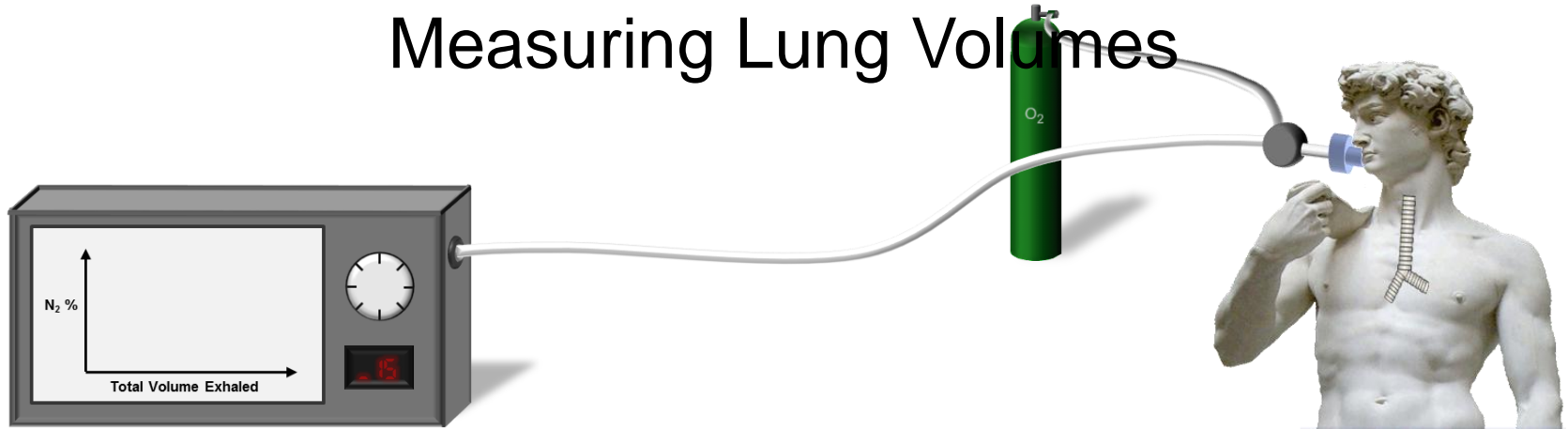


# Pulmonary Function Tests

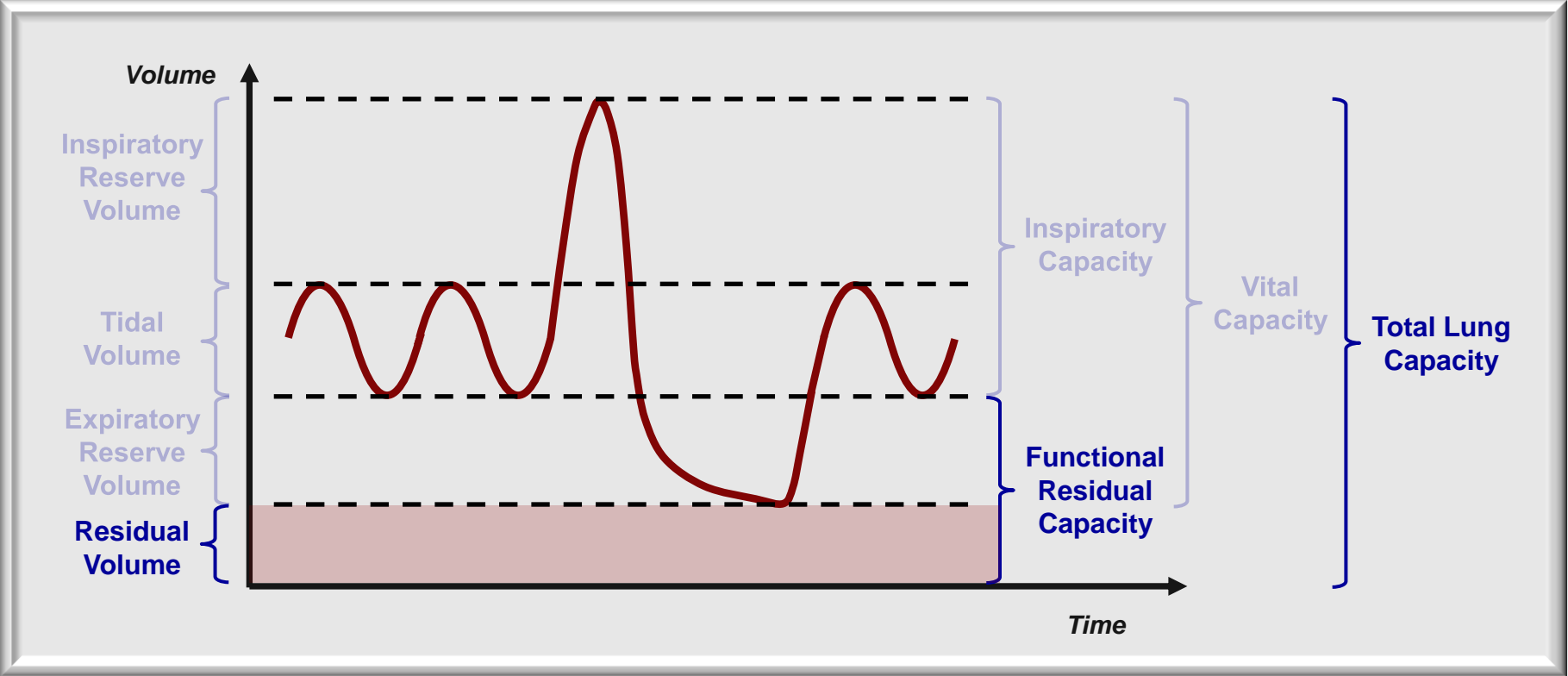
## Measuring Lung Volumes



# Learning Objectives

- Gain a basic understanding of the four primary methods for measuring FRC (and thus TLC).
- To be able to use the TLC to diagnose restrictive lung disease.

