LETTER TO THE EDITOR

MICROANALYSIS OF RESPIRATORY AIR SAMPLES, A SIMPLE DEVICE FOR UNDERGRADUATE DEMONSTRATION

Sir,

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Analysis of respiratory gas samples, forms an important laboratory experiment. Many teaching laboratories use a large and cumbersome Air Gas Analysis Apparatus of the colonial era (1). A simple device for determining the oxygen and carbon dioxide contents of small samples of alveolar, expired and inspired airs is presented.

Zero point two *ml* fractionated pipette is bent at right angles at two places (Fig. 1) and serves as apparatus for absorbing carbon dioxide and oxygen from the air samples introduced in it.

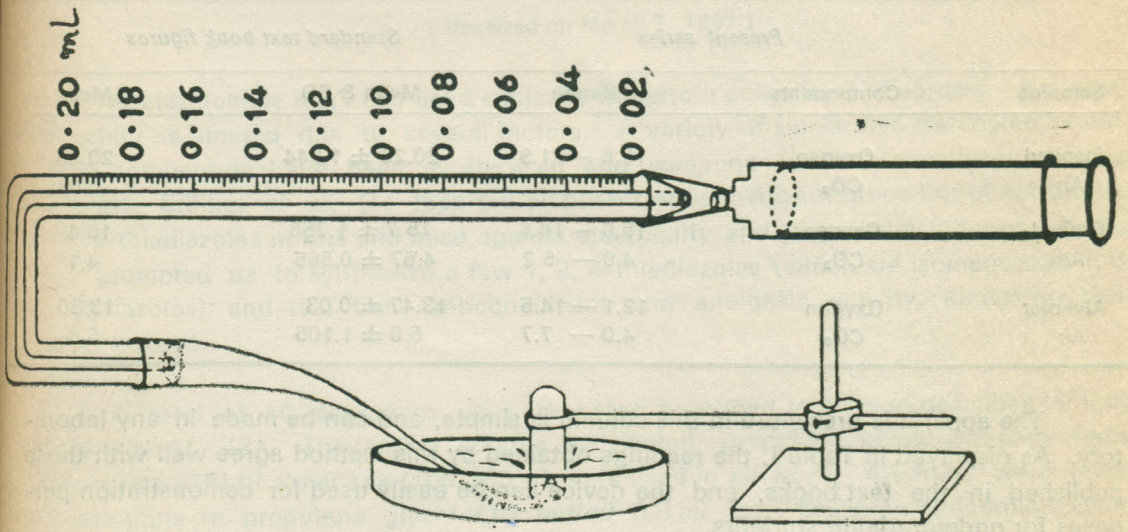
(a) Atmospheric air is taken as a sample of inspired air.

(b) Expired air sample is cellected under mercury in an inverted Kahn tube (capacity 5 ml) from a side tubing attached to the Douglas bag. The subject is made to breathe through the mouth piece connected to a Douglas bag for 7-10 minutes. The Douglas bag is kneaded to ensure the even mixing of the expired gases. A polythene tubing side connection is attached about two inches from the mouth of the Douglas bag. A Kahn tube filled with mercury is kept inverted over a petri dish also containing mercury. The end of the polythene tubing dips into the mercury and its tip is guided into the mouth of the Kahn tube. The Key of the Douglas bag is opened and the Douglas bag pressed gently so as to allow the air to escape through the polythene tubing into the Kahn tube.

(c) The alveolar air sample is collected with the help of the Haldane-Priestley tube which has a narrow side tube connection about two inches from the mouth piece. When taking the sample, a polythene tubing is fixed to the side tube and the collection is made in a Kahn tube kept filled with mercury and inverted over a petri dish containing mercury. The subject is made to exhale after a normal inspiration. Towards the end of expiration the other end of the long tube is closed by the

assistant while the subject closes the mouth piece with his tongue. The last portion of the expired air which is mainly the alveolar air is collected through the side polythene tubing in the Khan tube under the cover of mercury.

The polythene connection is attached to the pipette at one end and a 2 *ml* syringe at the other, as shown in Fig. 1. The whole apparatus including the polythene connection is filled with mercury and is thus made air tight. The free end of the polythene tubing is guided into the mouth of the inverted Kahn tube (through mercury). By gentle aspiration the required sample is drawn in. Care is taken to let in a mercury seal soon after the sample.



Once the sample is taken in, it is measured from the markings on the 0.2 *ml* pipette (the sample is always between two portions of mercury so that the sample does not come in contact with the atmospheric air). Then, the distal portion of mercury is discarded leaving a small seal of mercury still, the bent end dipped in a beaker containing saturated solution of KOH with a layer of paraffin over it. The mercury seal is dropped in KOH solution taking care not to allow any sample bubbles to come out. The saturated solution of KOH is taken in and the sample allowed to react with KOH by gently pulling and pushing the piston of the syringe. All the CO_2 from the sample gets absorbed by KOH, thus leading to a shrinkage in the original volume of the same. The amount of srinkage denotes the amount of CO_2 in the sample, which is then computed for the percentage of CO_2 in the same.

The absorption of CO_2 is complete by 3-5 min (till the reading remains constant). The KOH solution is then discarded, leaving a small seal of KOH and the tip of the

pipette now dipped into a beaker containing 10% pyrogallol also under cover of liquid paraffin. A small volume (about 0.02-0.04 *ml*) of pyrogallol is drawn in and allowed to react with the same sample. The oxygen from the sample is absorbed by the pyrogallol thus producing further shrinkage in the original volume. The shrinkage in the volume is then computed to get the percentage of oxygen in the sample. Whatever mercury dropped in KOH is recovered at the end of analysis.

TABLE I : Oxygen and carbon dixide percentage in the gas samples in 10 healthy subjects. The readings from standard text book, are also mentioned for comparison (2).

		Present series		*Standard text book figures*
Samples	Components	Range	Mean & SD	Mean
Inspired Air	Oxygen	18.6 — 21.9	20.29 ± 1.044	20.95
	CO_2			0.04
Expired Air	Oxygen	15.0 — 16.6	15.7 ± 1.756	16.4
	CO_2	4.0 — 5.2	4.57 ± 0.565	4.1
Alveolar Air	Oxygen	12.1 — 14.5	13.47 ± 0.03	13.80
	CO_2	4.0 — 7.7	5.6 ± 1.105	5.6

The apparatus presented in this column is simple, and can be made in any laboratory. As displayed in Table I, the readings obtained by this method agree well with those published in the text books, and the device can be easily used for demonstration purposes for undergraduate students.

FRIDA S. MONTEIRO AND M. G. GOGATE
Department of Physiology,
Goa Medical College,
P.O. Santa Cruz, Goa

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