Fred Bamatter Award Lecture

Understanding and improving respiratory care of preterm neonates
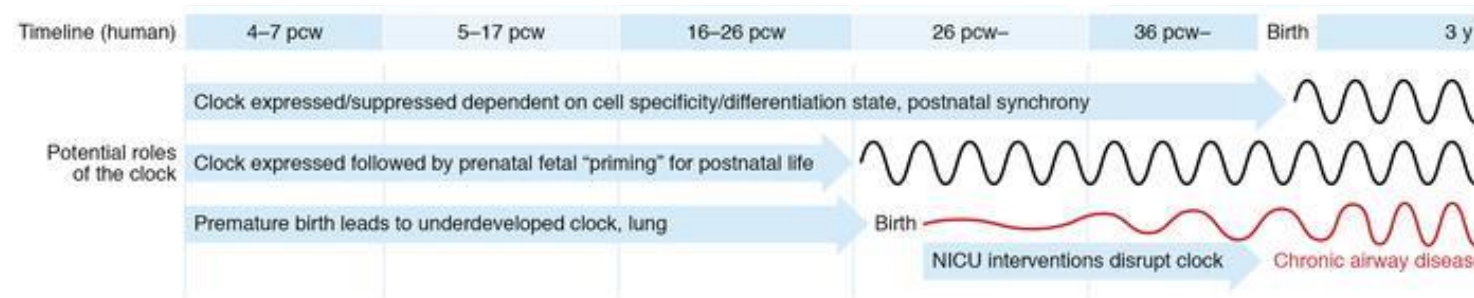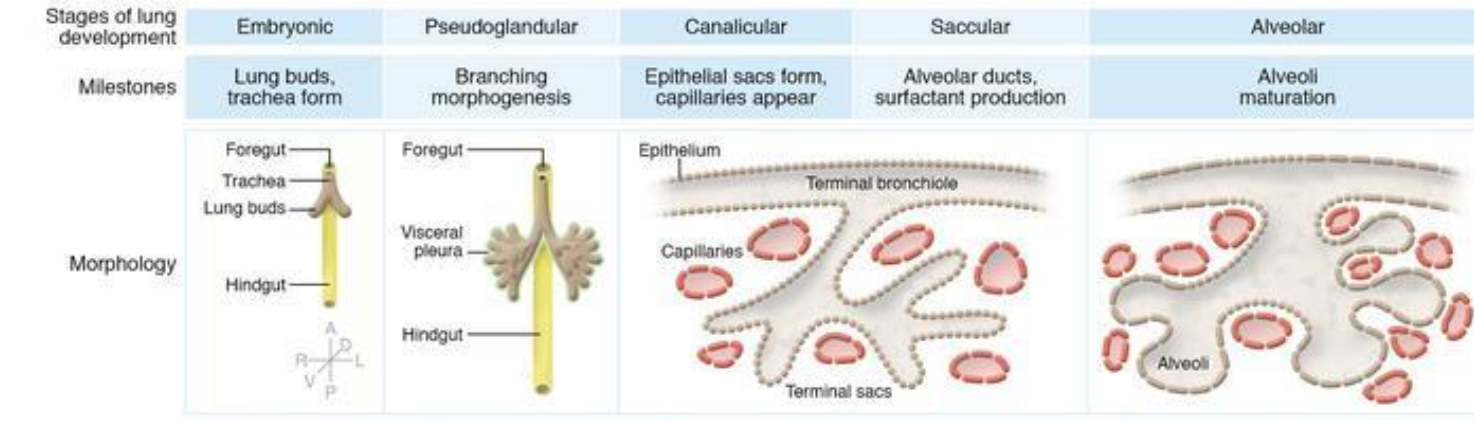
Prof Sven Schulzke, MD, MSc, FRACP

