jection since the sudden increase in pressure may result in a spurious dilatation of the pupil. On the other hand, if the injection is too slow the reaction may fail, particularly when working with high dilutions of epinephrine. It should be aimed to introduce the material at about the same rate as that of the blood flow in the blood vessel. A mechanical device has been found useful for this purpose.

We have compared the results of assay of epinephrine in serum of adrenal vein blood and of systemic blood to which epinephrine was added, using this method and the rabbit intestine method as employed by Stewart and Rogoff. The results obtained by the two methods compared remarkably well in practically every instance.

Since it is known that the epinephrine in blood is contained in the plasma or serum,[5] it is possible, by using serum for the tests, to study problems related to hyperepinephremia alleged to exist in various diseases. Any concentration of epinephrine found in the serum would correspond to about half that concentration in the whole blood. Thus, the test object, when sensitized to the degree found possible in the present investigation, could detect epinephrine in the systemic circulation if hyperepinephremia exists. Studies on the relation of the adrenals to hypertension and on the existence of detectable quantities of epinephrine in the circulation are in progress.

9264 P

Use of Air in Basal Metabolism.

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In the past there has been no reference in the literature to the use of air instead of oxygen in the semi-portable type of basal metabolimeters which are commonly used clinically. Yet, obviously, there may be certain advantages to using air instead of oxygen in a clinical metabolimeter. An article describing an air-using machine has just been published in a South American periodical by a doctor in Mexico City.[1] In certain parts of the world, oxygen is expensive and difficult to obtain.

It has been definitely shown[2] that the oxygen tension of the air

[5] Stewart, G. N., and Rogoff, J. M., *J. Pharm. Exp. Therap.*, 1917, **9**, 393.

[1] Macías, F. I., *Semana méd.*, 1936, **1**, 680.

[2] "Medical Studies on Aviation," *J. Am. Med. Assn.*, 1918, **71**, 17, 1383.

breathed can fall decidly before any detrimental physiological changes are noted, and Schneider[3] and others have found that the oxygen intake begins to fall only when the oxygen concentration in the air breathed is 14.8% or lower.

Our first experiments using air were carried out on a standard basal metabolimeter* which uses a motor-driven fan for circulating the gas in the closed system. Air was merely substituted for oxygen, and the tests were limited to periods of 4 minutes, as the total capacity of the machine was only 12 liters. Oxygen control

TABLE I.
Four-minute periods.

Subject	Date	Minute Volume		Deviation
		Oxygen cc.	Air cc.	%
L. N.	1-20	256	262	2.3
J. S.	1-23	213	208	-1.9
R. K.	1-26	280	278	-0.7
G. L.	2-13	276	276	0.0
	Totals	1025	1024	
		Average deviation		-0.1

TABLE II.
Preliminary Series. Six-minute periods.

Subject	Date	Minute Volume		Deviation	Gas Analysis
		Oxygen cc.	Air cc.	%	%
W. C.	7-11	233	223	-4.3	16.7
"	11	233	230	-1.3	
K. J	15	297	297	0.0	16.0
"	16	265	275	3.7	14.8
"	19	257	252	-1.9	14.4
"	20	294	296	0.9	15.3
"	20	289	278	-3.9	
C. P.	20	270	273	1.2	
"	27	284	271	-4.7	14.1
K. J.	27	318	322	1.4	
C. P.	28	270	275	1.6	
"	29	276	267	-3.0	15.0
"	30	291	285	-2.3	
"	30	293	288	-1.8	
"	8-3	298	302	1.2	14.1
"	3	303	278	-8.1	
"	6	289	271	-6.1	14.2
"	6	267	250	-6.3	
W. C.	9-29	218	228	4.6	
Totals		5255	5161		
		Average deviation		-1.8	

[3] Schneider, E. C., Truesdell, D., Clarke, R. W., *Am. J. Physiol.*, 1924, **70**, 283.

* "Sanborn Motor-Grafic, Model E-I-S." Manufactured by the Sanborn Company, Cambridge, Mass.

tests were made immediately preceding and following each test using air. Four different subjects were used. It was found that the results of the tests in which air was used agreed to 0.1% with those in which oxygen was used.

As a 4-minute test was not considered to be a period of sufficient length for a good determination, an auxiliary tank of air was connected in series with the metabolimeter. Using a 6-minute

TABLE III.
New Machine. Six- and 8-minute periods.

Subject	Date	Minute Volume		Deviation
		Oxygen cc.	Air cc.	%
B. L.	11-2	225	238	5.7
H. D.	4	190	197	3.4
S. K.	6	202	182	-9.9
F. B.	7	162	157	-3.1
H. P.	8	233	221	-5.1
"	8	233	230	-1.6
C. P.	12	266	259	-3.0
"	13	272	265	-1.8
	Totals	1783	1749	
		Average deviation		-1.9

period, a preliminary group of 20 trials and 19 control determinations were made with this apparatus on 3 normal subjects. The average of the results of these 6-minute periods agreed within 1.5% with the results obtained with oxygen. (Table II.)

These results caused us to construct a machine with the spirometer incorporated into an auxiliary tank. The construction of this machine is shown in the diagram. The oxygen consumption is measured by the fall of the spirometer which is recorded on a kymograph drum in the usual way. The spirometer was calibrated by carefully measuring the distance traversed by the pen on the kymograph drum when air was added or subtracted in 500 cc. increments from the machine. The results on patients were also compared and found to agree with data obtained with a Benedict machine. Our machine was constructed from plans calculated to give it a total capacity of 40 liters, which was sufficient to provide the patient with fresh air for the entire 6-minute period of the test. Circulation of the air within the apparatus was maintained by means of a small 6-volt motor, driven by a storage battery. This motor did not heat the air to any measurable extent.

