Control of Breathing Under Mechanical Ventilation

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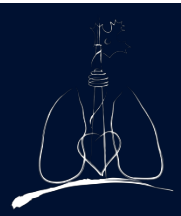


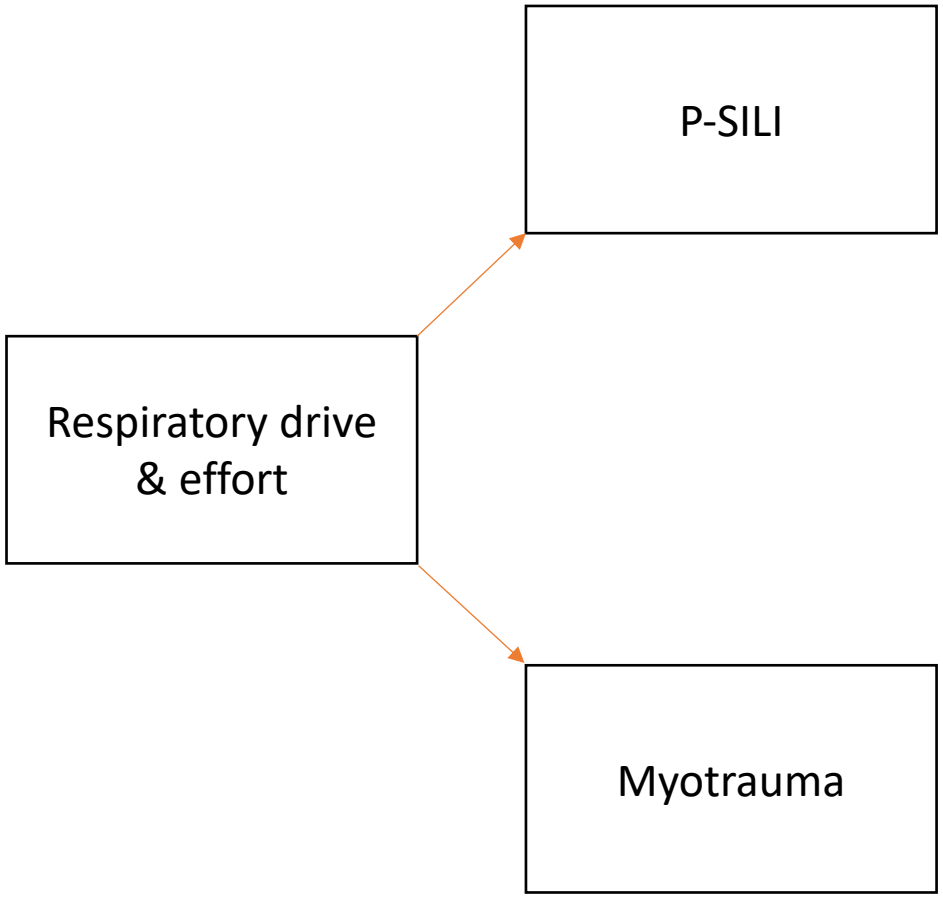
Disclosures

- Conflicts of Interest
  - Equipment and personal fees from Getinge
  - Equipment from Timpel

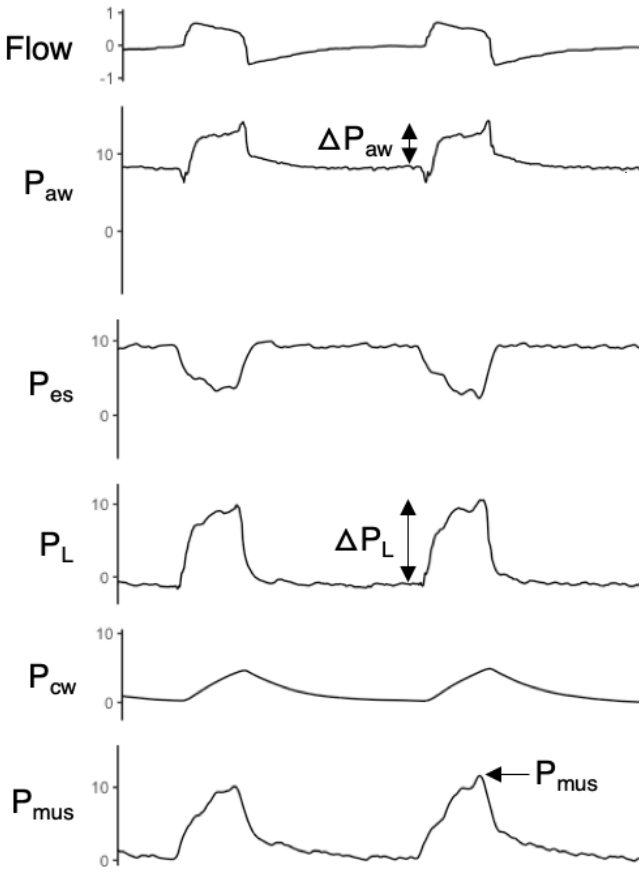
Outline

- Why we care: targeting respiratory effort
- Control of ventilation
  - In non-ventilated subjects
  - On the ventilator
- Determinants of respiratory effort

