On the two occasions in which the amounts of thiobarbituric acid reactive materials were estimated in the brain, the amount of lipid peroxides in the O_2-treated group was found to be almost twice that found in the animals not treated with O_2.

It is possible that the total length of exposure to O_2 (total of 30–40 h in the animals which were kept alive for the longest period) was not long enough to produce more marked changes. In the presently described experiment, highest O_2 tensions probably prevailed in the blood stream and in the walls of blood vessels. Also in the autopsy described by LUND[14] most chromolipoid deposition in the brain was perivascular. Perivascular pigmentation was also observed in the central nervous system of various vitamin E deficient animals in addition to neuronal pigmentation[15,16].

It appears therefore that the blood vessel walls and specially those of the central nervous system play an important role in the determination of lesions by hyperoxia. The possibility that unsaturated phospholipids and other unsaturated lipids are the primary target of hyperoxia appears to be logical and is being further studied[17].

Zusammenfassung. Ratten, die wiederholt hohen O_2-Drucken ausgesetzt wurden, zeigten nach 4 Wochen erhöhte chromolipoide Pigmentation. Die Pigmentation blieb relativ gering und lag hauptsächlich in der Gefässwand und deren Umgebung bzw. den Stellen höchsten O_2-Druckes.

M. WOLMAN and LILIANA ZAIDEL

Department of Pathology, Government Hospital Tel-Hashomer (Israel), January 2, 1962.

[14] T. LUND, Acta psych. neurol. scand. Suppl. *108*, 235 (1956).
[15] L. EINARSON, J. Neurol. Neurosurg. Psychiat. *16*, 98 (1953).
[16] L. EINARSON and I. R. TELFORD, Biol. Skrift. K. Danske Videnskab. Selsk. *11*, 3 (1960).
[17] The assistance of Dr. A. MAKLER and of Misses T. BEN-YOSEF and Z. BAR is gratefully acknowledged.

Potassium Levels in Human Semen with Reference to Sperm Motility

Mammalian seminal plasma is known to contain sodium, potassium, calcium, magnesium, and traces of heavy metals (MANN[1]). The effect of these metals and related ions on the metabolism and motility of the mammalian spermatozoa has been of great interest to workers concerned with the metabolism of spermatozoa. It was observed by WALES and WHITE[2,3] that, in the case of dog and fowl, low concentrations of potassium were necessary for optimal metabolism of spermatozoa, whereas high concentrations were found to be detrimental. CRAGLE and SALISBURY[4] found that oxygen uptake and glycolysis of bull spermatozoa were reversibly inhibited by potassium concentrations of 200 to 280 mg/100 ml. The high potassium content of semen also had a deleterious effect on motility. It has already been reported by SHETH and RAO[5] that 0.05 *M* KCl inhibited fructolysis completely. These results indicated that more than optimal concentration of potassium may also adversely affect motility of spermatozoa. It was therefore of interest to determine the potassium content of human semen with spermatozoa with different percentage motility. Preliminary results are presented in this communication which give an account of the potassium levels in 120 normal and subnormal semen samples.

Semen samples used in these studies were obtained from fertile donors and from men referred for infertility by the K.E.M. Hospital, Parel, Bombay. Soon after liquefaction of the semen (about $^1/_2$ h after ejaculation) the spermatozoal count and percentage motility were determined, using standard methods. Semen was centrifugated for 30 min at 2000 r.p.m. to separate spermatozoa and seminal plasma. Potassium levels in semen and seminal plasma were determined by the method of KING[6].

Results given in the Table show that potassium content of seminal plasma accounted for almost all the total potassium content in whole semen. The potassium values of seminal plasma were found to be a little higher than those of the respective semen sample. This may be due to the difference in volume brought about by the displacement of seminal plasma by the different volumes of spermatozoa in the individual semen samples.

