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EDITORIAL

Preface: "Imaging the Lung in 3D: Pictures with Impact"

Charles G. Irvin[1]

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Have you ever noticed the impact of images? As you pick up a textbook, read a paper, or review a grant, have you noticed how your eye and mind quickly grasp and capture pictures as opposed to graphs or tables of data? Indeed, I confess that I will buy a book based on the quantity and quality of the diagrams and pictures. One germane example is the book by the late Ewald Weibel "The Pathway for Oxygen" (Weibel 1984) that has marvelous scanning electron micrographs that I regularly use for teaching. Papers that include histologic or pathological images are somehow more interesting and if nothing else, inserting a picture breaks up the monotonous lines of text of a hereto pedantic grant application. A really wonderful example of the power of images comes when one considers how quickly X-rays were put into clinical practice from their discovery–mere months (Howell 2016). This is the power of images in science. Even more powerful are these images if they are coupled to data that quantifies what conclusions our eyes capture (Henson et al. 2010). As my mind ponders an image of the lung, I almost immediately begin to consider how the structure or pathological changes impact the function—an occupational hazard of being a physiologist.

This Special Issue devoted to "3D Imaging in Lung Biology" is of special interest to me for a more personal reason. In 2005, I received a call from a colleague at the Jackson Laboratories who I had met on a mini sabbatical year in Australia in the 1980s. In the interval, I had lost touch with him and now he turns up on the faculty at Jackson Laboratories. He had many questions about measuring lung function in mice using techniques that were being developed and perfected in my laboratory at the time (Wagers et al. 2007). One thing led to another and we concocted a plan to develop a course, "Phenotyping Mouse Models of Human Lung Disease" that focused on assessing the structure and function of health and disease of the laboratory mouse—an obvious fit with the Jackson Laboratories. And while I stopped organizing the course some years ago, I am gratified that the course continues, and even more gratified by this special edition of *Histochemistry and Cell biology* that is the result of wonderful things that happen when colleagues get together away from the day-to-day grind—the principle of proximity at work.

Drs. Mühlfeld and Taatjes point out in their introduction to this special issue that: "*…imaging of the lung not only reveals its structural composition but also its functional status during development and under normal and pathological conditions. The history of the discovery of the structure–function relationships of the lung is also a history of the development of microscopic techniques*". Oh, so true. I am old enough to remember when the concept of lung structure/function relationships was first promulgated by Norman Staub back in the 1970s (Staub 1975). It did not take much for this concept to be widely accepted as the association of structure to function, at least in terms of the lung, was so patently obvious. I totally agree with my colleagues Mühlfeld and Taatjes when they also point out that "*For relating structures to their function it is often not enough to describe them qualitatively but to express them in quantitative terms*". One really good example of the power of this quantitative structure/function approach is the concept of "*Silent Zone*" of the lung or small airways disease. In 1964, following the publication of Weibel's first book (Weibel 1963), Malcolm Green took pencil and paper calculating the resistance of each generation of airway using assumptions that while somewhat flawed, turned out to be true. The resultant diagram that was published in the hospital newsletter is now found in every standard textbook of physiology (Green 1964)! This led to a prediction that the small airways contributed little to overall lung resistance in spite of the fact the airways progressively narrow with each generation of branching. (As a note, Fritz Rohrer (Rohrer 1915) had arrived at the same conclusion 50 years previously, but this was ignored.) In 1967, my mentor Peter Macklem and his colleague Jere Mead (1967) published their seminal work

✉ Charles G. Irvin
charles.irvin@med.uvm.edu

[1] Departments of Medicine, Physiology and Biophysics, Larner College of Medicine, University of Vermont, Burlington, VT 05405, USA

demonstrating in a normal, living animal that Green's prediction was functionally correct—the small airways contribute little to overall airflow resistance. This is a foundational concept in pulmonary physiology and medicine and it is explained by the quantitative microanatomy of the lung (Hyde et al. 2009).

The goal of this special issue of *Histochemistry and Cell Biology* is to highlight the exciting possibilities and insights that could be gained from 3D imaging of the microscopic structure of the lung, analogous to insights into health and disease we have gained when we transitioned from plain X-rays to CT. Indeed, several of the papers use CT or CT plus microscopic images to great effect. Further, this special issue is an informational treasure trove for those interested in various ultrastructural approaches such as TEM. Early results presented in these papers demonstrate how 3D approaches promise to inform us further of the all-important development and role of lung surfactant as one example. Further, many of the authors provide interesting findings and new perspectives of the devastation caused by disease that promise further insights in our future. Accordingly, this special issue promises to be a seminal contribution to the field and I congratulate Drs. Mühlfeld and Taatjes for their insight and initiative.

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