It was noticed that a rise of temperature of one degree centigrade produced an error of about 4% in this machine. In order to avoid

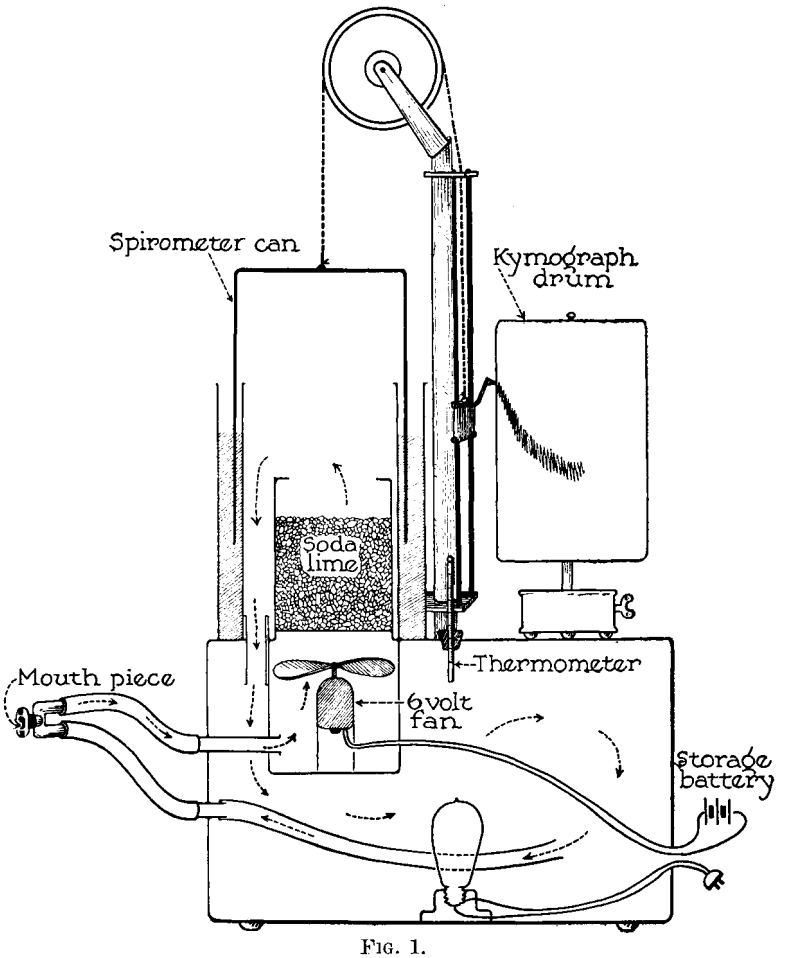

FIG. 1.
Scale diagram of metabolism machine constructed to use air instead of oxygen. Capacity of tank and spirometer = 40 liters.

this source of error, the air was heated before each test by a light-bulb inside the machine. The temperature during the test was then found to remain constant.

Checks on the oxygen level in the various containers were obtained by means of gas analyses, using a modified form of the Henderson-Orsat gas analysis machine.[4] In the preliminary series of tests, the oxygen concentration fell from 20.9%, to between 14 and 15%. (Table II.) In the tests with the 40 liter machine it fell to 16%, which is not below the oxygen concentration in ordinary expired air,[5] and indicates a wide margin of safety for this machine.

[4] Henderson, Y., *J. Biol. Chem.*, 1918, **33**, 31.

[5] Du Bois, E. F., "Basal Metabolism in Health and Disease," Lea & Febiger, 1924, p. 64.

An average of 8 determinations of metabolism with this machine on 6 different subjects gave results which varied by less than 2% from that obtained under exactly similar conditions with a standard machine. This is within the requirements of clinical calorimetry.

9265 P

Total Thyroidectomy for Human Diabetes Insipidus.

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Among the indications that the thyroid may play an important rôle in water metabolism are several pieces of evidence which suggest that total thyroidectomy might appreciably ameliorate the symptoms of human diabetes insipidus: Mahoney and Sheehan[1] abolished experimental temporary diabetes insipidus in dogs by this procedure and reëstablished the polyuria by feeding thyroid substance; Fisher and Ingram[2] obtained similar though less striking results in cats; others[3, 4] found that in thyroidectomized dogs anterior pituitary extract had no diuretic effect; and Strauss[5] once saw clinical diabetes insipidus disappear with the onset of spontaneous myxedema. It was anticipated that species differences might spell failure in the human subject, for anterior lobe extracts do not induce polyuria in normal rats[6] and Stern and Gilligan[7] found that the responses to water-drinking and to pituitrin are similar in normal subjects and in those with artificial myxedema. Our patient was fully aware of the experimental nature of the proposed operation and willingly cooperated. We have seen no previous reports of similar studies in man or monkeys.

W. D., a 55-year-old colored male with central nervous system syphilis and diabetes insipidus of 3 years' duration which had not yielded to antiluetic therapy, underwent complete thyroidectomy on

[1] Mahoney, W., and Sheehan, D., *Am. J. Physiol.*, 1935, **112**, 250.

[2] Fisher, C., and Ingram, W. R., *Arch. Int. Med.*, 1936, **58**, 117.

[3] Barnes, B. O., Regan, J. F., and Bueno, J. G., *Am. J. Physiol.*, 1933, **105**, 559.

[4] Biasotti, A., *Compt. rend. Soc. de biol.*, 1934, **115**, 329.

[5] Strauss, L., *Deutsche med. Wchnschr.*, 1920, **6**, 939.

[6] White, H. L., *Am. J. Physiol.*, 1937, **119**, 5.

[7] Stern, B., and Gilligan, D. R., PROC. SOC. EXP. BIOL. AND MED., 1934, **32**, 843.