
# Week 11

# Breathing for Recovery

## Augmenting Health and Human Performance

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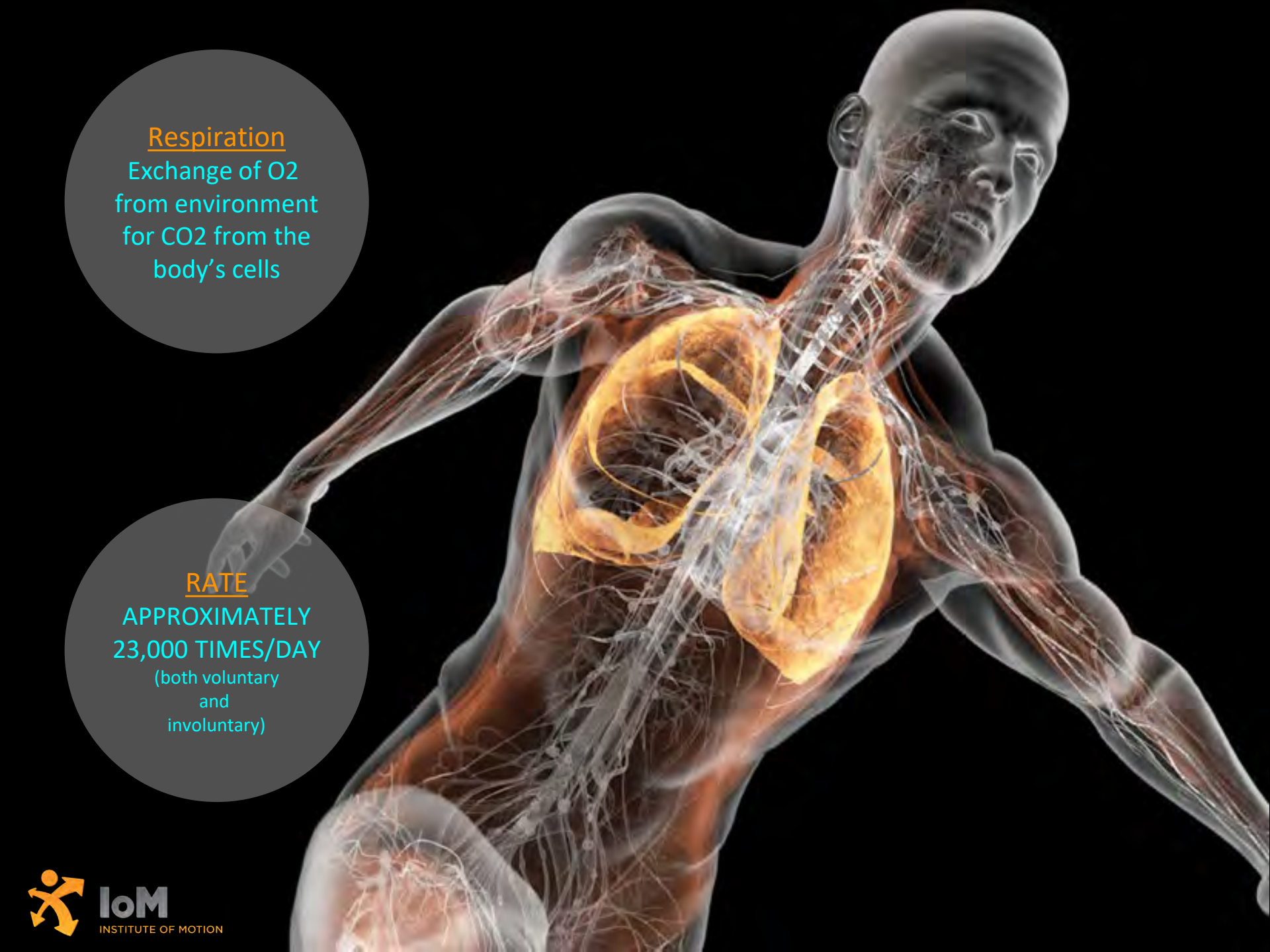

Respiration

Exchange of O2 from environment for CO2 from the body's cells

RATE

APPROXIMATELY 23,000 TIMES/DAY

(both voluntary and involuntary)

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# HEALTH
AND
# HUMAN PERFORMANCE
## Recovery

Must take advantage of:
- Nerve
- Muscle
- Mechanics
- Gas Exchange
- voluntary / involuntary controls

