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Below are brief overviews of the articles that appeared in this issue of VOLUME:

Use of Cyclotron-Generated Radionuclides in Respiratory Medicine (Roger K. A. Allen FRACP)

This interesting review article describes the clinical and research applications of radionuclides (ie atoms with an unstable nucleus, often called radioactive isotopes) to investigate the dynamics of blood flow, ventilation and diffusion, and the use of radioactive labelling (lymphocytes, macrophages, drugs, bioamines, etc) to provide a powerful tool to explore the metabolism and immunology of the lungs. There was a lot of interest in this article in 1984, as it was written before Australia had established the technology (ie a particle accelerator called a cyclotron, invented in 1929) needed to generate the shorter half-life radionuclides which have to be produced at or near where they will be used. In fact, Australia was one of the last industrialised countries to acquire a cyclotron, so few people here at the time had practical knowledge of the technologies and their potential clinical and research applications.

As Dr Allen stated in his review, the hope was that the use of short half-life radionuclides would lead to improved diagnostic techniques and therapeutics with the added benefits of less invasive procedures and lower radiation exposure.

The applications of several isotopes to respiratory medicine investigations are summarised in the following table.

Radionuclide	**Mode of Decay**	**Half-Life**	**Application**
Krypton-81m	γ	13.3 sec	Ventilation distribution studies
Carbon-11	β^+	20.3 min	Regional lung function studies (^{11}CO); Metabolism of lung tissue and vessels (eg labelling bioamines and drugs with carbon-11 and quantitate uptake and clearance)
Oxygen-15	β^+	123 sec	Detecting pulmonary emboli and regional lung function studies (eg $C^{15}O_2$, and $C^{15}O$); Regional pulmonary blood flow ($^{15}O_2$); Volume of extra-vascular lung water ($^{15}O_2$)
Oxygen-18	γ	Stable	Diffusing capacity (eg $C^{18}O$, $^{18}O_2$);
Gallium-67	γ	78.3 hours	Management of interstitial lung disease eg sarcoidosis
Gallium-68	β^+, γ	68.1 min	Detecting pulmonary emboli
Technetium-99m	γ	6.02 hours	Ventilation distribution studies
Xenon-133	β^-, γ	2.19 days	Ventilation distribution studies

(The creation of artificial radionuclides is often achieved by bombarding certain target elements with high-energy subatomic particles by accelerating the particles within a shaped electromagnetic field. They can also be produced using radionuclide generators (or reactors) from the decay of a parent isotope. For example, the commonly used technetium-99m (the "m" indicates metastable) is produced from the decay of molybdenum-99. The radionuclides of particular interest in respiratory medicine are those that decay with short half-lives and emit low energy gamma radiation. The low energy γ-radiation is detected by positron

cameras located on either side of the patient and by analysing these data using sophisticated computer algorithms it is possible to accurately locate within 3-dimensional space the exact source of the emission using positron emission tomography (PET). In this way, and in combination with CT or MRI scans, PET can produce a detailed 3-dimensional image (or map) of the anatomic and functional metabolic processes in the body.

In hindsight, it appears to me that many of the uses of short-lived radionuclides will and indeed have remained in the research domain. The main clinical advances since 1984 appear to have in the imaging field and the application of radionuclides such as ^{18}F for staging lung cancer and investigating metabolism. Technegas was discovered in Australia and is now widely used for ventilation scans. It is perhaps not surprising that in this context the transition from basic science to clinical practice is a long road, especially considering: 1) the cost of this technology, 2) cost of producing radionuclides, and the ethical requirements with respect to radiation exposure.

It may be of interest to readers to learn that the principle underlying the computerised 'weighted averaging technique' for characterising the accuracy and linearity of flow sensors using multiple strokes of a calibration syringe that was described by Yeh et al (Journal of Applied Physiology, 53(1): 280-285, 1982) was conceived whilst he listened to a research talk on CT and PET imaging at the LDS Hospital in Salt Lake City! DPJ)

Comparison of the Mixing and Saturation-Tension Techniques for Determination of Oxygen Haemoglobin-Dissociation Curve for Position (Rosann Glas McCullough RN CCPT, Eva Toyos BS, Lorna Grindlay Moore PhD)

This neat research paper describes a simple method for directly measuring the position of the oxygen-dissociation curve. It was written by a group from the University of Colorado, USA and was first published in the journal, Analyzer (National Society for Cardiopulmonary Technology). The article was reproduced in VOLUME for the benefit of our members through a reciprocal publishing arrangement (see Mouth-Piece below).