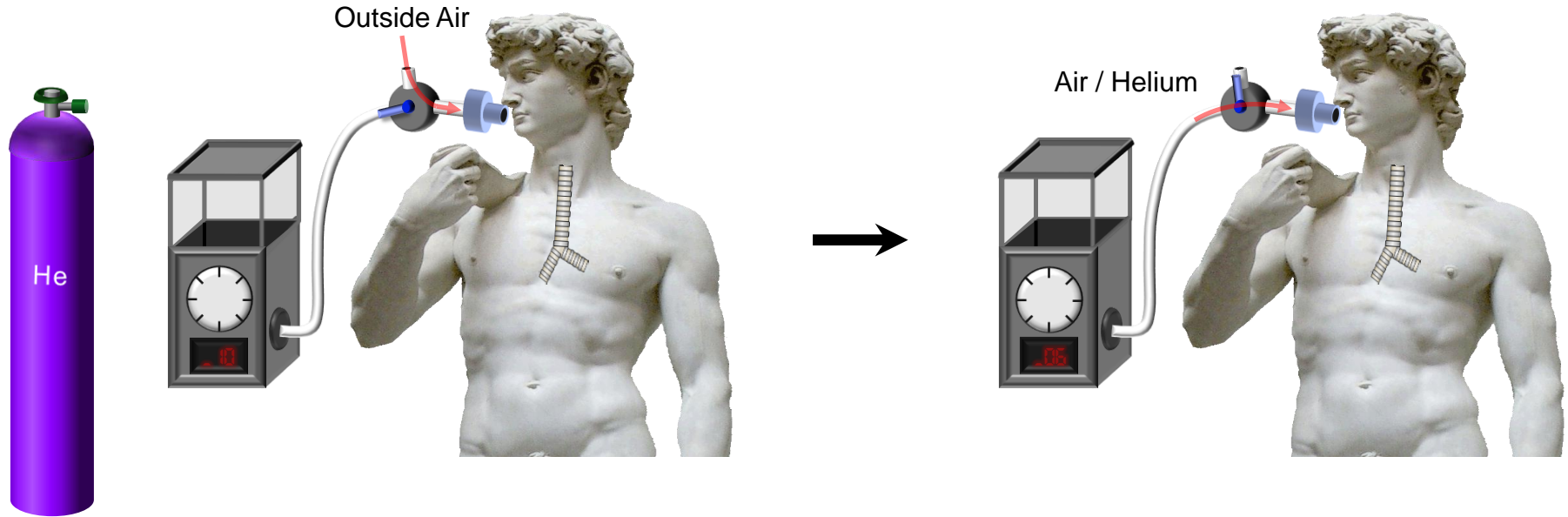
# Lung Volumes



# How Are Lung Volumes Measured?

- Helium Dilution
  - Nitrogen Washout
  - Body Plethysmography
  - Radiographic measurements (Chest X-ray or CT)
- } Gas Dilution Techniques