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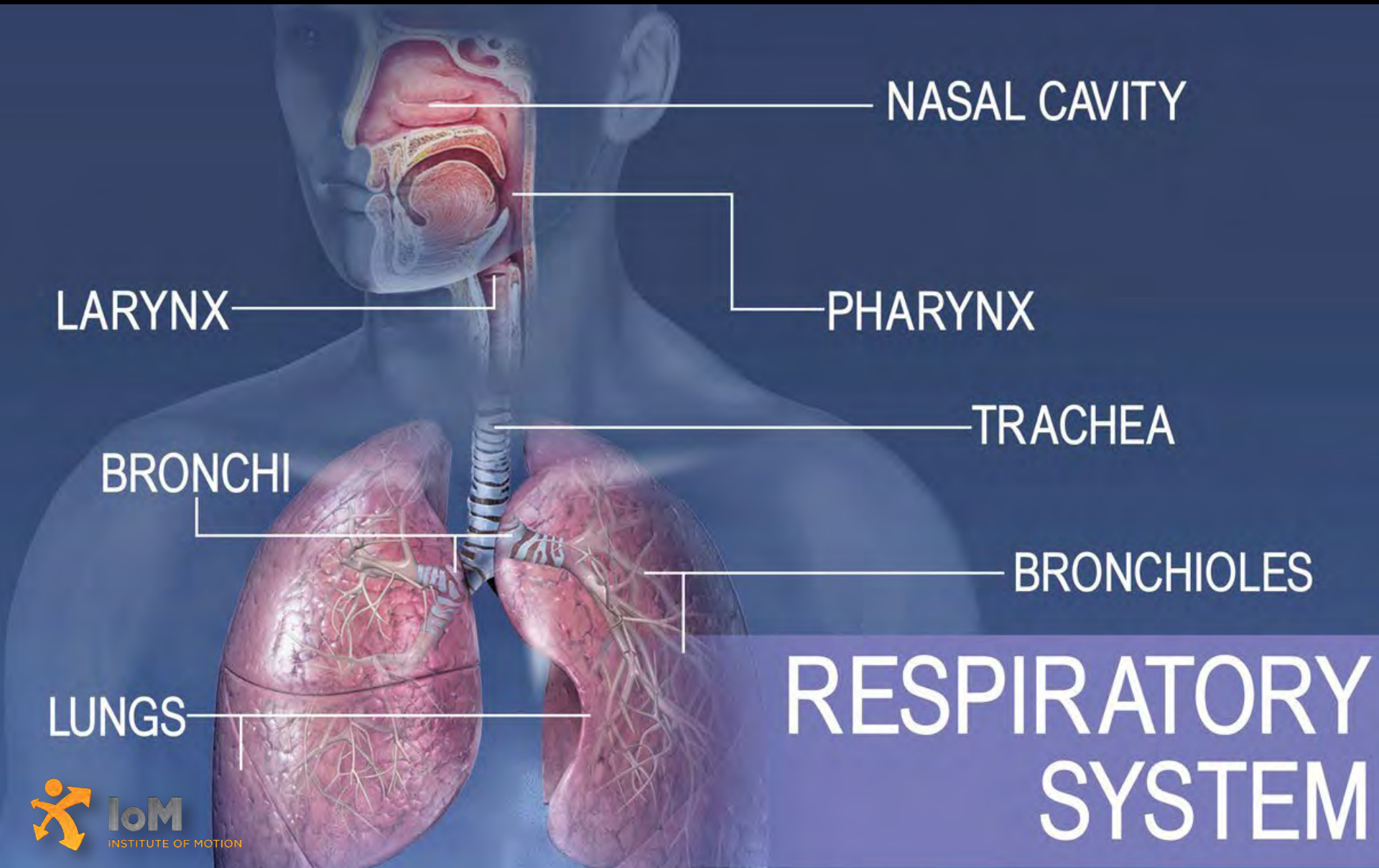
NASAL CAVITY
LARYNX
PHARYNX
TRACHEA
BRONCHI
BRONCHIOLES
LUNGS
RESPIRATORY SYSTEM