Department of Neonatology
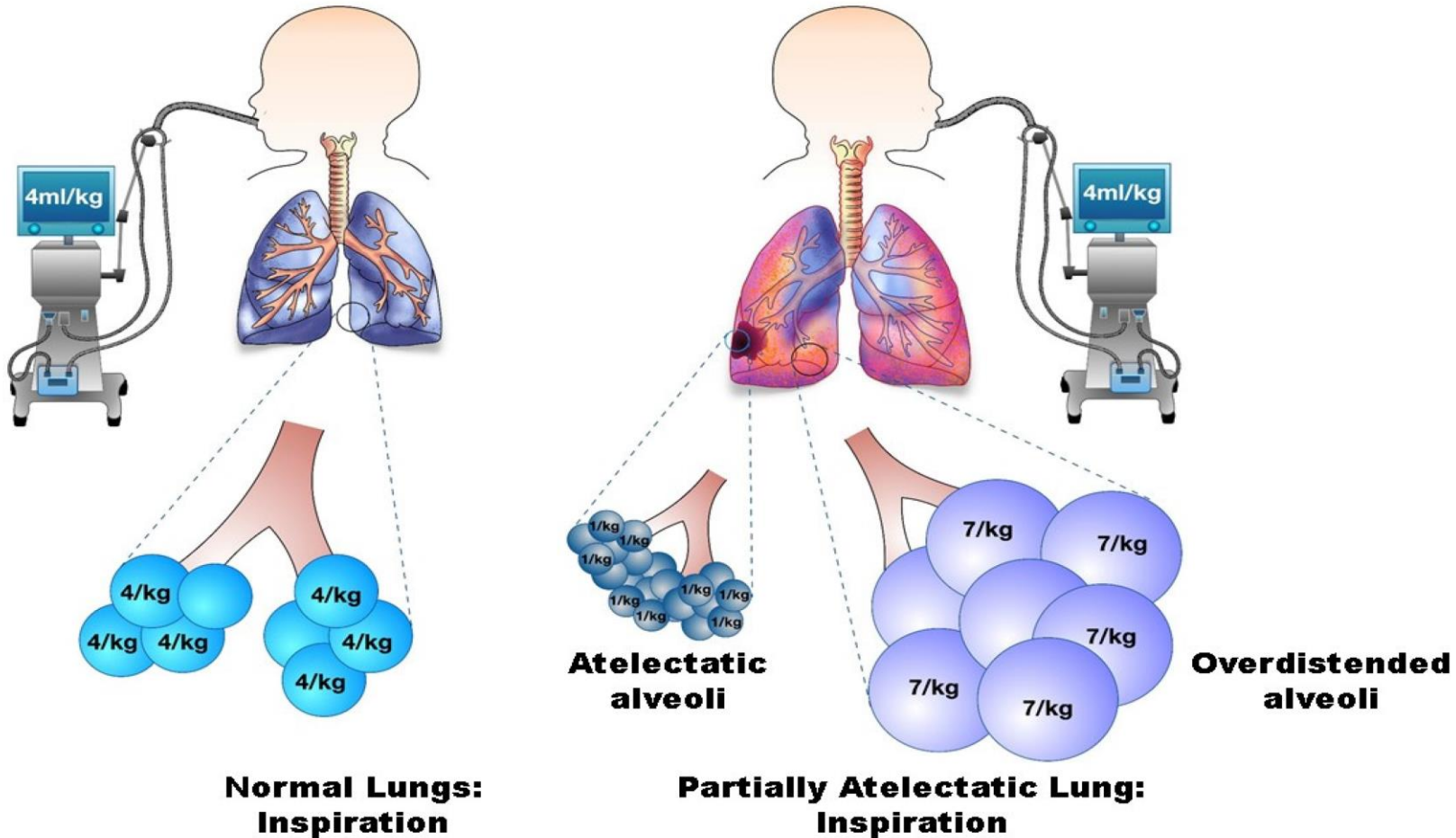
University Children's Hospital Basel UKBB