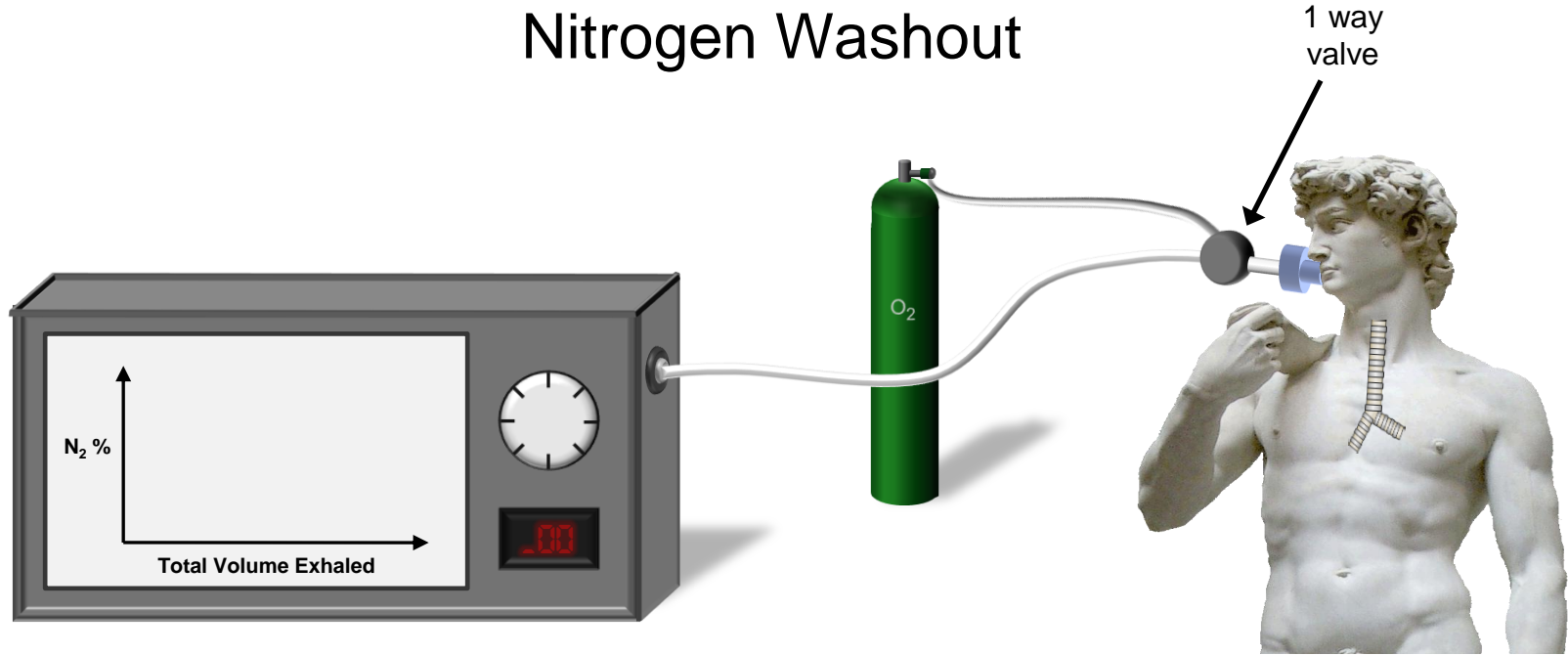
# Helium Dilution



$$C_{\text{He,initial}} \times V_{\text{reservoir}} = C_{\text{He,final}} \times (V_{\text{reservoir}} + \text{FRC})$$

$$\text{FRC} = V_{\text{reservoir}} \left[ \frac{C_{\text{He,initial}} - C_{\text{He,final}}}{C_{\text{He,final}}} \right]$$