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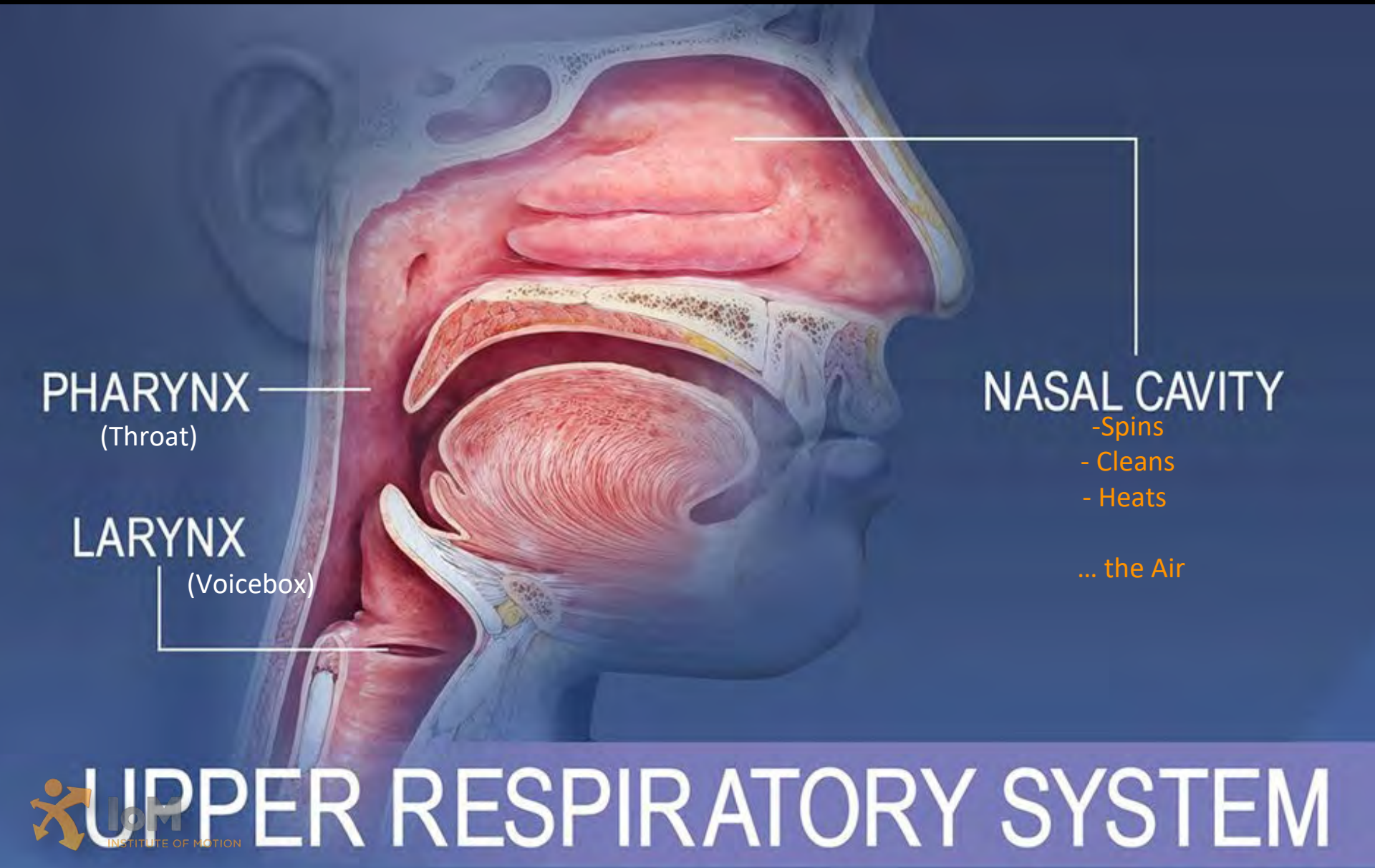
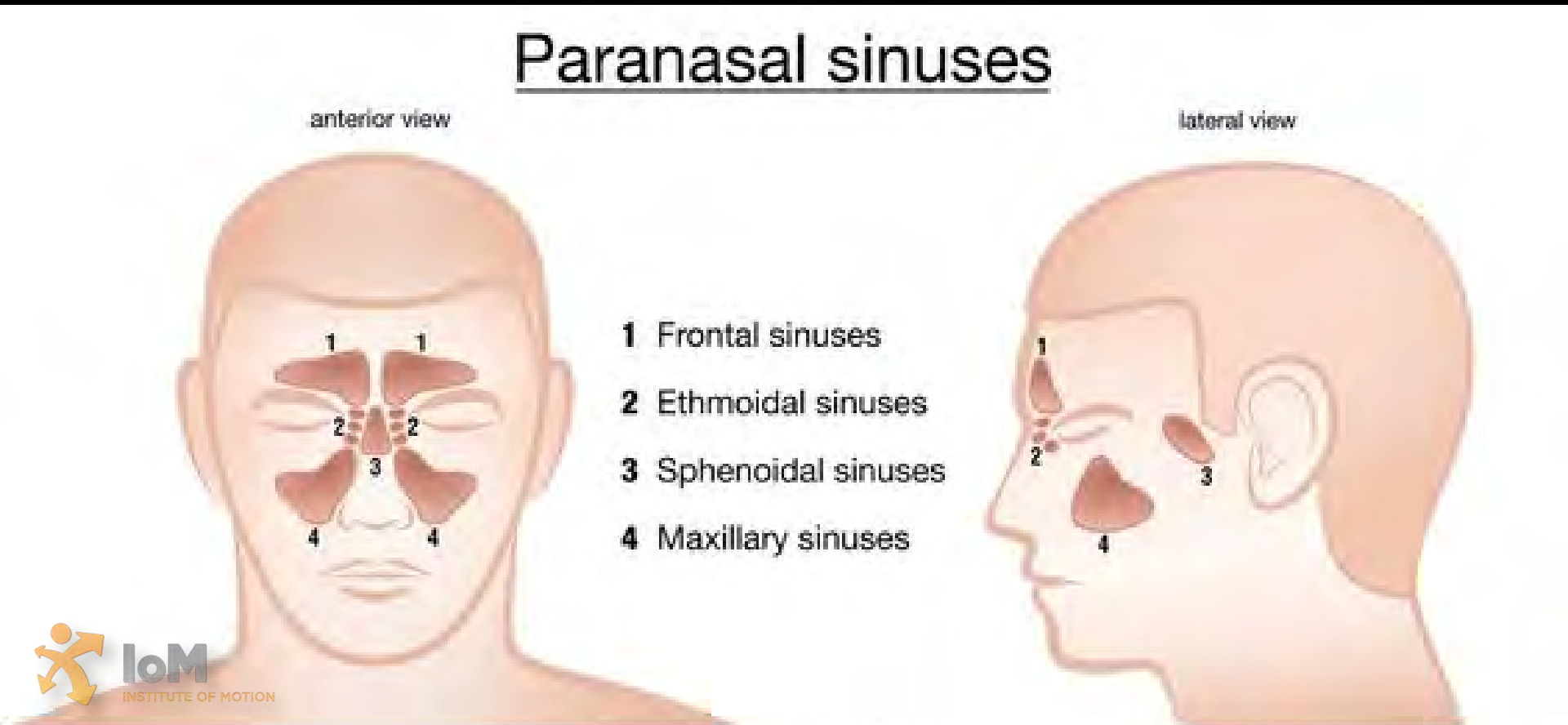
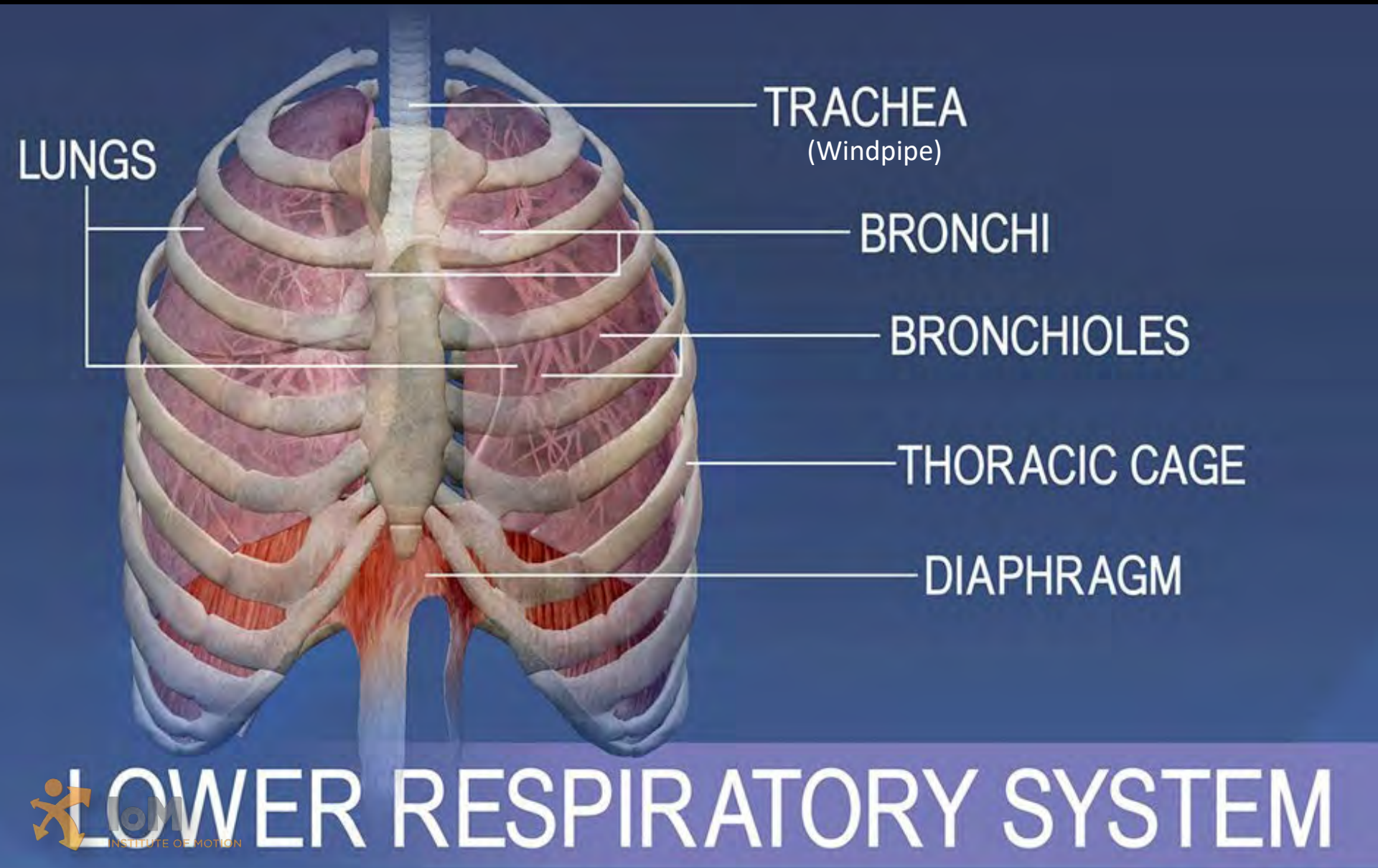
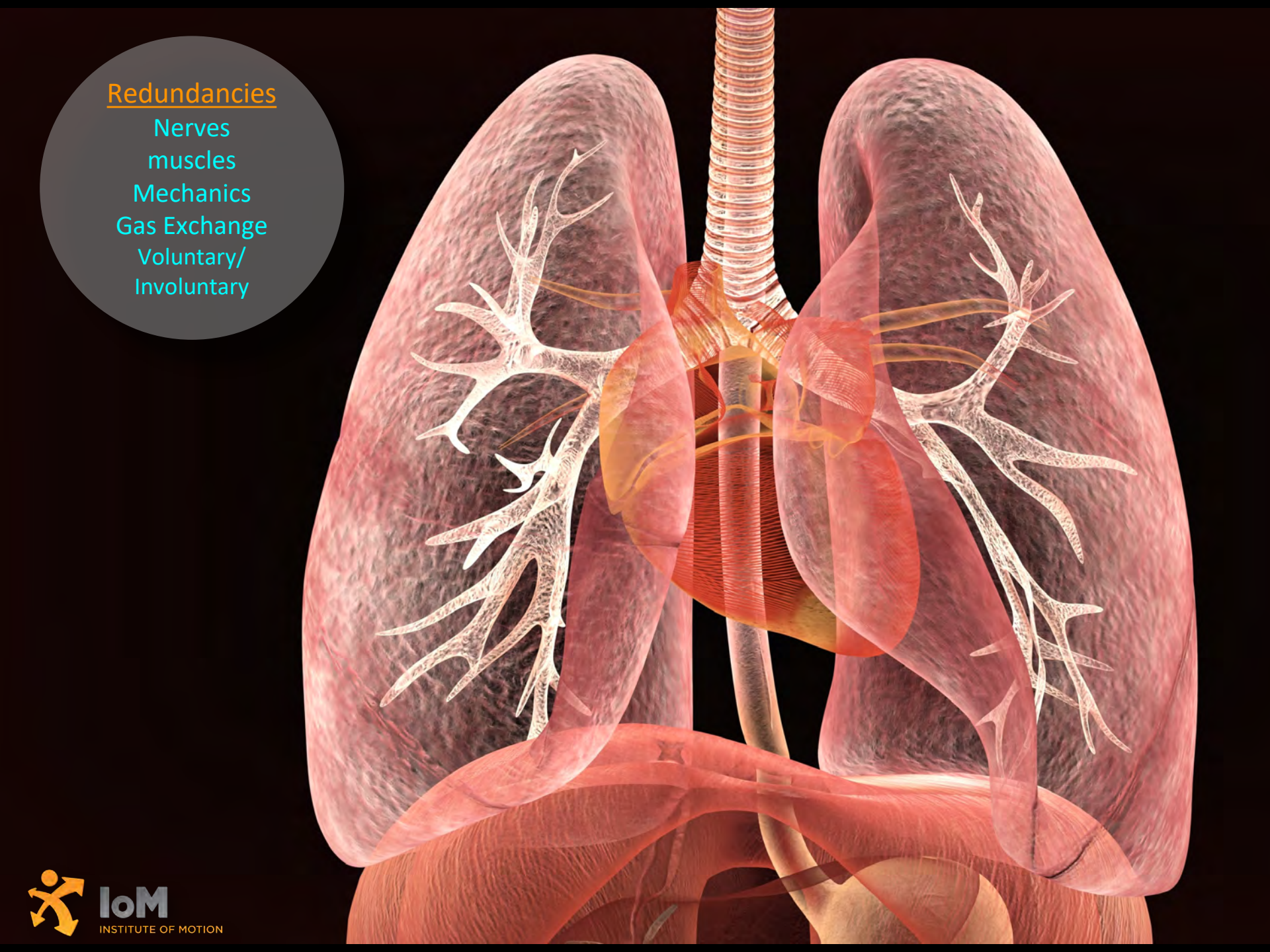