1x3

Important aspects for medical students and junior doctors
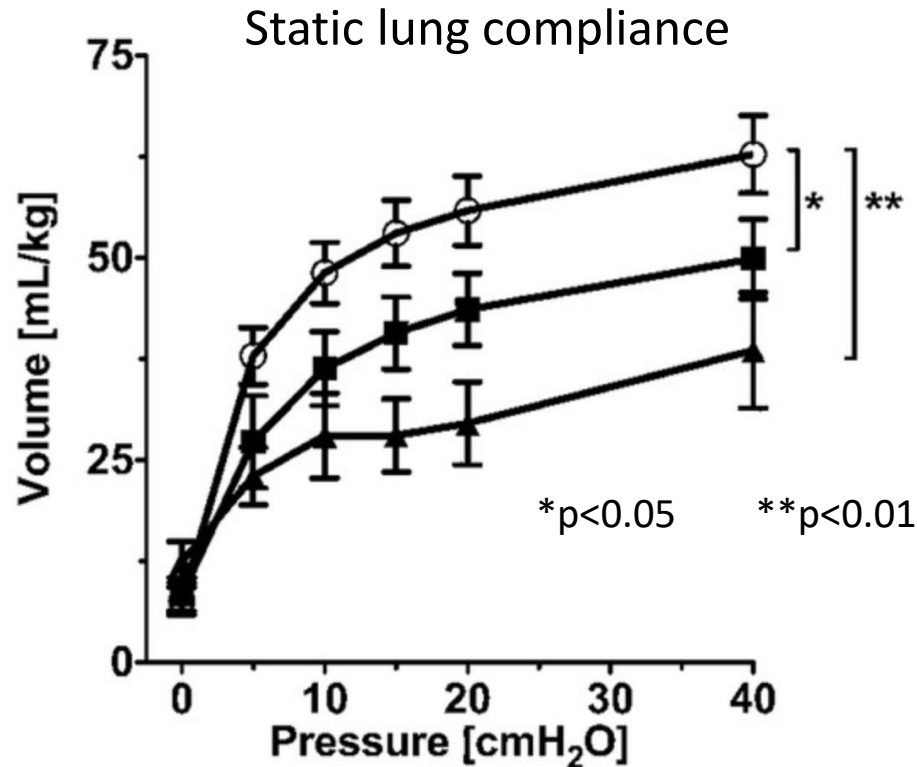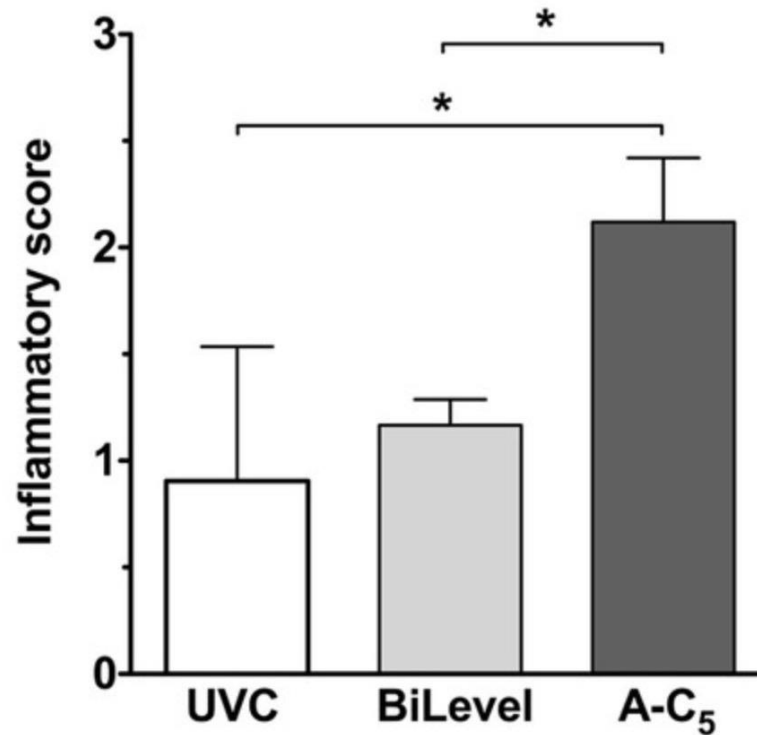
Developmental stages of the lung