Challenge: Managing Respiratory Drive



Respiratory drive and effort



Volutrauma

Myotrauma

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STATE OF THE ART

Respiratory Drive in Critically Ill Patients

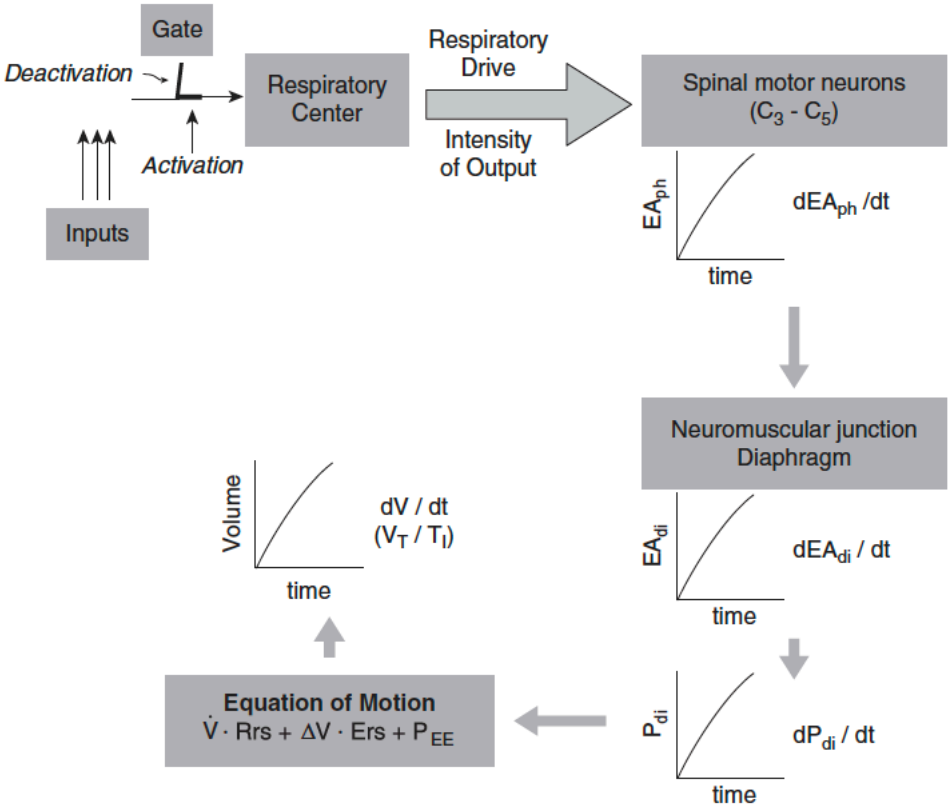
Pathophysiology and Clinical Implications

Katerina Vaporidi[1], Evangelia Akoumianaki[1], Irene Telias[2,3], Ewan C. Goligher[2,4,5], Laurent Brochard[2,3*‡], and Dimitris Georgopoulos[1*]

[1]Department of Intensive Care Medicine, University Hospital of Heraklion, Medical School University of Crete, Heraklion, Greece; [2]Interdepartmental Division of Critical Care Medicine, University of Toronto, Toronto, Ontario, Canada; [3]Keenan Research Center and Li Ka Shing Knowledge Institute, St. Michael's Hospital, Toronto, Ontario, Canada; [4]Department of Medicine, University Health Network, Toronto, Ontario, Canada; and [5]Toronto General Hospital Research Institute, Toronto, Ontario, Canada

ORCID ID: 0000-0002-7766-8688 (K.V.).

Control of Ventilation



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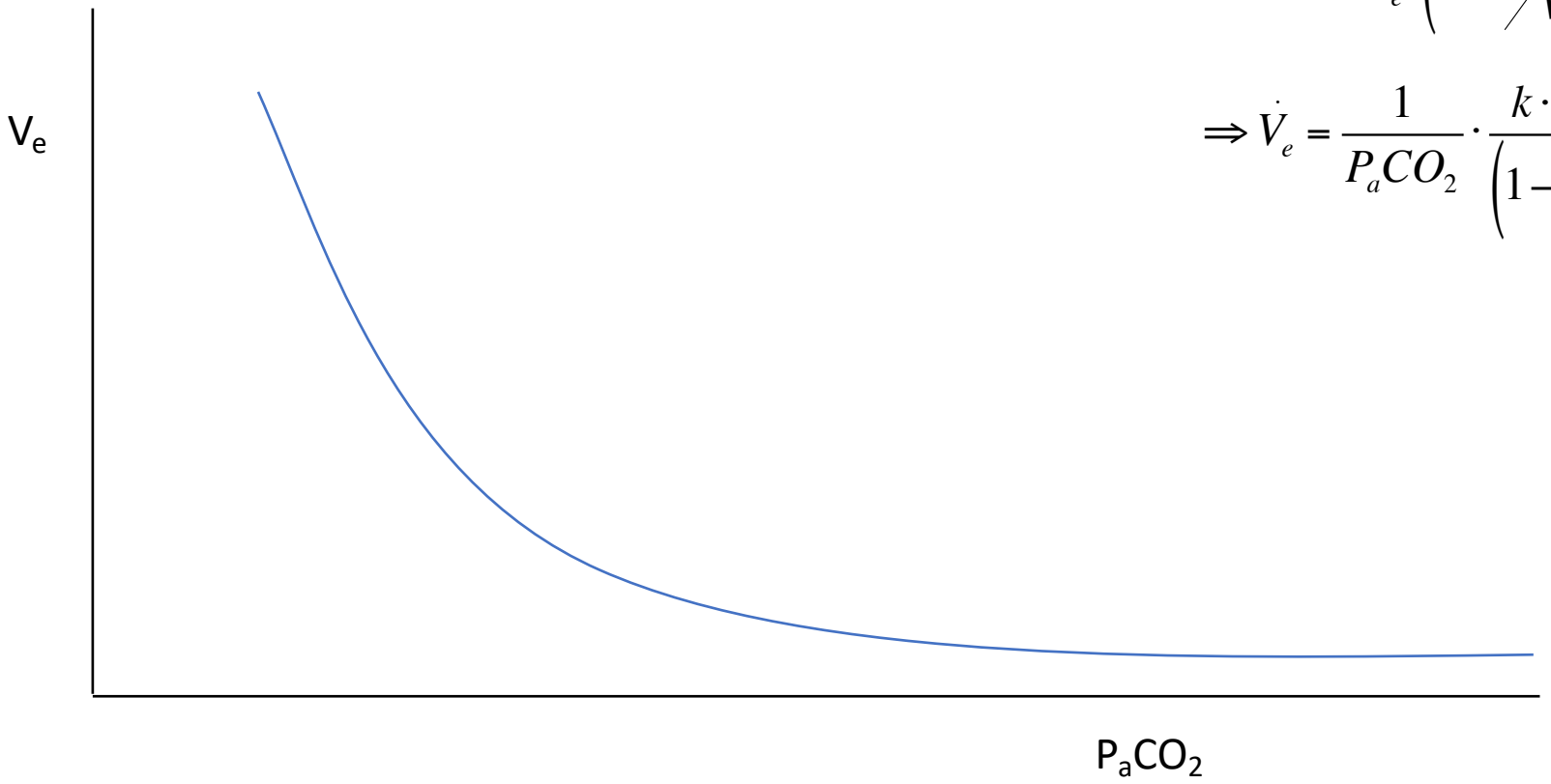
Control of Ventilation