PHARYNX
(Throat)
LARYNX
(Voicebox)
NASAL CAVITY
-Spins
- Cleans
- Heats
... the Air
UPPER RESPIRATORY SYSTEM

# Inhalation of nasally derived nitric oxide modulates pulmonary function in humans

J O Lundberg [1], G Settergren, S Gelinder, J M Lundberg, K Alving, E Weitzberg




LUNGS
TRACHEA
(Windpipe)
BRONCHI
BRONCHIOLES
THORACIC CAGE
DIAPHRAGM
LOWER RESPIRATORY SYSTEM


Redundancies
Nerves
muscles
Mechanics
Gas Exchange
Voluntary/
Involuntary
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Redundancies

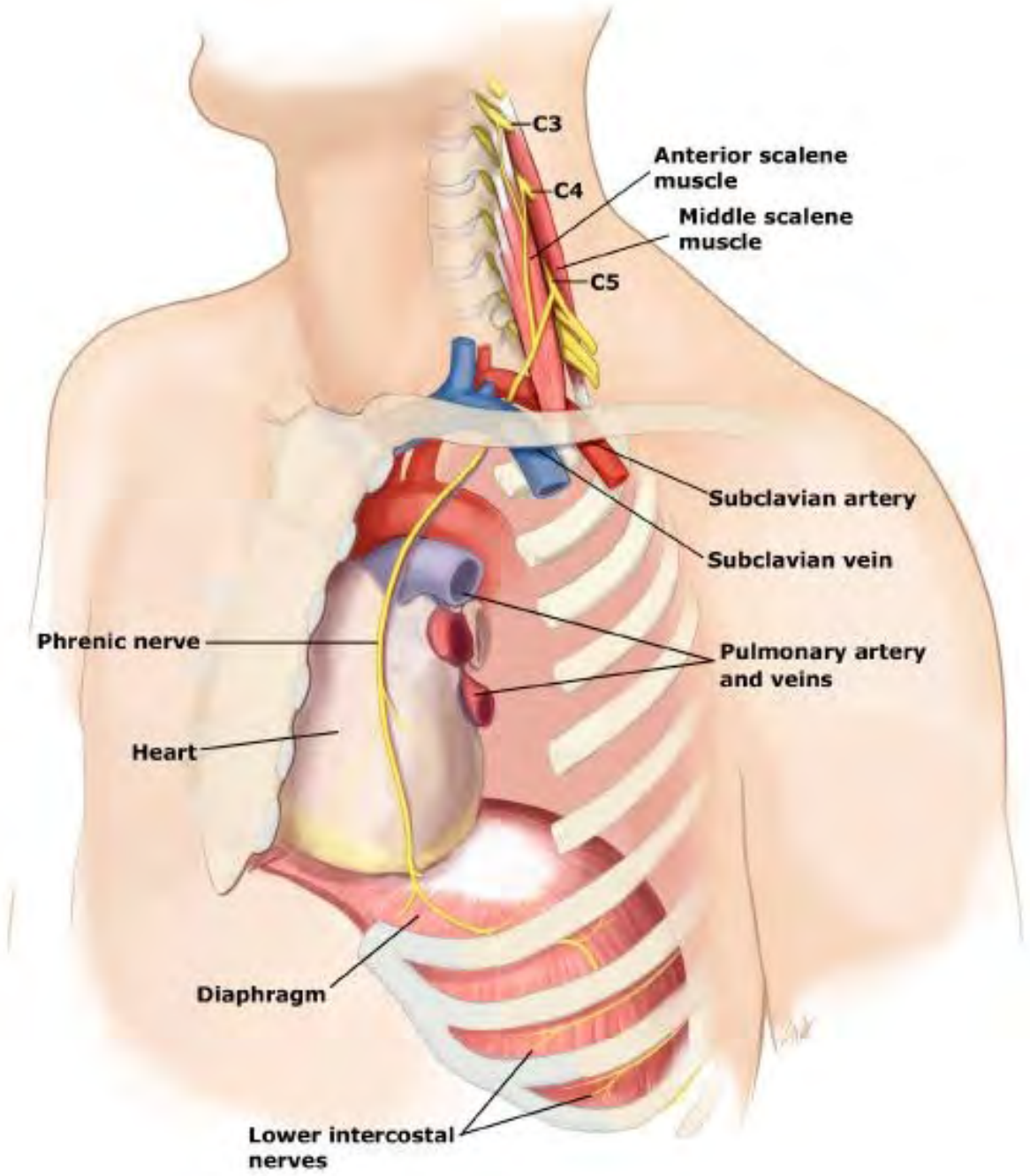
Nerves

muscles

Mechanics

Gas Exchange

Voluntary/ Involuntary

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Redundancies

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muscles

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Voluntary/ Involuntary

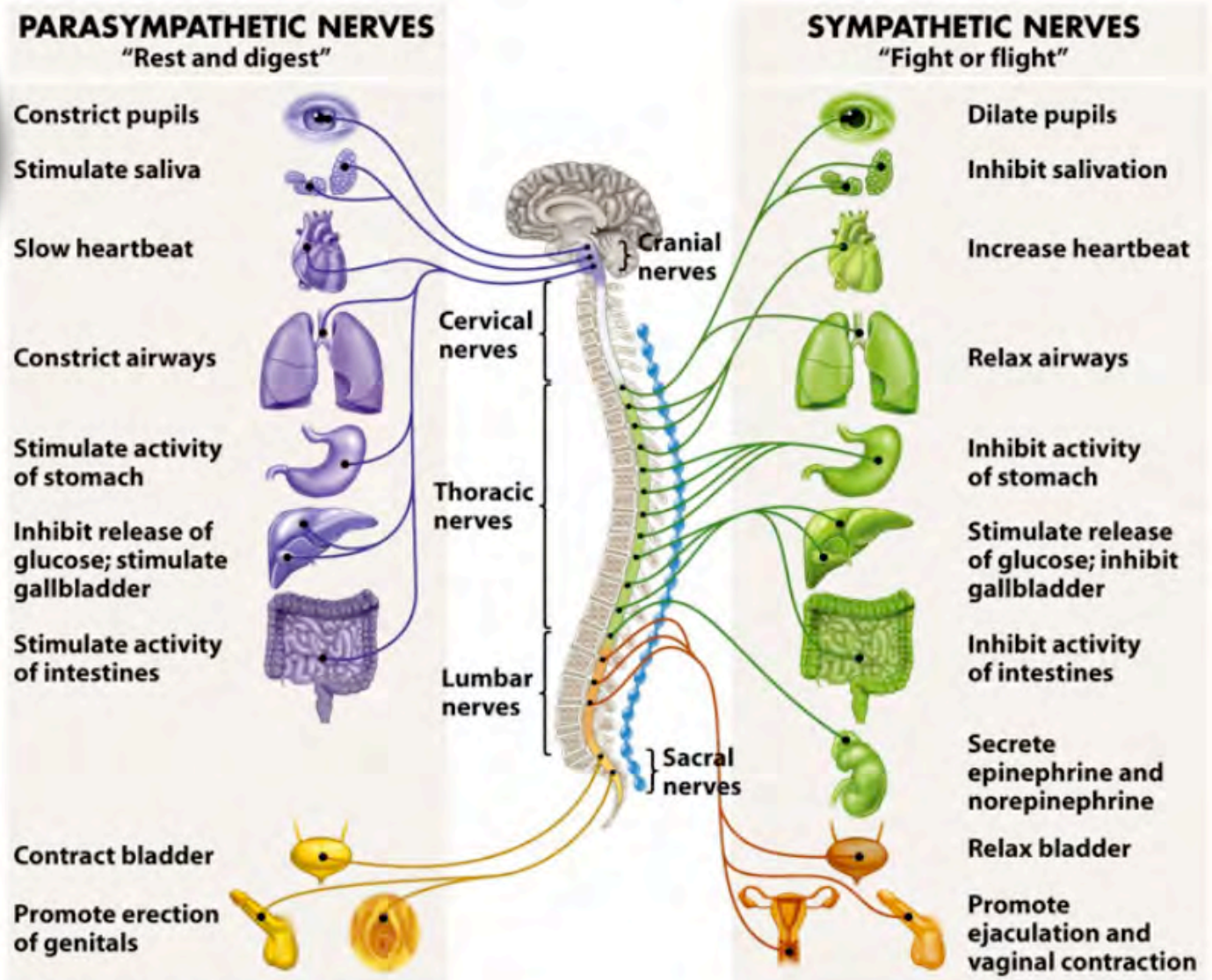


Figure 45-20 Biological Science, 2/e



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Redundancies
Nerves
muscles
Mechanics
Gas Exchange
Voluntary/
Involuntary

# INSPIRATION

## *Muscles*

1 - Respiratory Diaphragm

2 - Pectoralis Minor
3 - Pectoralis Major
4 - Serratus Anterior

Muscles which lift the ribs from the scapular girdle

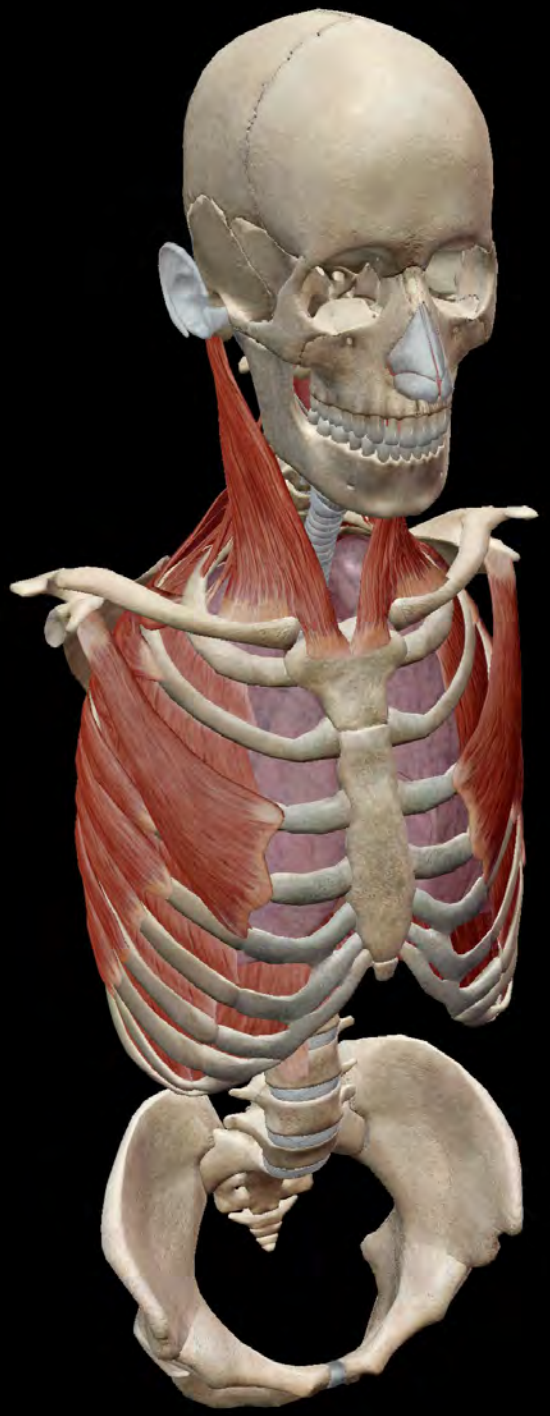
5 - Levatores Costarum
6 - Transversopinalis

Muscles which lift the ribs away from the thoracic spine

7 - Serratus Posterior Superior

8 - Sternocleidomastoid
9 - Scalenes

Muscles which lift the ribs from the head or neck



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Redundancies
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# EXPIRATION

## *Muscles*

1 - Abdominal Muscles

2 - Pelvic Diaphragm (floor)

3 - Transversus Thoracis
(at the inside of the rib cage)

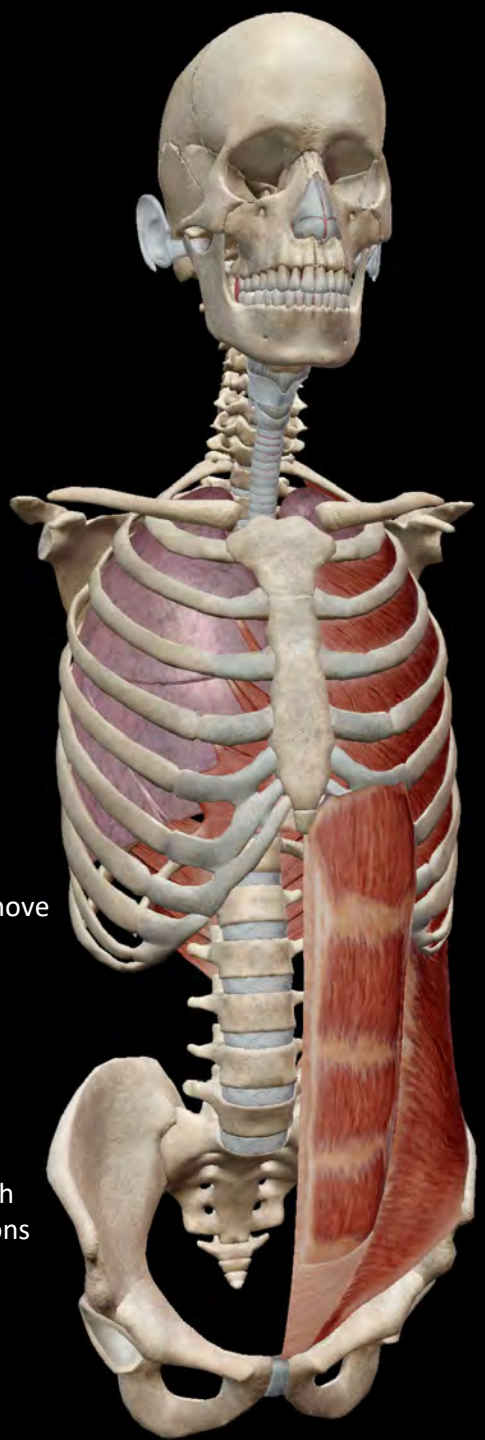
4 - Quadratus Lumborum

5 - Serratus Posterior Inferior

Muscles that move the ribs

6 - Intercostals
(Internal / External)