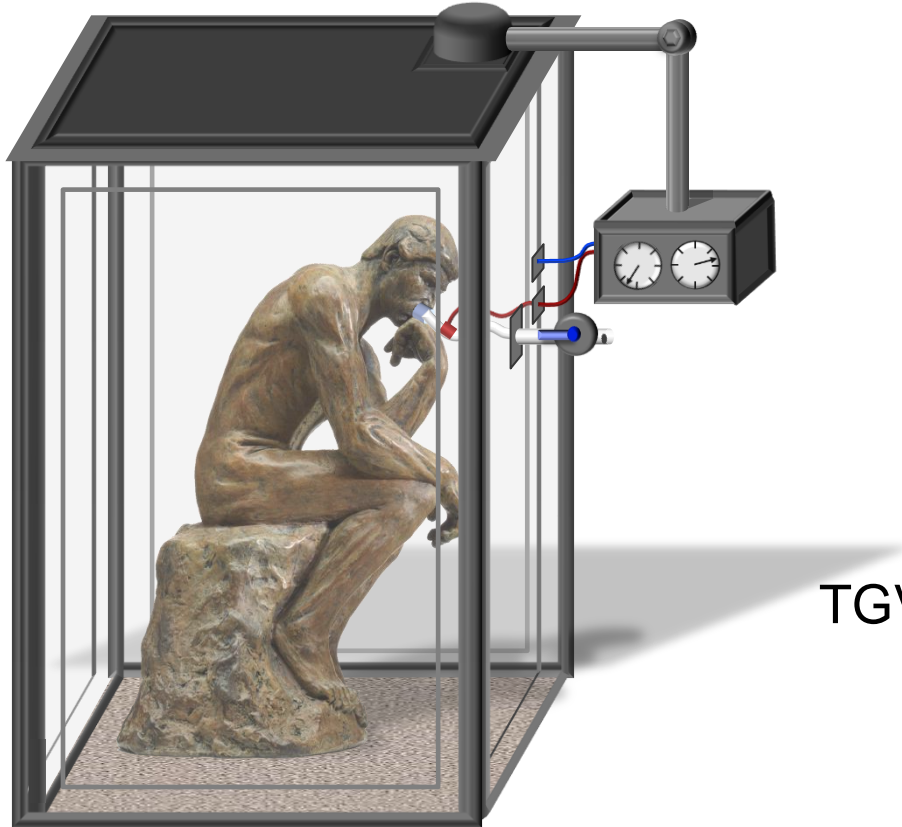
# Nitrogen Washout



Initial Amount of N<sub>2</sub> in Lungs = Total Amount of N<sub>2</sub> Exhaled

$$\text{FRC} = \frac{V_{\text{exhaled}} \times C_{\text{exhaled},\text{N}_2}}{C_{\text{alveolar},\text{N}_2}}$$