Bartman et al, J Clin Investig 2020

Ventilator-associated lung injury

Normal Lungs:
Inspiration

Partially Atelectatic Lung:
Inspiration

Atelectatic alveoli

Overdistended alveoli

Lung injury after only 2 h of ventilation

Static lung compliance

*p<0.05   **p<0.01

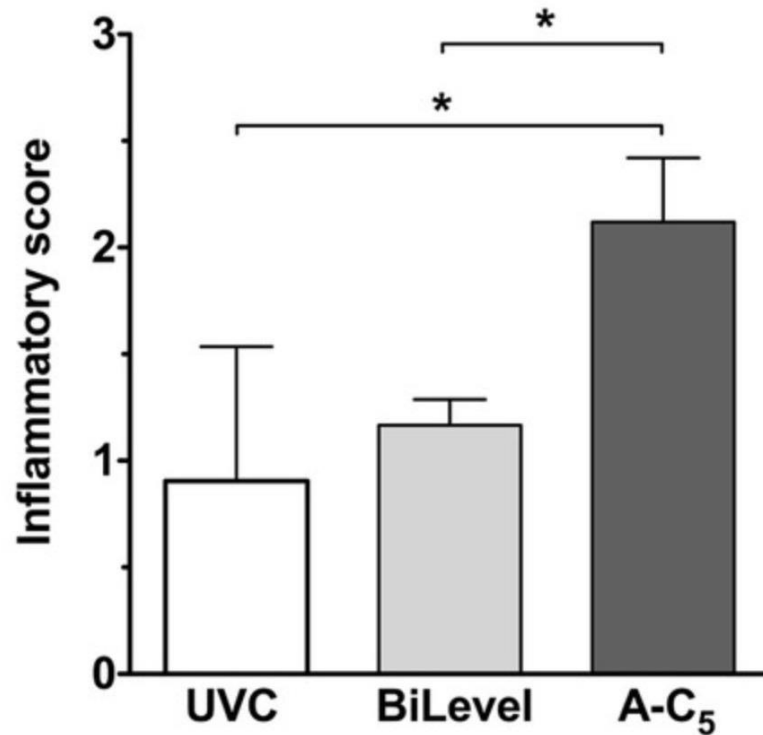Schulzke et al., Ped Research 2009

Protective ventilation reduces inflammation

*p<0.05   **p<0.01

Schulzke et al., Ped Research 2009

Protective ventilation reduces inflammation

Ventilation is a powerful tool – even if used only for a few hours or days!

*p<0.05   **p<0.01

Schulzke et al., Ped Research 2009

Incorporate external evidence

- Respiratory care is not a personal playground
- Our clinical studies (observational, RCT, systematic review)
  - Ventilation modalities, trigger mechanisms
  - Prevention and prediction of chronic lung disease

- So much more evidence out there!
  - Annual entry-level course on evidence-based medicine (EBM) for junior doctors at UKBB
  - Twice weekly EBM bedside teaching rounds for students and doctors

Schulzke & Stöcklin, Paediatr Anaesth 2022; Schulzke et al. J Pediatr 2015; Schulzke et al. Cochrane Lib 2014)

Conventional ventilation
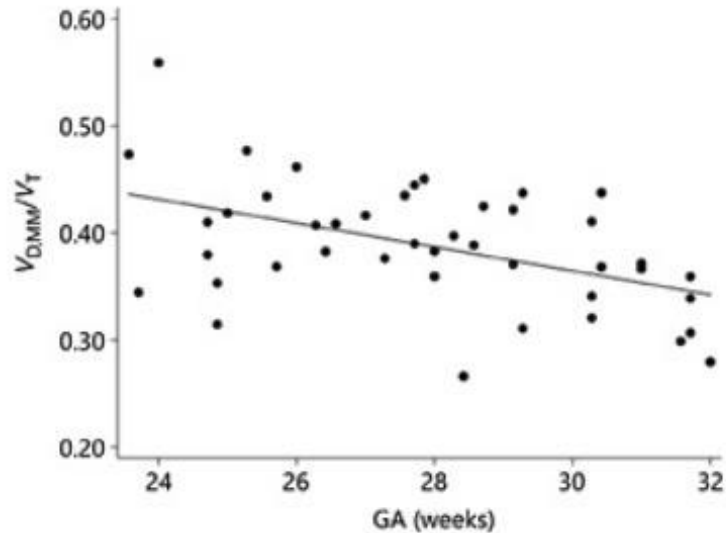
High-frequency oscillatory ventilation