Muscles with variable actions



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Redundancies

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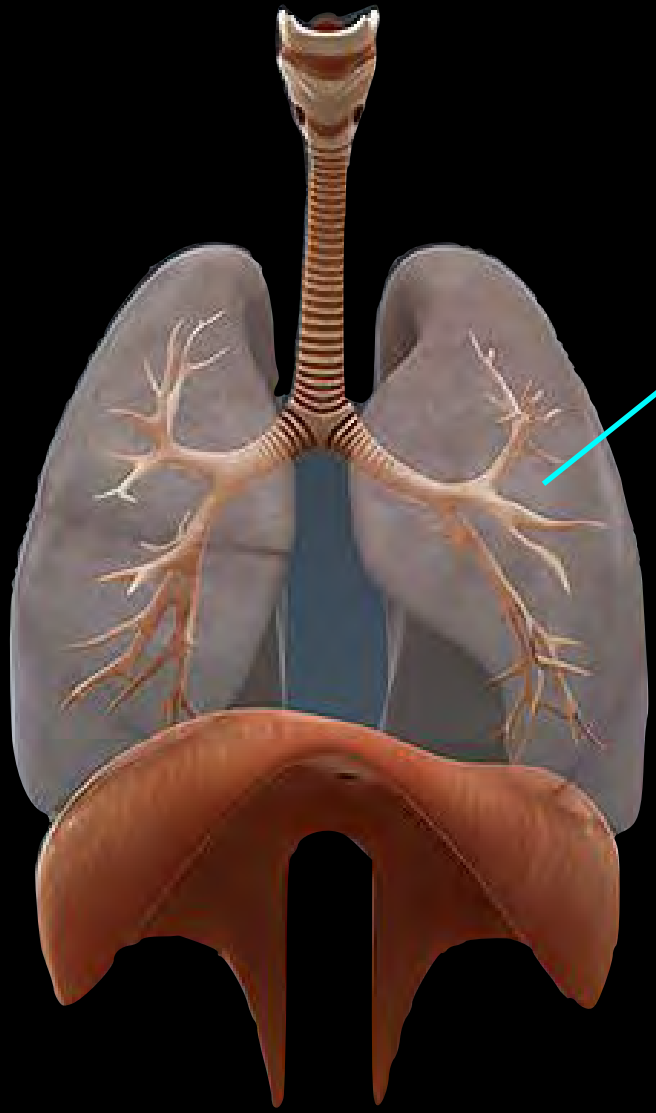

Spine

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Redundancies

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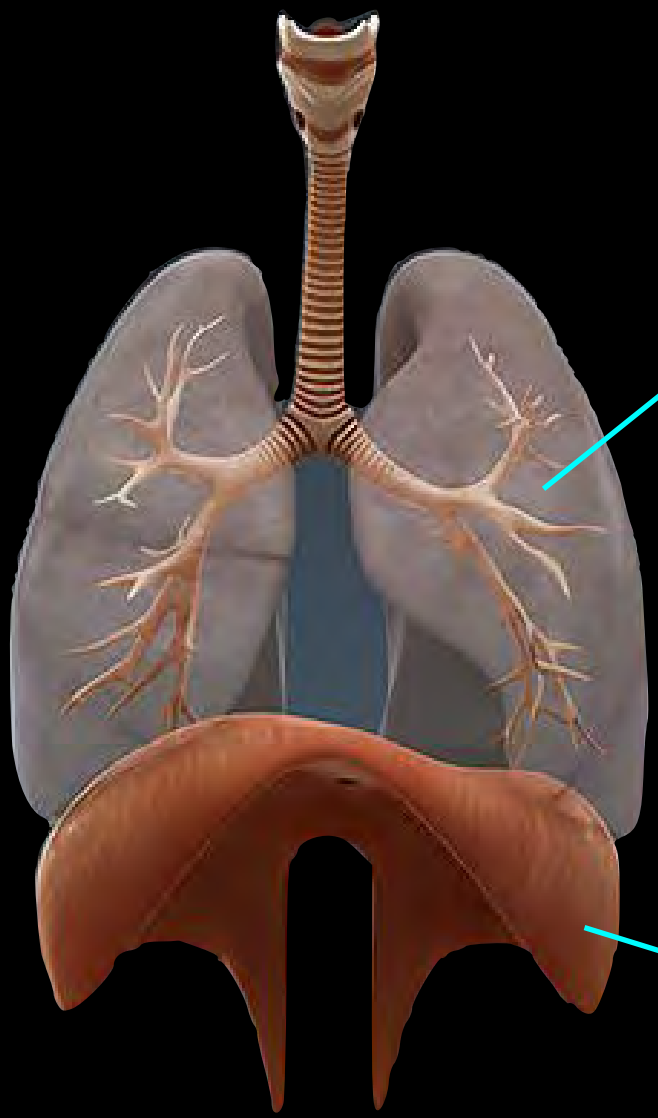
muscles

Mechanics

Gas Exchange

Voluntary/
Involuntary



Spine

Parietal Peritoneum

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Redundancies

Nerves

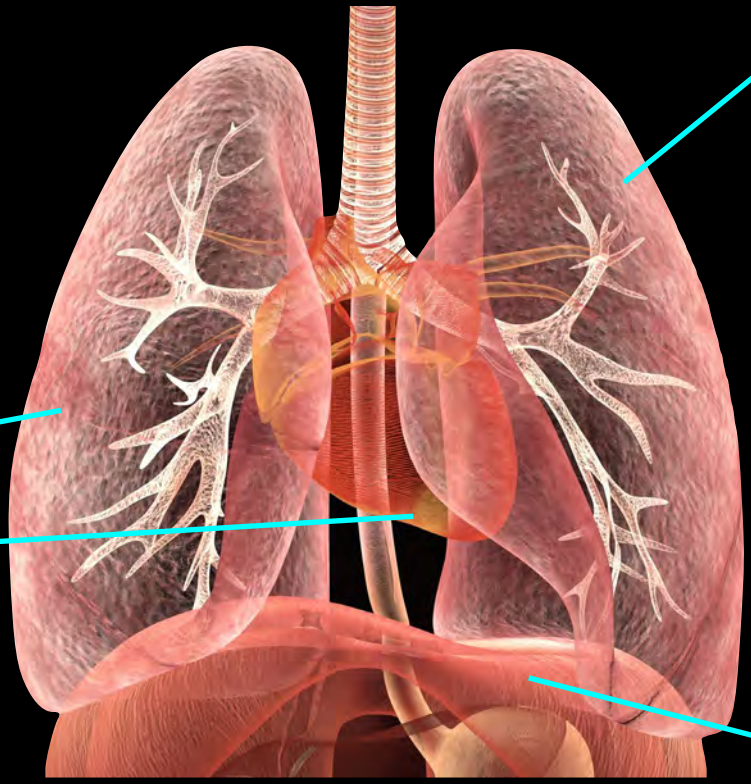
muscles

Mechanics

Gas Exchange

Voluntary/
Involuntary

Spine



Parietal Peritoneum

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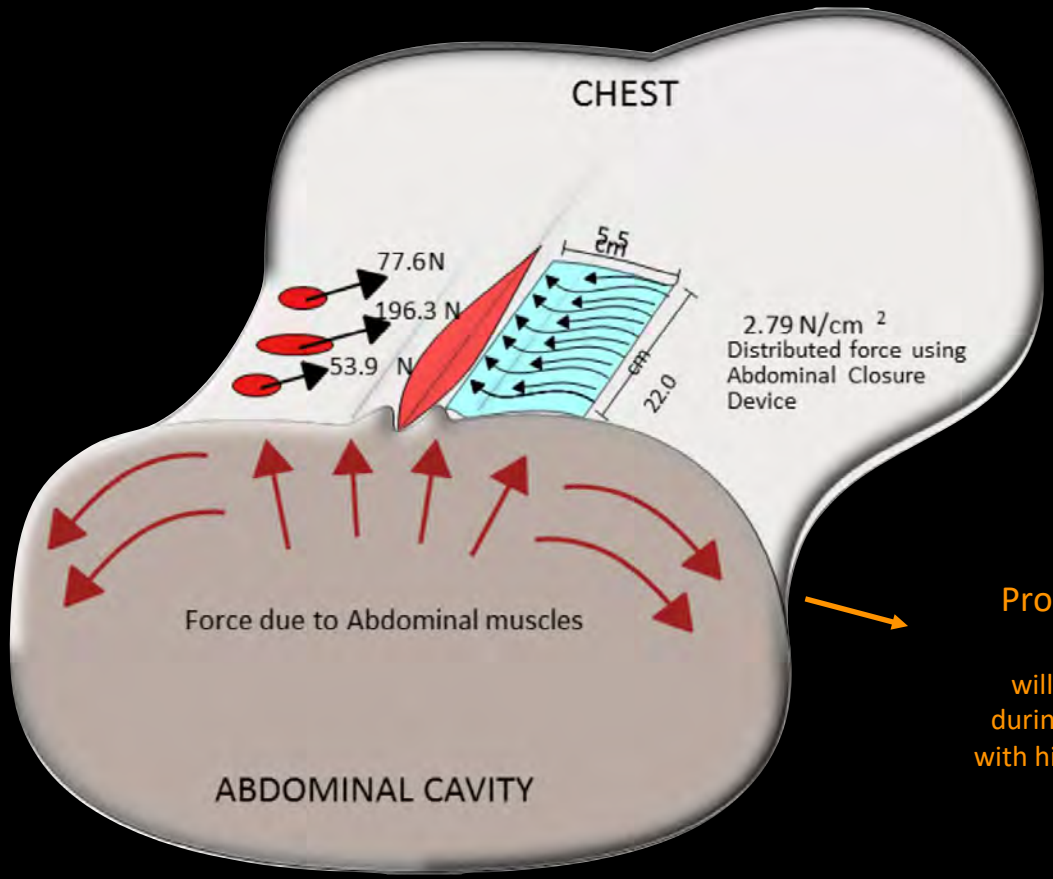


Proximal Stability

will help hamstrings during high contraction with high ventilation rates e.g. Crossfit)

Abdominal 'Hoop Tension'
(accented during exhalation)
/ diaphragmatic sparing)

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[HGb]

[MGb]

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[HGb]

[MGb]

CO2 clearance

(Metabolite formation)

OBLA

(Acidosis [H+])