The study was conducted because the authors were interested in the effect of high altitude and other hypoxic conditions on the oxygen transport system, specifically the position of the oxygen-dissociation curve, which is quantified by the P_{50} (the blood PO_2 at which the haemoglobin is 50% saturated with oxygen). They described a clever, yet simple, modification of the mixing method described by Edwards and Martin (J. Appl. Physiol., 21(6): 1898-1902, 1966) for directly measuring P_{50}. The method required the equilibration of blood (using a tonometer) with two separate gas mixtures; one containing 0% oxygen and the other a sufficiently high oxygen concentration to fully saturate the blood. (Both gas mixtures contained 6% CO_2 to ensure that the blood PCO_2 was close to arterial levels.) Thus, one of the blood samples became fully desaturated (ie SO_2 = zero) and the other fully saturated (ie SO_2 = 100%). They designed a neat syringe system using a small bead of mercury as a mechanical stirrer, to mix together equal volumes (0.5 ml each) of the desaturated and saturated blood samples. The SO_2 of the resulting mixed blood sample is therefore 50% (ie SO_2 = (0 + 100)/2), and the PO_2 of the sample provided a direct measure of P_{50}. They determined the accuracy of their mixing method by comparison with results obtained using the classic, but laborious, saturation-tension method described by Naerraa et al (Scan. J. Clin. Lab. Invest., 15: 141-151, 1963).

Their results indicated that the modified mixing method for determining P_{50} was accurate and comparable to that obtained using the classic saturation-tension method: mean P_{50} using their mixing method was 27.4 mmHg (SEM 0.6) compared with 26.1 mmHg (SEM 0.8). They concluded that the advantages of their mixing method were: 1) requires only a small blood sample, 2) simple and readily available instrumentation (tonometer, conventional blood-gas

analyser and accurate syringe), 3) only two measurements of PO_2 are needed, and 4) P_{50} is determined directly rather than by interpolation.

Single Breath TLCO Questionnaire (David P. Johns, Peter D. Rochford, Hennig Imberger).

This 29 item TLCO and VA questionnaire was designed to provide information on the range of instruments, methods, quality assurance procedures and predicted values used in Australian and New Zealand laboratories. The survey was done to better understand the possible causes for the well-known inter-laboratory and inter-system variation in these measurements. The questionnaire included several sets of raw data from which respondents were asked to compute VA and TLCO as there was evidence that computational errors or the use of inappropriate equations were a major source of inter-laboratory variability. (Yes, back then we routinely calculated the values manually!)

(Twenty-two laboratories completed the questionnaire. The results, together with the theoretical implications were published in a 'future' issue of VOLUME (December 1985). The results were very interesting and I will comment further when I review that issue. DPJ).

Mouth-Piece

Reciprocal Publishing Rights: An announcement was made that reciprocal publishing rights had been negotiated between VOLUME and the journal Analyzer (National Society for Cardiopulmonary Technology, Inc., USA). Thus, original articles published in Analyzer could be reprinted in VOLUME and vice versa.

Letter to the Editor. Jenni Savage (a well known scientist from Queensland and long-term supporter of our Society) wrote thanking the South Australia group for organising the scientific meeting in Adelaide. She also alerted members to the availability of a new textbook edited by Jack Clausen: "Pulmonary Function Testing Guidelines and Controversies: Equipment, methods and normal values."

Announcement: This announcement alerted members who used Ascarite 1 (a form of soda lime that was commonly used to absorb carbon dioxide from respiratory circuits) that this material consists of sodium hydroxide coated with **ASBESTOS**! Yes, you read that correctly.

Please contact me if you are interested in a copy of this or any other issue of VOLUME.

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