$$P_aCO_2 = \frac{k \cdot \dot{V}_{CO_2}}{\dot{V}_e \cdot \left(1 - V_d / V_t\right)}$$

$$\Rightarrow \dot{V}_e = \frac{1}{P_aCO_2} \cdot \frac{k \cdot \dot{V}_{CO_2}}{\left(1 - V_d / V_t\right)}$$



Control of Ventilation

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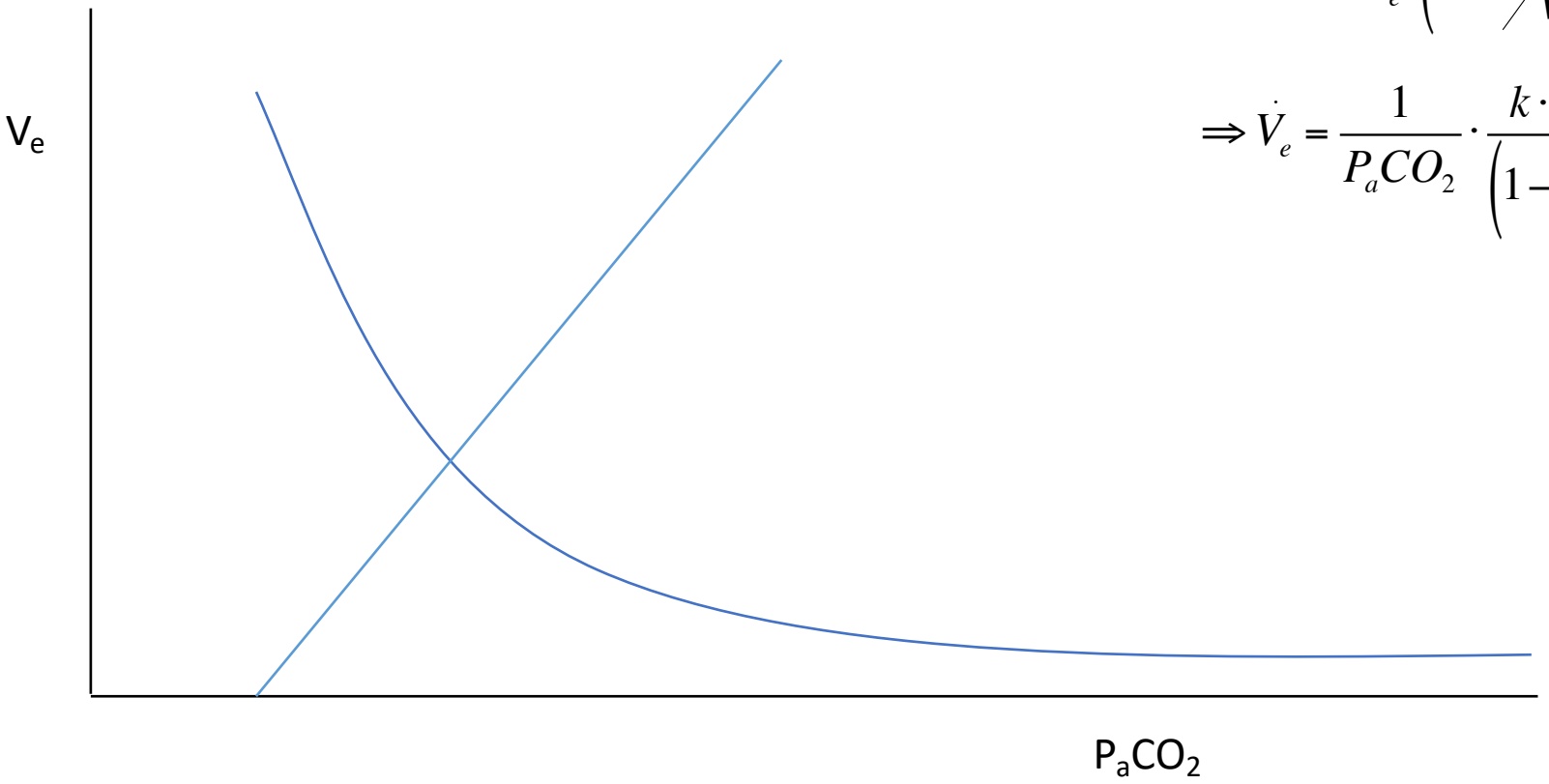

