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Introduction

e human respiratory system is a marvel of biological engineering, nely tuned to ensure the exchange of gases vital for cellular function while maintaining physiological balance. Understanding the intricate workings of respiratory physiology is crucial for comprehending not only the mechanisms of breathing but also the pathophysiology of respiratory disorders and the e ects of external factors on respiratory function. e respiratory system is a marvel of biological engineering, orchestrating the exchange of oxygen and carbon dioxide between the body and the environment, supporting the metabolic demands of cells while maintaining internal homeostasis [1]. From the moment of birth to the nal breath, this system operates tirelessly, adapting to varying environmental conditions and physiological demands to ensure the survival of the organism. At its core, respiratory physiology encompasses the intricate interplay between anatomical structures, mechanical processes, and regulatory mechanisms that collectively enable e cient gas exchange.

Anatomy forms the foundation of respiratory physiology, delineating the structures responsible for air intake, distribution, and exchange within the body. e respiratory tract, consisting of the upper and lower airways, guides air from the external environment into the lungs, where gas exchange occurs at the alveolar-capillary interface. Understanding the anatomical organization of the respiratory system is crucial for elucidating how air ow is regulated, how gas exchange is facilitated, and how respiratory disorders manifest. Mechanical aspects of respiratory physiology govern the movement of air into and out of the lungs, a process known as pulmonary ventilation. is intricate dance involves the expansion and contraction of the thoracic cavity, driven by the coordinated actions of respiratory muscles, chie y the diaphragm and intercostal muscles. e principles of air ow dynamics, such as airway resistance and compliance, dictate the e ciency of ventilation and play a pivotal role in respiratory pathophysiology [2]. However, the mere presence of oxygen in the alveoli does not guarantee its uptake by the bloodstream, nor does the production of carbon dioxide in tissues ensure its elimination from the body. Gas exchange relies on the principles of di usion, whereby oxygen di uses from the alveoli into the pulmonary capillaries, while carbon dioxide traverses the opposite path, facilitated by concentration gradients and the thin respiratory membrane.

Jean P, Department of Microbiology, University of Hong Kong, Hong Kong, E-mail: pjean.gy@hotmail.com

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Beyond anatomy and mechanics, respiratory physiology is intricately regulated by neural and chemical mechanisms that ne-tune ventilation and gas exchange in response to physiological demands.