BOOK REVIEW

The Ins and Outs of Breathing: How We Learnt about the Body's Most Vital Function. Norman Jones. Bloomington: iUniverse Publishing, 2011. ISBN-10: 1462030068; ISBN-13: 978-1462030064; 284 pages.

Norman Jones has written a marvelous book called *The Ins and Outs of Breathing – How we Learnt about the Body's Most Vital Function*. He describes it as an 'odyssey', both of his own lifetime of learning, and of mankind's discoveries about nearly everything related to air, life and breathing. It is written to be accessible to a general reader, but has plenty to entertain and enlighten those in professions related to respiration. Similar to Homer's *Odyssey*, it can be read a chapter at a time, each one describing a memorable adventure. The twenty-two chapters are really independent, self-contained essays on separate topics. Each one begins with an intriguing quotation taken from a surprising assortment of thoughtful physicians, physiologists, performers of respiratory feats, poets, artists, musicians and others, then tells a lively story of early thinkers, people in history who made discoveries and proposed theories, their debates as ideas developed, the ingenuity, difficulties and significance of key experiments and observations, usually ending with a well-judged account of what we know now.

Professor Jones is a fine story-teller. The step-by-step evolution of ideas is clearly laid out, the people and events are alive with interesting details, humorous capsule biographies and telling little anecdotes. (How many know, for example, that JS Haldane subjected his son JBS to experiments on breathing in the garden shed; or that Boyle wrote an essay on 'The Unsuccessfulness of Experiments'). He is also an exceptional teacher. The explanations are remarkably clear; basic concepts are plainly laid out for beginners; more complex and abstract concepts are made easily comprehensible.

It is hard to do justice to the scope and spirit of this entertaining work, but tidbits sampled from a few chapters may help. Chapter 1 is the history of people who wanted to know why animals breathe. It begins with Hippocrates and Plato, goes on to Vesalius, Harvey, and the 17th and 18th century Oxford physiologists Boyle, Willis, Mayow, Priestly et al, and then Lavoisier, who finally worked out the puzzle of the composition of air, the consumption of oxygen and evolution of carbon dioxide. It reads rather like a detective story, showing how theories evolved as new experiments were performed or reinterpreted, how unrecognized problems with methods could cause confusion, why dogmas that now sound ridiculous persisted as long as they did and how the problem was finally solved. For beginners, there is an inset that explains the concept of pressure and, for lovers of the arcane, a full account of phlogiston theory and a note about Priestly measuring his own lung volume by the dilution of laughing gas. Illustrations include Malpighi's diagram of lung structure and a drawing by Mme Lavoisier of her husband's experiment on gas exchange in exercise. Chapter 4 is introduced by a quote from Thomas Willis on gas exchange in the lung, and begins with the history of measuring pressure and of noticing changes in the colour of blood. With the help of an inset that defines the necessary symbols, the beginner is led painlessly from there through the hemoglobin-oxygen dissociation curve as far as Riley's oxygen-CO_2 diagram, ventilation-perfusion ratios and what insight they brought. Chapter 8 begins with quotes from both Erasmus and Charles Darwin, describes breathing by insects, birds, fish, eggs and elephants, and ends with Weibel and fractals. Chapter 11 quotes W Wordsworth on 'thoughtful breath' and tells about Hering & Breur, Christie & Meakins, William James, psychophysics of dyspnea and the experiment in which Moran Campbell had himself paralyzed with curare while awake and found he could then remain without breathing for several minutes without discomfort, proving that respiratory muscles are an important source of dyspnea. Chapter 15, titled 'Body, Mind, Spirit, Breath', talks not only about how breathing assists the circulation through pressure changes in the chest (as in coughing to support cardiac output while waiting for your pacemaker to kick in), but also the influence of breathing on blood gases, the autonomic nervous system, and the immune system as well as varieties of breathing control in yoga practices. There is a thoughtful comment about how unhelpful it is to classify as 'psychogenic' those maladies that doctors do not understand. Chapter 17, about singing, starts with a delightful quotation from a Doctor C Burney describing a duet in 1720 between a trumpet and a castrato, then gives a detailed account of physiology and acoustics of the upper airway and the role of muscles of the thorax in singers. Illustrations include a 1601 drawing of a dissection of the vocal organs, and a graph made by Donald Proctor of his own subglottic pressure while singing a Schubert song. Other chapters deal with such things as anatomy, control of breathing, mechanics, athletes, breath-hold divers, newborn babies, lung structure and function, evolution and dynamics of atmospheric air, mountaineering, diving, sleep, asthma, exercise, smoking and air pollution. By the end of the 'odyssey', readers may believe they are close to the answer about life, the universe and everything.

Full of history, erudition, humour and wisdom, this book deserves to be widely read. It will give pleasure to both general readers and professionals of breathing. Teachers and students will find it an invaluable sourcebook and study companion. It ought to pique the interest of young people and inspire some of them to think of respiratory careers. Five stars.

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