# Body Plethysmography



$$P_1 V_1 = P_2 V_2$$

*Boyle's Law*



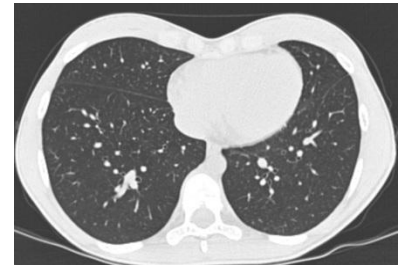
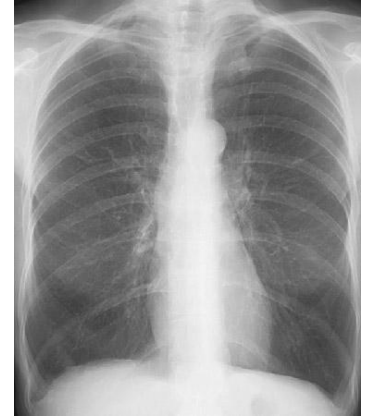
*Lots of algebra  
and physics*

$$TGV = - (\Delta V / \Delta P) \times P_{A2} \times (P_{A1} / P_B)$$

*(TGV = Thoracic Gas Volume)*

# Imaging Techniques

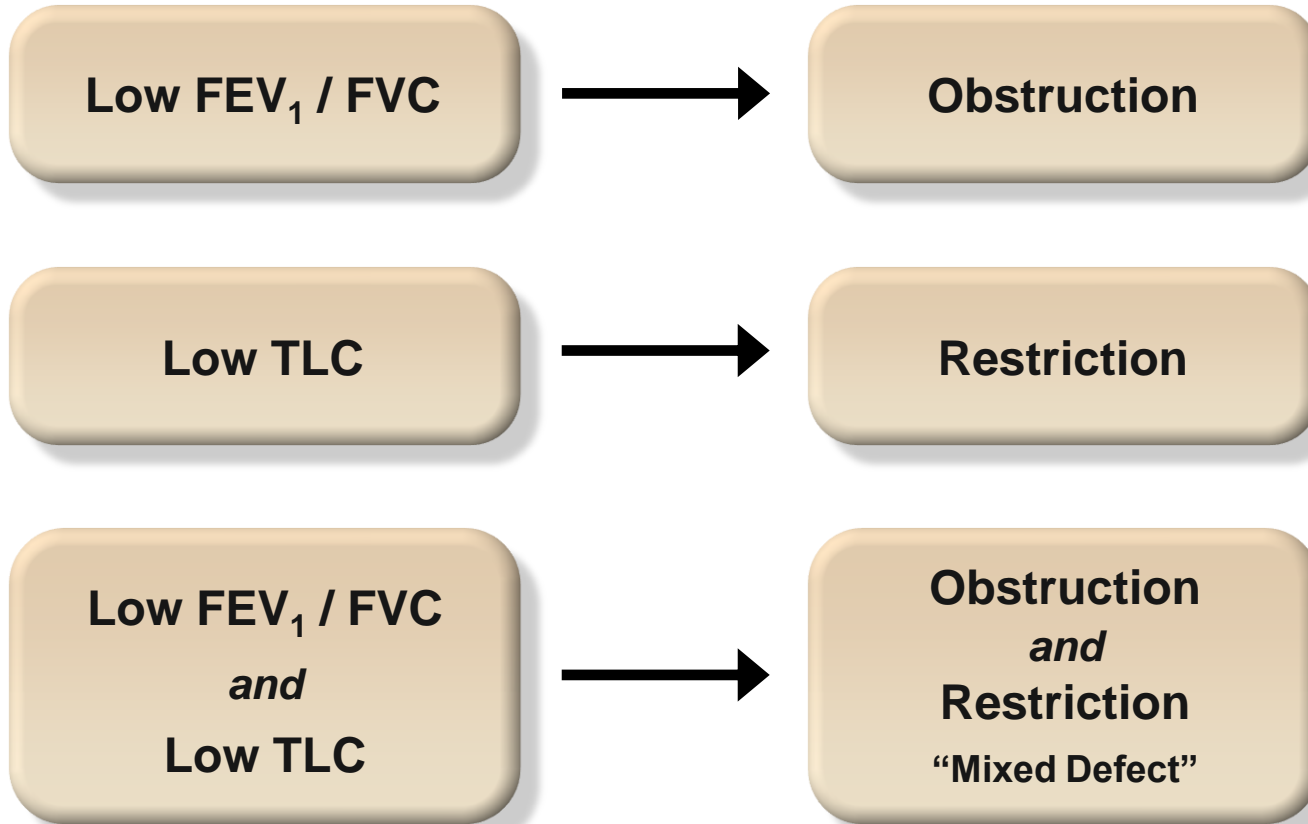
- From a chest X-ray, measurements of the lungs in PA and lateral views are taken, and entered into an algorithm to estimate lung volume.
- From a chest CT, the cross sectional area of the lungs in each axial slice is multiplied by the thickness of the slice, and all of them are added together for lung volume.
- Both are easier to perform for the patient, but less accurate.
- Patient still needs to perform an adequate breath hold.