Non-invasive respiratory support

2x3

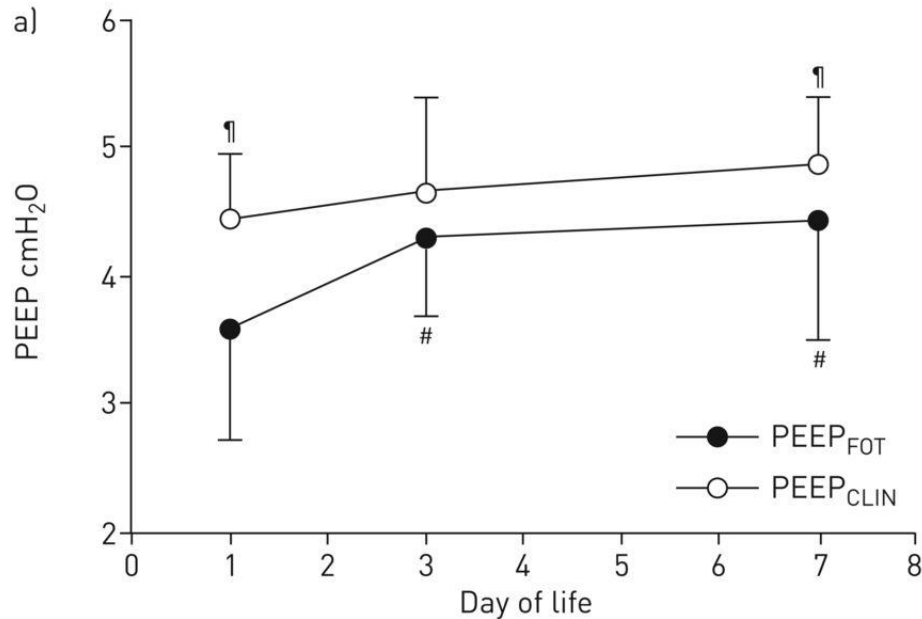# Important aspects for clinicians/neonatologists

Tidal volume - one size fits all?

Dead space to tidal volume ratio

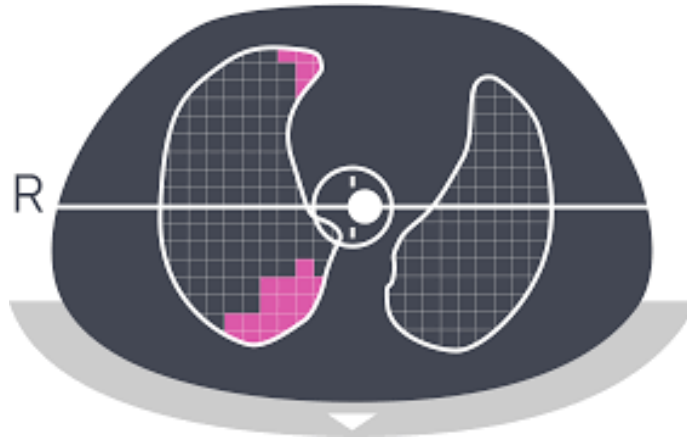Neumann et al., Neonatology 2015

PEEP – physiological basis

Wallström et al., Eur Respir J 2019

Zannin et al., Pediatr Res 2019

PEEP titration tool under development

EIT: Optimal volume distribution

FOT: Optimal compliance

It's not over after leaving the NICU

European Respiratory Society guideline on long-term management of children with bronchopulmonary dysplasia