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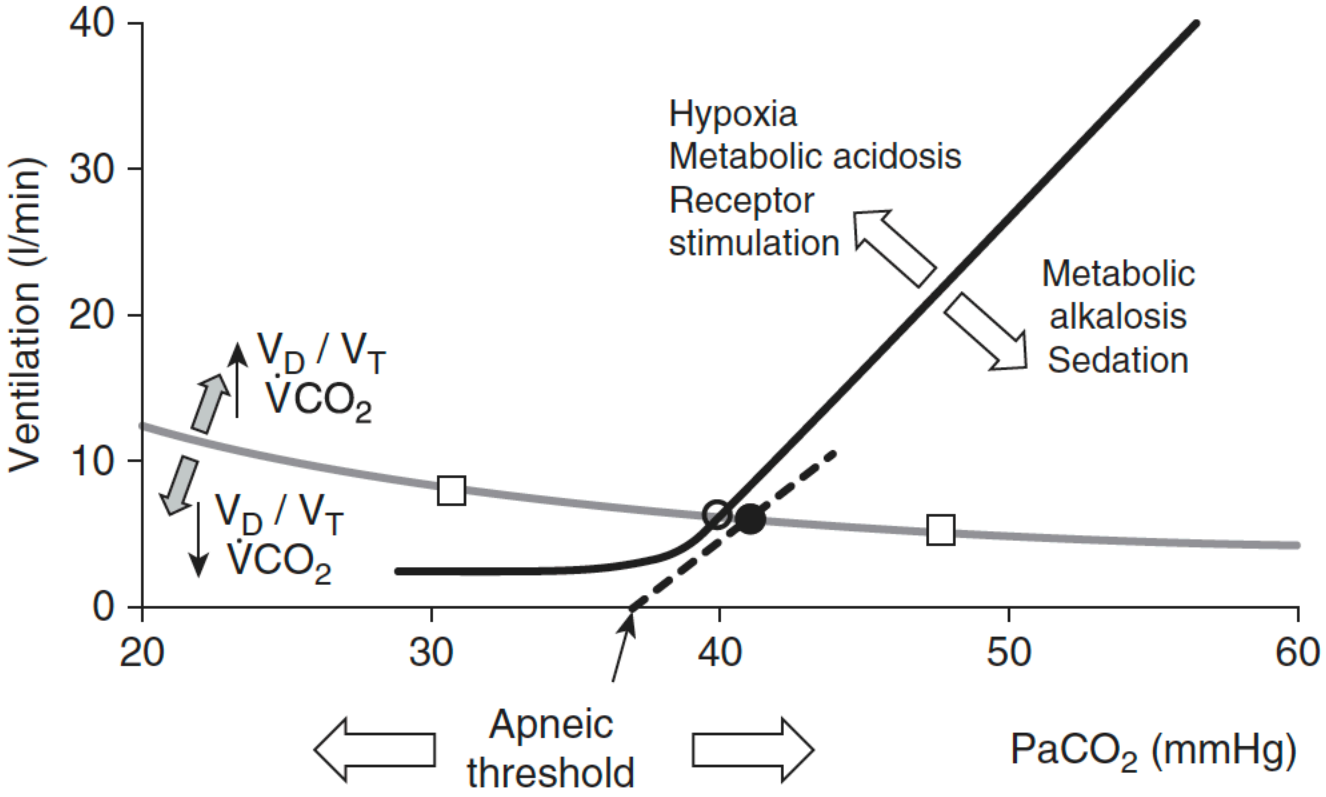

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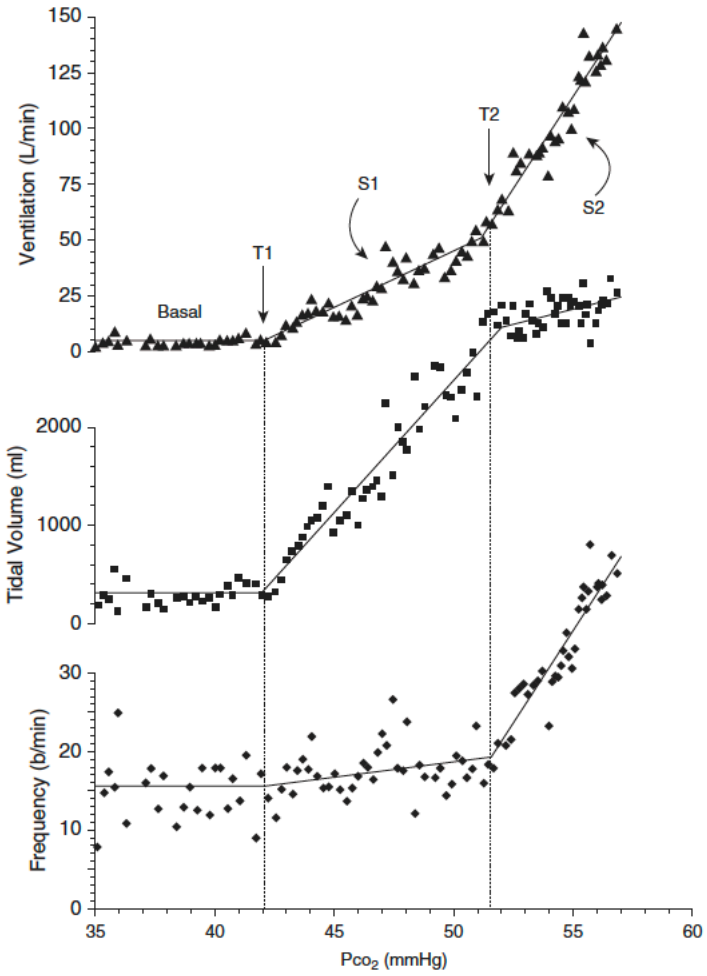
Control of Ventilation: Pattern