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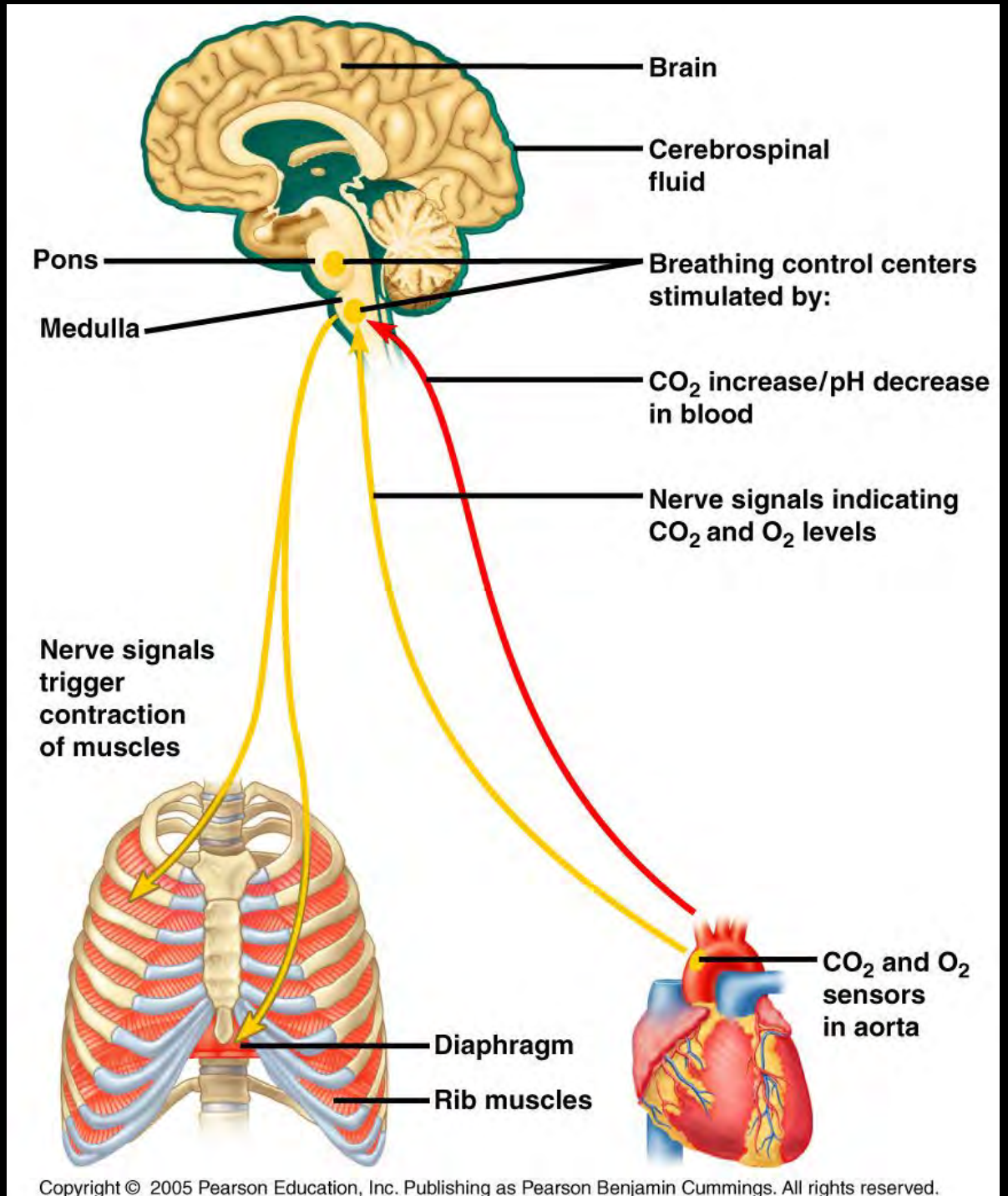




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# Respiratory Muscle Training (RMT)

BreathWork

## Theory

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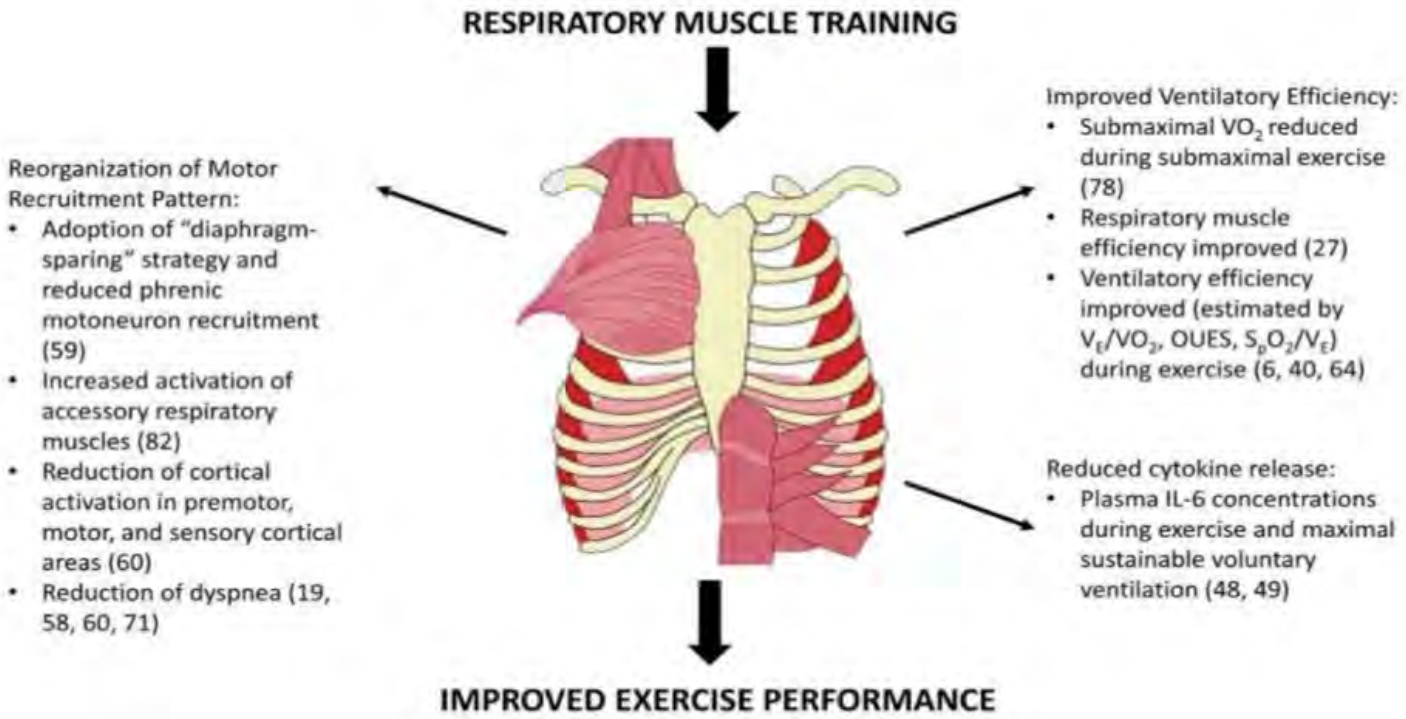


**Figure 2.**
Illustration of new insights from recent investigations into physiological adaptations induced by IMT that may enhance exercise performance.

*Adopted from: Recent advancements in our understanding of the ergogenic effect of respiratory muscle training in healthy humans: a systematic review*

# RESPIRATORY M

Reorganization of Motor Recruitment Pattern:

- Adoption of "diaphragm-sparing" strategy and reduced phrenic motoneuron recruitment (59)
- Increased activation of accessory respiratory muscles (82)
- Reduction of cortical activation in premotor, motor, and sensory cortical areas (60)
- Reduction of dyspnea (19, 58, 60, 71)

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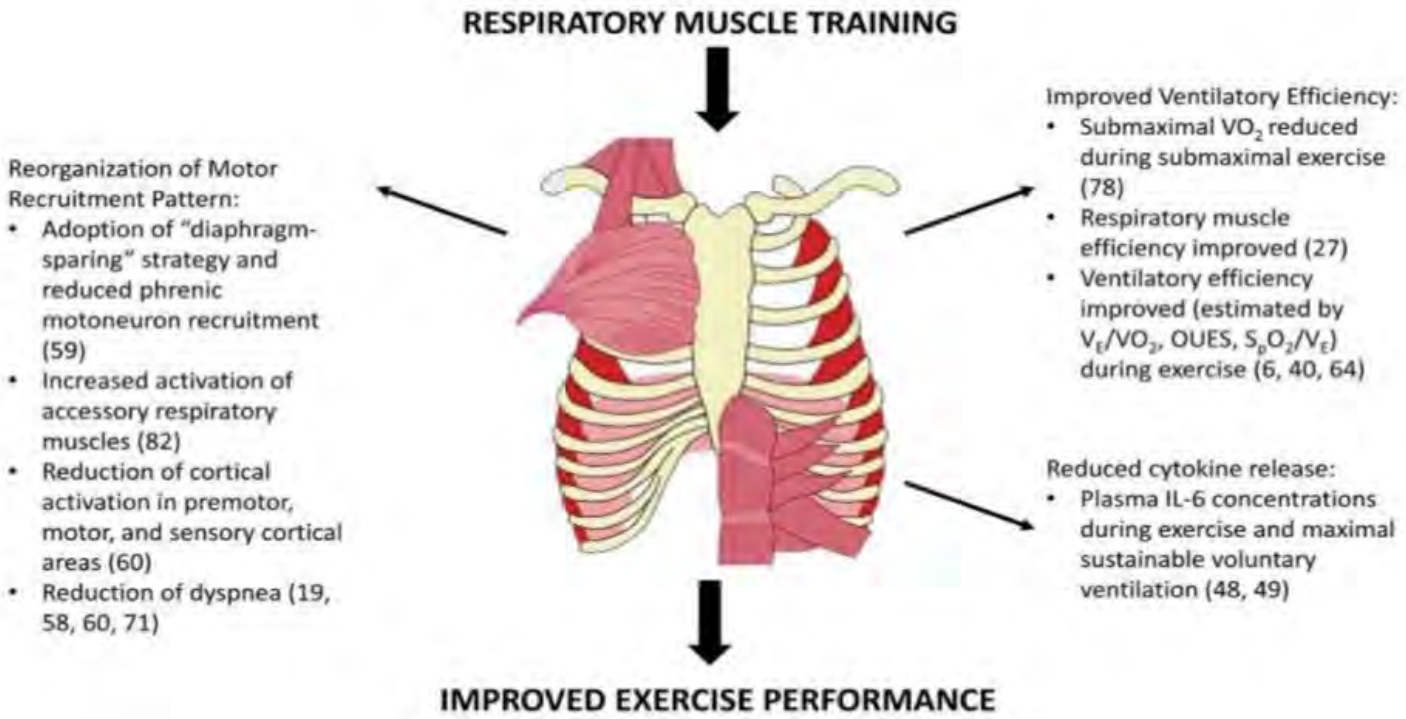