Liesbeth Duijts [1] [2], Evelien R van Meel [3], Laura Moschino [4], Eugenio Baraldi [4],
Magda Barnhoorn [5], Wichor M Bramer [6], Charlotte E Bolton [7], Jeanette Boyd [8],
Frederik Buchvald [9], Maria Jesus Del Cerro [10], Andrew A Colin [11], Refika Ersu [12] [13],
Anne Greenough [14], Christiaan Gremmen [5], Thomas Halvorsen [15] [16], Juliette Kamphuis [8],
Sailesh Kotecha [17], Kathleen Rooney-Otero [18], Sven Schulzke [19], Andrew Wilson [20],
David Rigau [21], Rebecca L Morgan [22], Thomy Tonia [23], Charles C Roehr [24] [25],
Marielle W Pijnenburg [3]
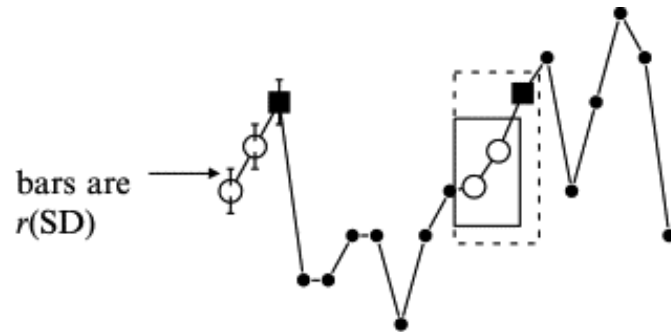
3x3

Important aspects for researchers

"It is difficult to make predictions, especially about the future"

Old Danish proverb
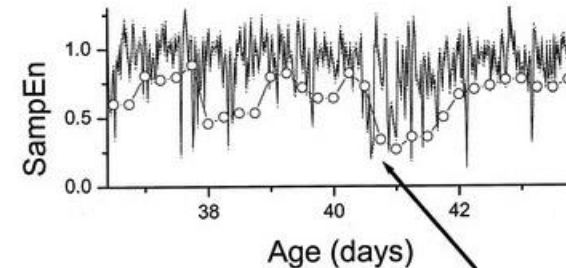
Mathematical prediction tools

Sample entropy (SampEn)

bars are $r(SD)$

■ A_i = number of matches of length $m+1$ with ith template
○ B_i = number of matches of length m with ith template
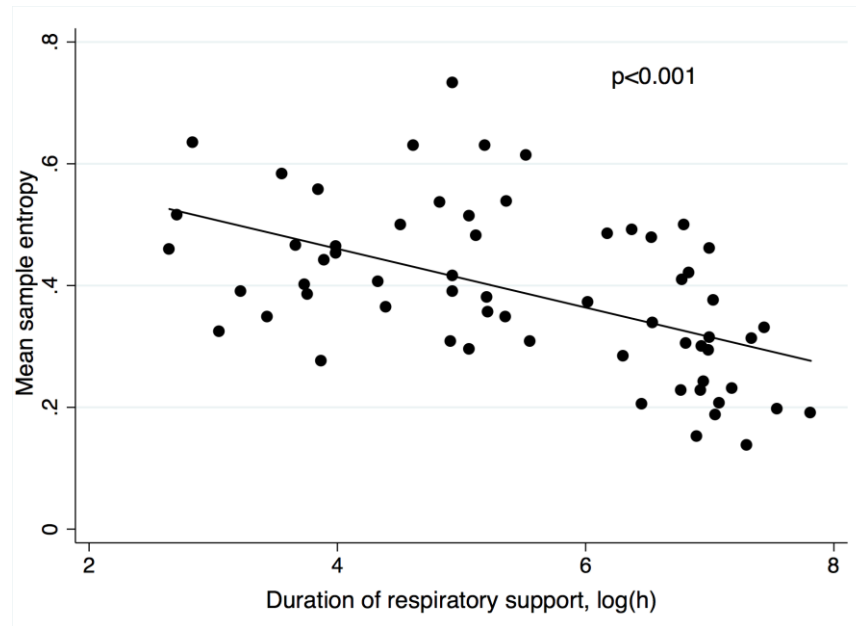
$$ApEn \approx \Sigma -\log (1+A_i)/(1+B_i)$$
$$SampEn = -\log ((\Sigma A_i)/(\Sigma B_i)) = -\log A/B$$

For regular, repeating data, A/B nears 1 and entropy nears 0.

Crash

Lake et al., Am J Physiol Regul Integr Comp Physiol 2002

Predicting duration of respiratory support

Thank you for the support