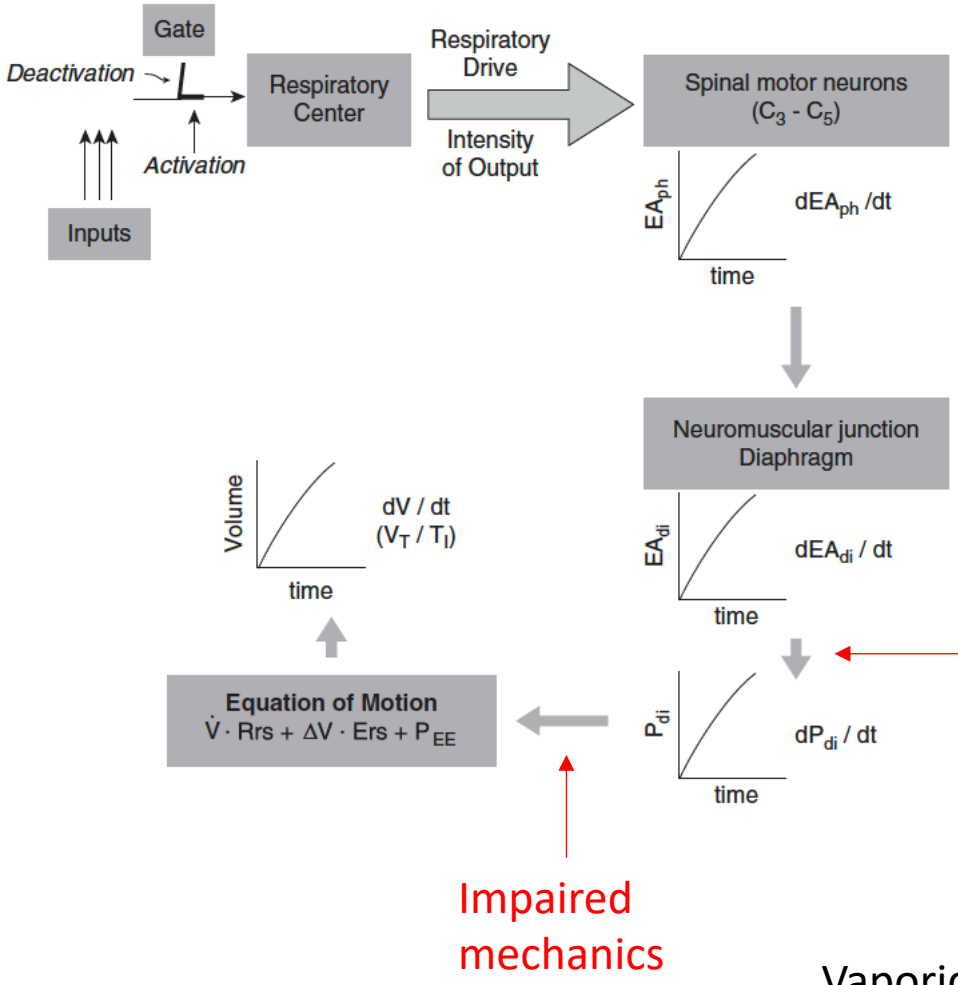
Ve

Vt

RR



Control of Ventilation: Respiratory Failure



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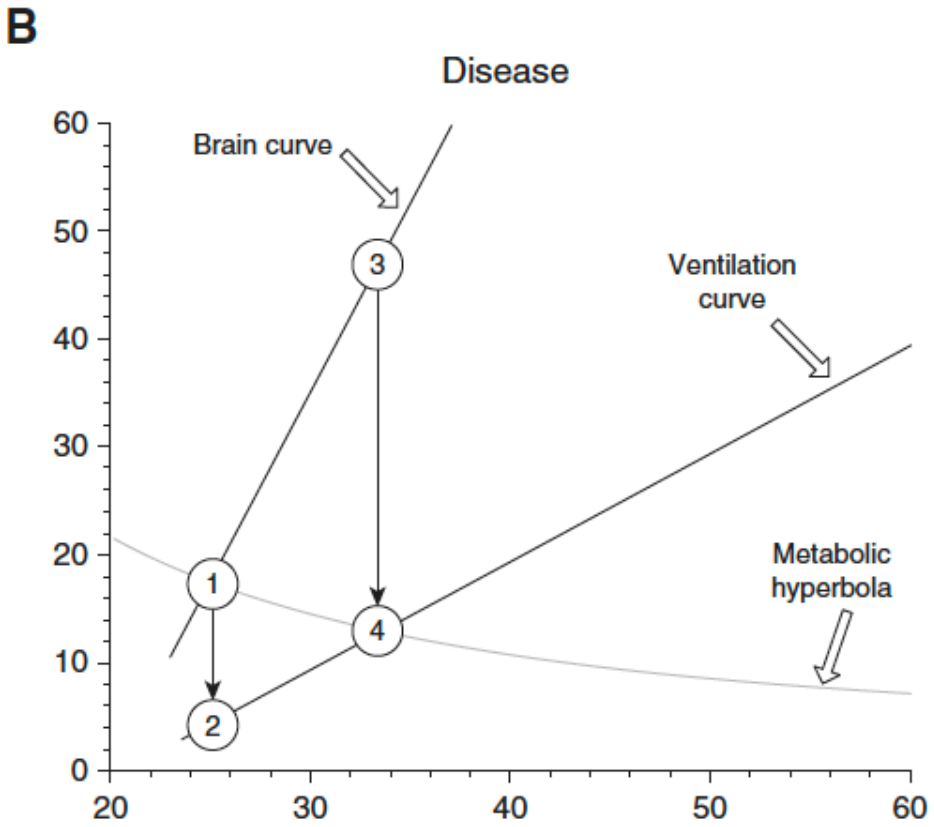
Control of Ventilation in Respiratory Failure