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Improved Ventilatory Efficiency:

- Submaximal $VO_2$ reduced during submaximal exercise (78)
- Respiratory muscle efficiency improved (27)
- Ventilatory efficiency improved (estimated by $V_E/VO_2$, OUES, $S_pO_2/V_E$) during exercise (6, 40, 64)

Reduced cytokine release:

- Plasma IL-6 concentrations during exercise and maximal sustainable voluntary ventilation (48, 49)

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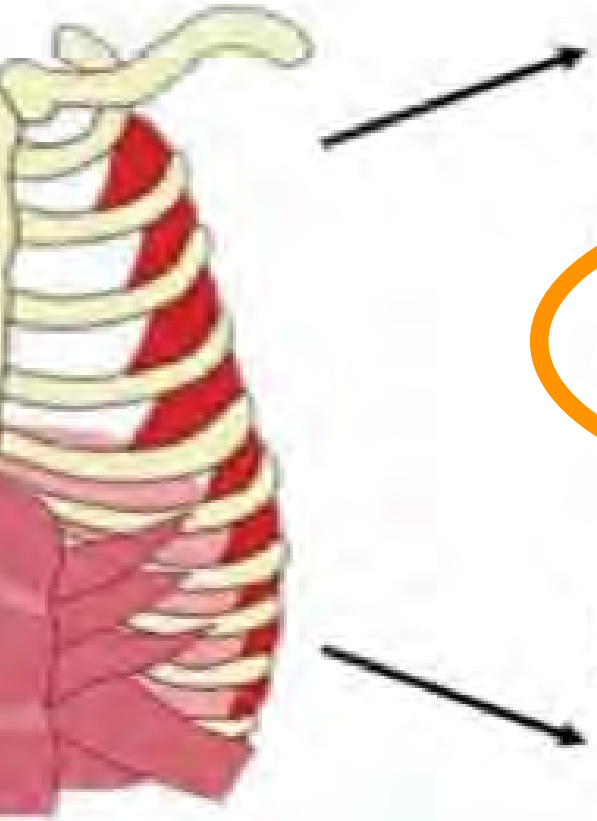

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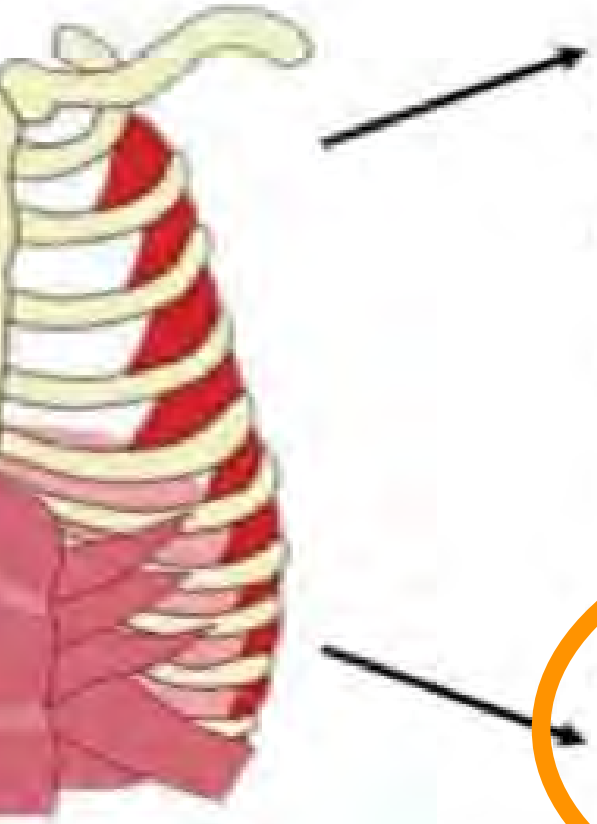

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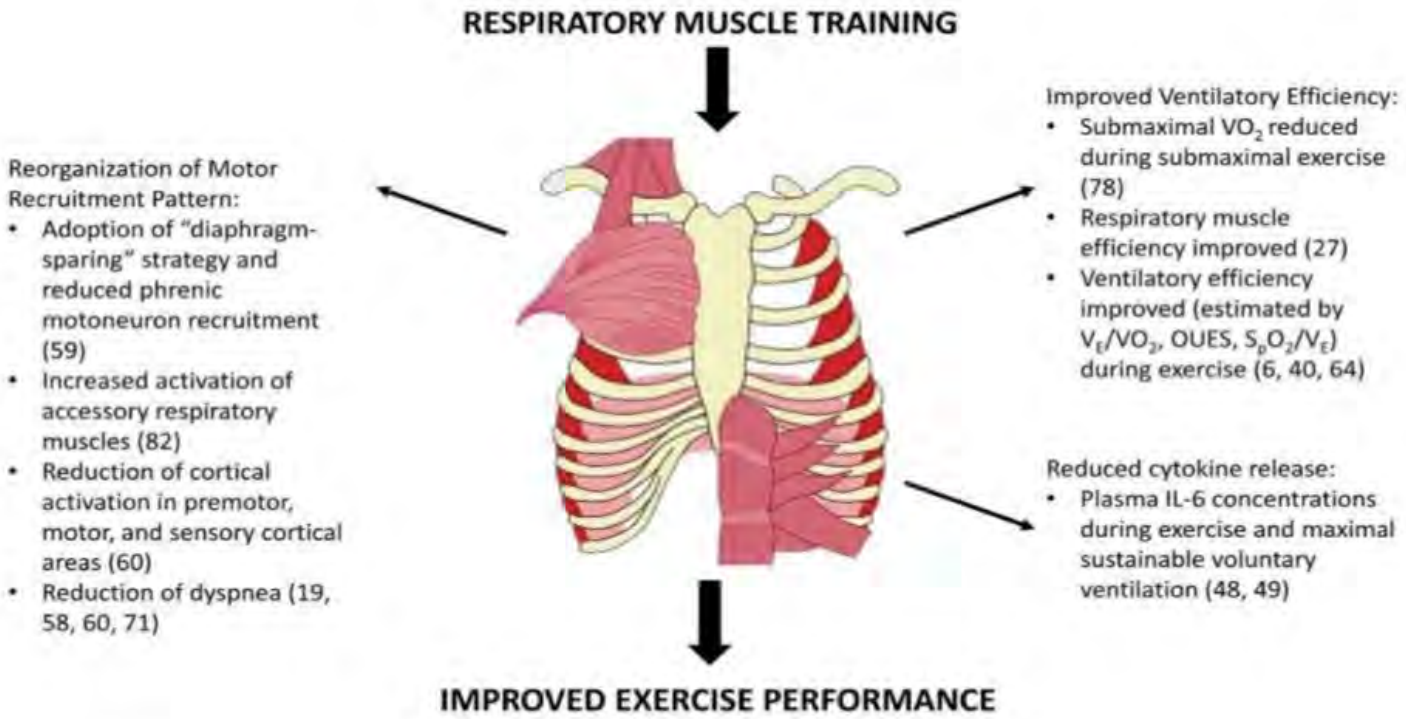