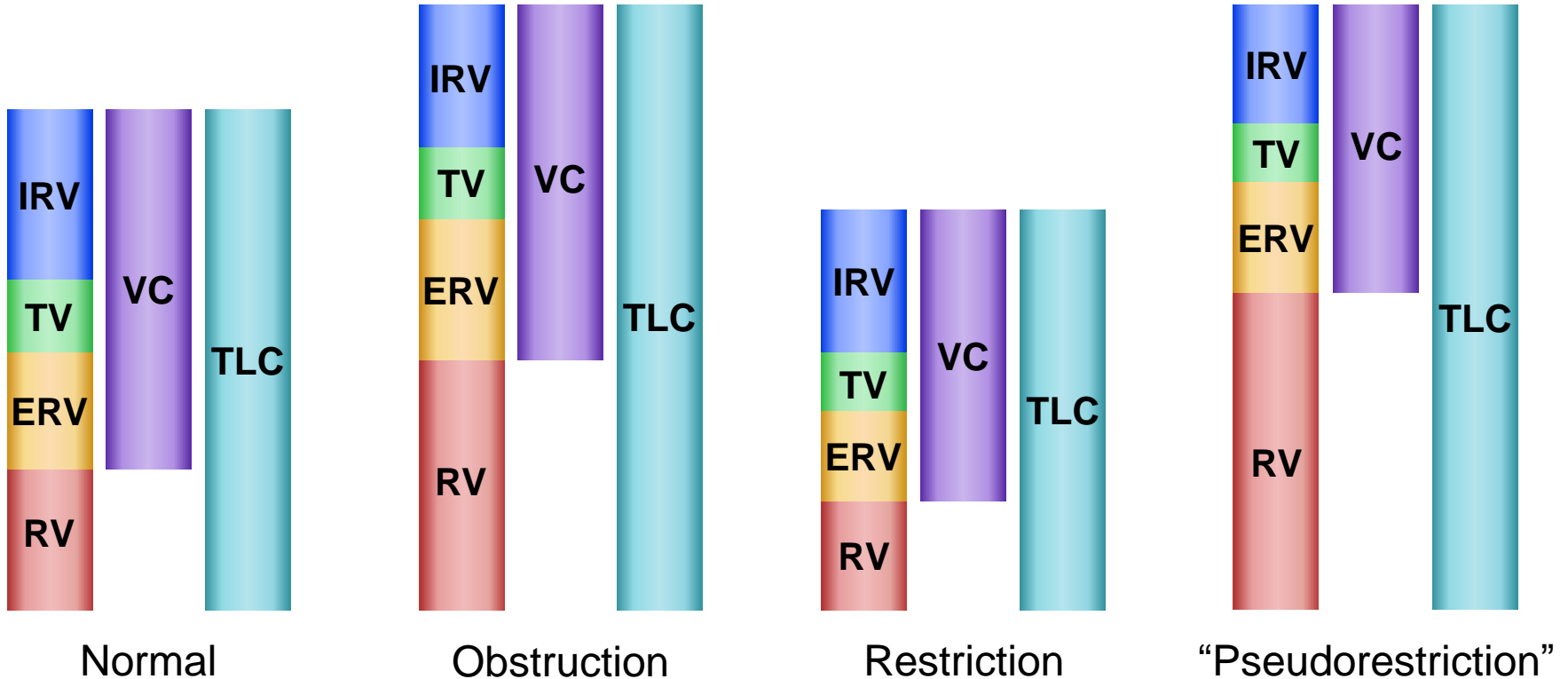


# Interpretation of Lung Volumes

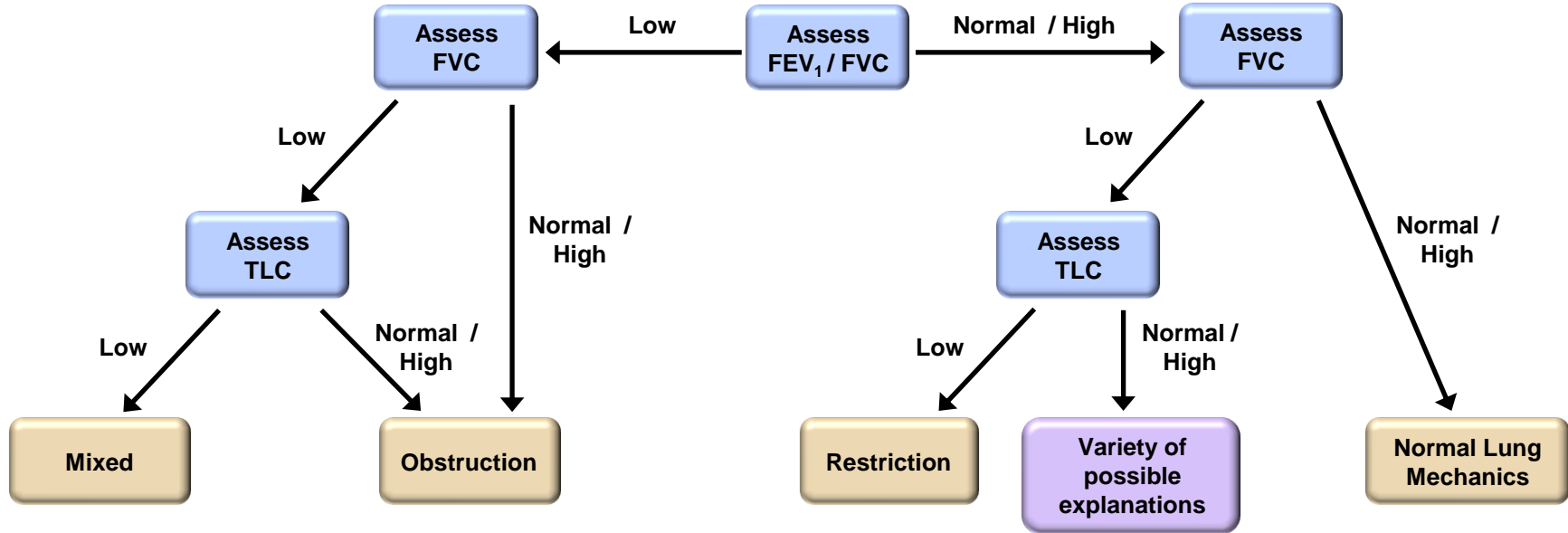
# Interpretation of Lung Volumes



# Interpretation of Lung Volumes



# Interpretation of Lung Volumes





Copyright © 2014 by Eric Strong

This work is made available under the terms of the Creative Commons  
Attribution-NonCommercial-NoDerivs 3.0 Unported License

For details, please refer to: [creativecommons.org/licenses/by-nc-nd/3.0/deed.en\\_US](https://creativecommons.org/licenses/by-nc-nd/3.0/deed.en_US)