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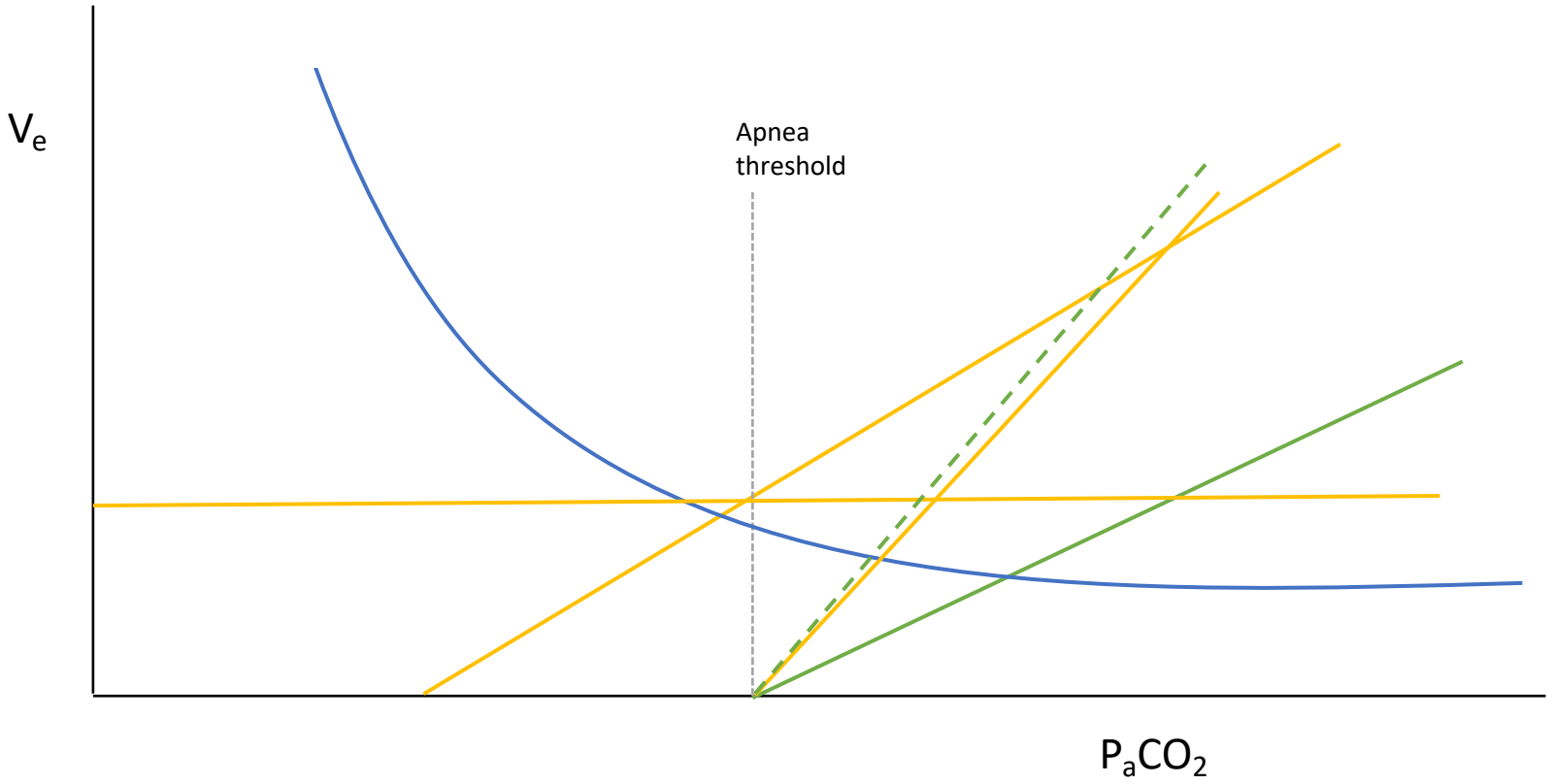
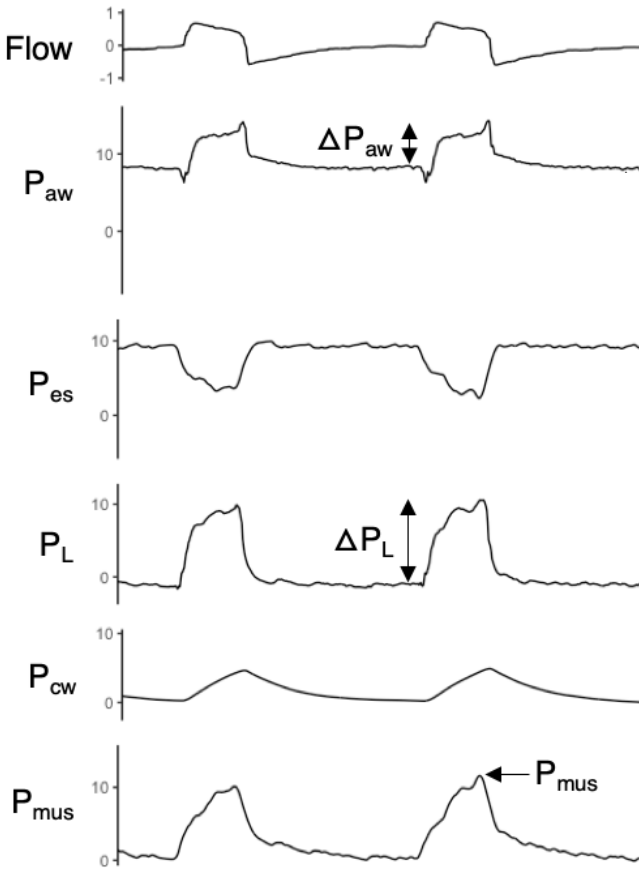
Control of Ventilation: Modes