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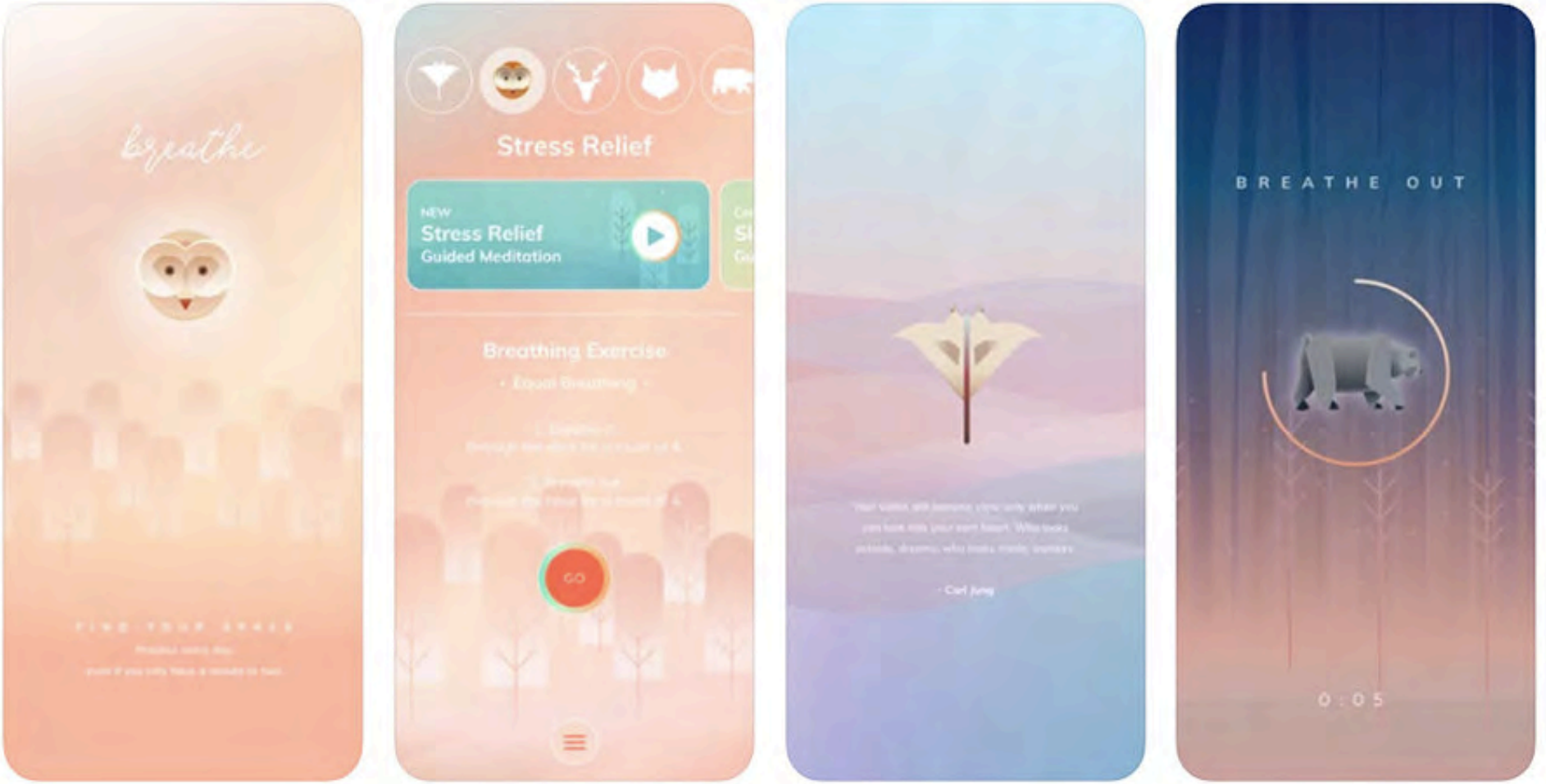


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# Breathing for Recovery

## Augmenting Health and Human Performance

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# The Science and Application of BreathWork

## Augmenting Health and Human Performance

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# The Science and Application of BreathWork

## Augmenting Health and Human Performance

What has become notably popular as of late, is information and techniques around breathing. Some focus on the performance outcomes, others on the wellness/meditative benefits, others still on the biohacks associated with breathing techniques.

In our webinar, “The Science and Application of BreathWork”, we will clarify the science around breathing’s impact on:

- Nervous System. (regulation of sympathetic/parasympathetic tone)
- Biomechanics/Preparedness. (The role of proximal stability and how this can increase mobility)
- “Diaphragmatic Sparing”. (and it corresponding influence on 1- abdominal hoop tension (and decreasing the risk of hamstring strain) 2- Cytokine regulation)

Additionally, we will showcase and explain BreathWork applications, for Health and Human Performance, including:

- Forced Breathing Techniques
- Percussive Breathing Techniques
- Weighted BreathWork
- 4Q BreathWork
- Pre-Position BreathWork
- Cadence BreathWork

Lastly, we will discuss where all of this science and Application can fit into a program.

Don’t miss this chance to learn more about the profound impacts of BreathWork

# Respiratory Muscle Training

RMT

The physiological effects of RMT that may explain the improvements in performance have been proposed to include diaphragm hypertrophy, muscle fiber type switching, improved neural control of the respiratory muscles, increased respiratory muscle economy, attenuation of the respiratory muscle metaboreflex, and decreases in perceived breathlessness and exertion

Importantly, changes in ventilatory efficiency, oxygen delivery, cytokine release, motor recruitment patterns, and respiratory muscle fatigue resistance are highlighted as potential mechanistic factors linking RMT with performance improvements.

The majority of studies have found that training the respiratory muscles appears to be an effective ergogenic aid for exercise performance. Nevertheless, there has been some controversy regarding the efficacy of training the respiratory muscles to improve exercise tolerance

Ren-Jay Shei



## Redundancies

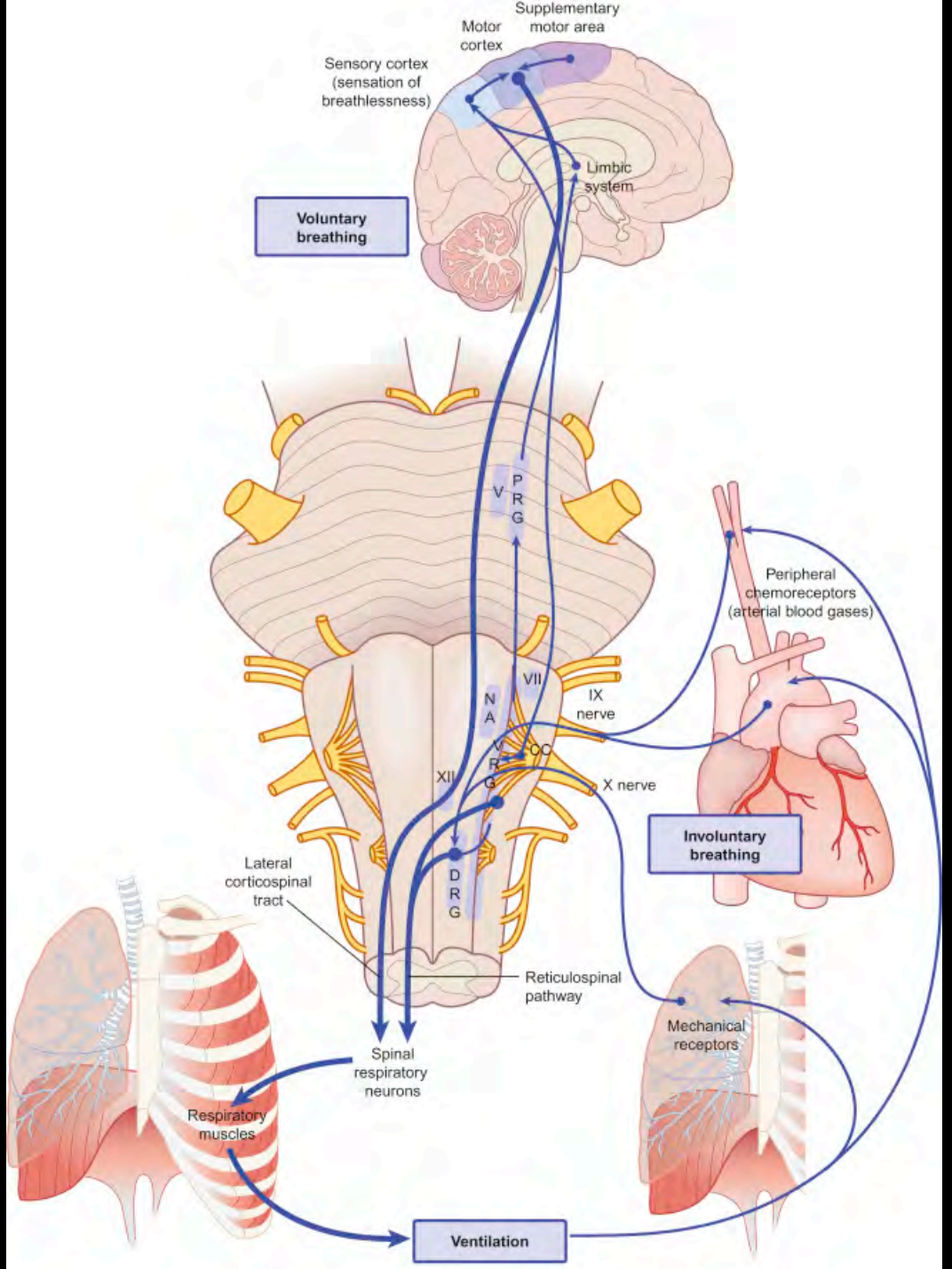
Nerves

muscles

Mechanics

Gas Exchange

Voluntary/
Involuntary

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https://pubmed.ncbi.nlm.nih.gov/22836606/

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6105530/

https://www.zora.uzh.ch/id/eprint/76634/1/Illi_SportsMed_2012_Manuscript_ZORA.pdf

https://journals.lww.com/nsca-jscr/Fulltext/2013/06000/Effects_of_Respiratory_Muscle_Training_on.25.aspx

https://www.youtube.com/watch?v=u4W3s2USw9w

https://www.youtube.com/watch?v=3oYFCQvC-0Q&t=39s

https://en.wikipedia.org/wiki/Phrenic_nerve

https://en.wikipedia.org/wiki/Vagus_nerve

http://www.vivo.colostate.edu/hbooks/pathphys/digestion/basics/peritoneum.html

https://en.wikipedia.org/wiki/Thoracic_diaphragm

https://en.wikipedia.org/wiki/Interleukin

https://en.wikipedia.org/wiki/Interleukin_6

https://en.wikipedia.org/wiki/Cytokine