Respiratory drive and effort



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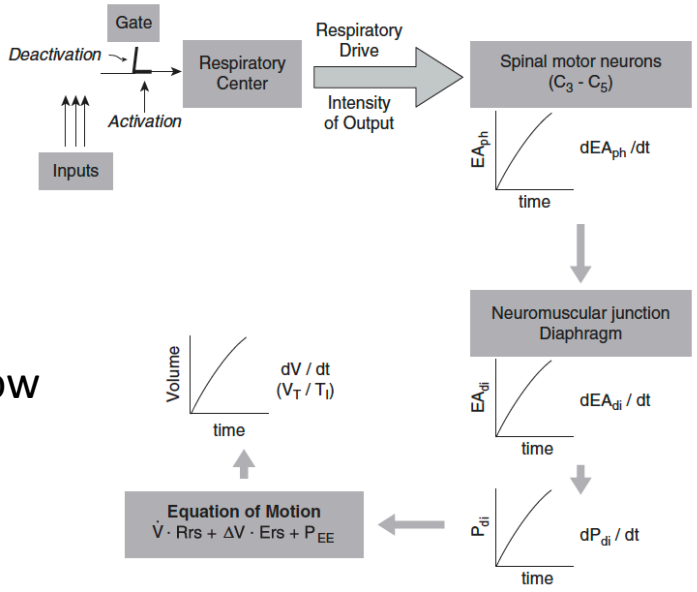
Determinants of Respiratory Muscle Pressure

Determinants of respiratory drive: sleep-wake status, acid-base, sedation, hypoxia, central demands



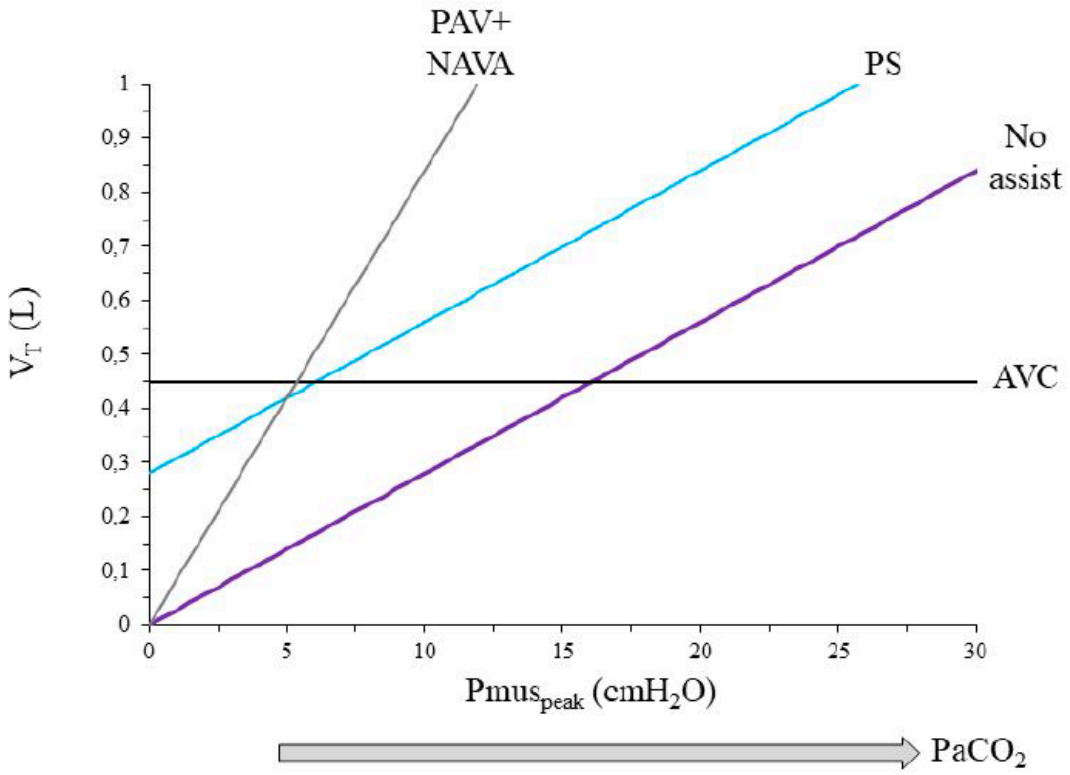
Desired tidal volume
Desired inspiratory flow

Diaphragm function

Ventilator pressure, flow, PEEP

Respiratory mechanics

Patient-Ventilator Interaction



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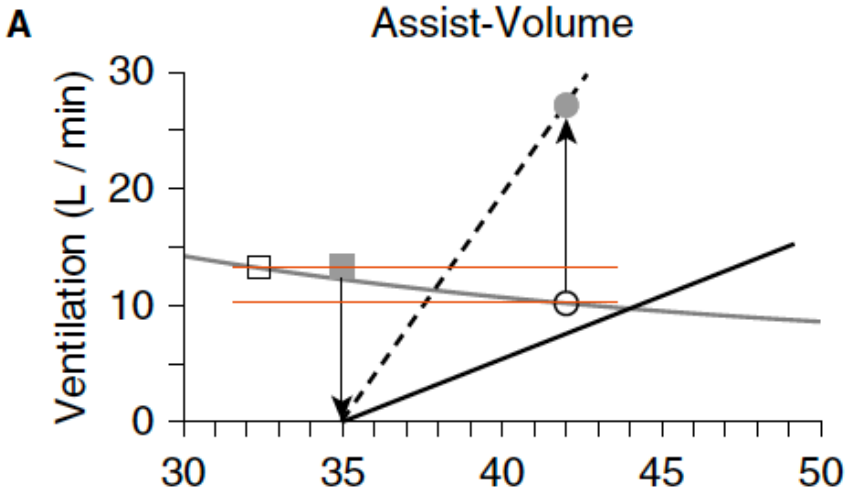
Patient-Ventilator Interaction



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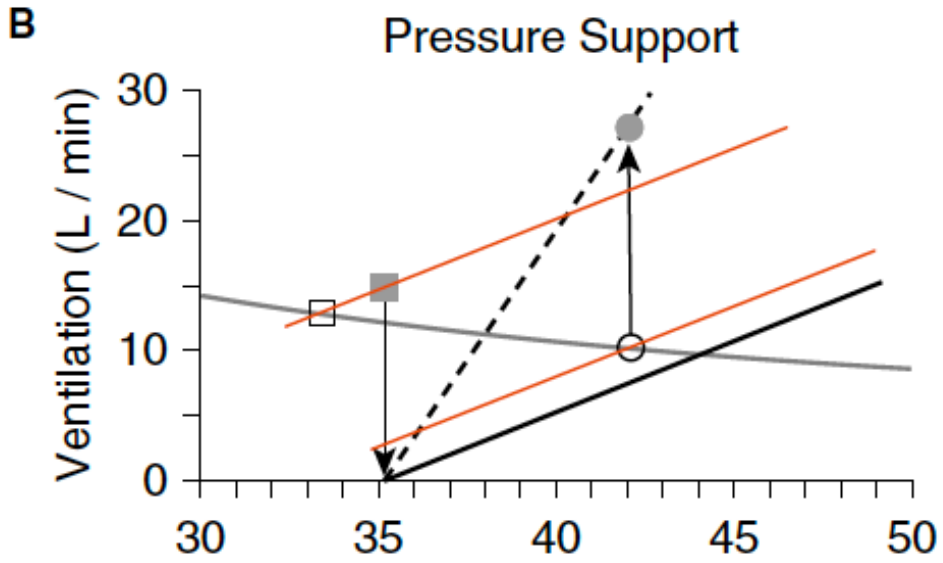

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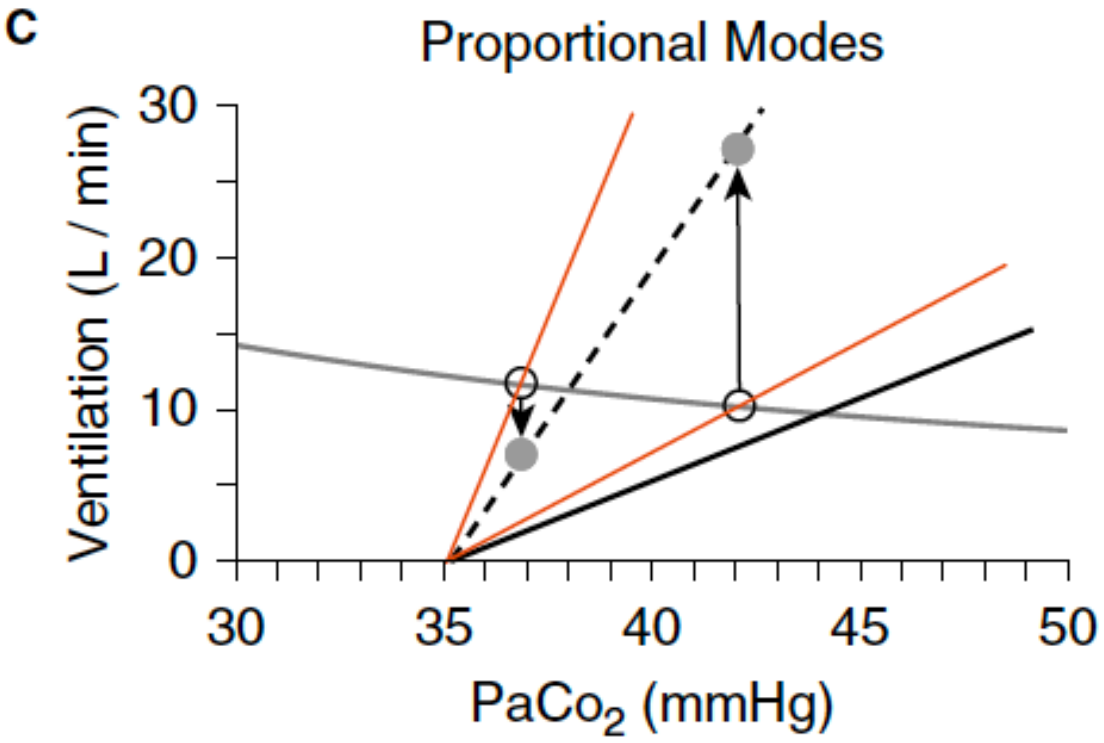

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Summary

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