These results are in contrast to those reported by CRAGLE, SALISBURY, and VAN DEMARK[7], who reported a higher concentration of potassium in bovine spermatozoa as compared to bovine seminal plasma. In the work reported here only seminal plasma was used to determine the levels of potassium since potassium was not present in spermatozoa in any significant amounts. In all, 120 semen samples were used to measure the potassium levels in the respective seminal plasma. Semen samples were arbitrarily divided into groups according to the percentage of motile spermatozoa present. Those samples in which more than 30% of spermatozoa were motile were considered to have good motility, while those with 30% or less than 30% motile spermatozoa were considered to be of poor motility. The mean potassium level in good motility samples was found to be 126 mg/100 ml (S.E. $\pm$ 1.2) and was compa-

Potassium levels of semen and seminal plasma

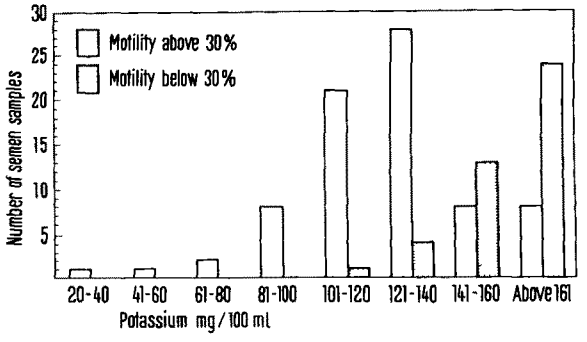
Sample number	Count/ml in millions	Percentage motility	Potassium values mg/100 ml Semen	Seminal plasma
1	40	50	148	152
2	300	40	140	148
3	80	30	196	202
4	60	50	138	140
5	200	40	128	132

[1] T. MANN, *Biochemistry of Semen* (Methuen and Co. Ltd., London 1954), p. 32.
[2] R. G. WALES and I. G. WHITE, J. Physiol. *142*, 494 (1958).
[3] R. G. WALES and I. G. WHITE, Austr. J. biol. Sci. *11*, 589 (1958).
[4] R. G. CRAGLE and G. W. SALISBURY, J. Dairy Sci. *43*, 1304 (1959).
[5] A. R. SHETH and S. S. RAO, Ind. J. Physiol. Pharmacol. *4*, 17 (1960).
[6] E. J. KING, *Microanalysis in Medical Biochemistry* (J. & A. Churchill Ltd., London 1951), p. 86.
[7] R. G. CRAGLE, G. W. SALISBURY, and N. L. VANDEMARK, J. Dairy Sci. *41*, 1267 (1958).

ratively lower than in poor motility samples which had 196 mg/100 ml (S.E. ±11.8). The difference in the potassium values of the two groups was found to be statistically significant. The Figure shows the distribution of semen samples in the two groups according to their potassium level.

The observation that there is a considerable difference in potassium level of seminal plasma separated from semen containing spermatozoa of good and poor motility is of significance. It has been clearly demonstrated by many workers (MARDEN and WERTHESEN[8], ROZIN[9], MACLEOD and FREUND[10], and SHETH and RAO[11]) that seminal plasma exerts a marked influence on the motility and metabolism of animal and human semen. Experimental data presented here indicate that potassium is one of the important constituents of seminal plasma which could influence the motility of spermatozoa. The observations of CRAGLE and SALISBURY[4] are of great significance in the context of the results reported here. They observed that epididymal secretions of the bull exhibited a high value for potassium. It is known that epididymal spermatozoa were in a 'quiscent' stage as compared to ejaculated spermatozoa. They postulated that, on ejaculation, the high potassium level of epididymal secretion gets diluted with sodium and calcium from other secretions of the accessory glands. This they suppose to overcome the inhibitory effect of potassium on the motility of spermatozoa.

WALES and WHITE[2] found that neither magnesium nor calcium eliminated the toxic effect of potassium. Attempts are being made in our laboratory to study in detail the effect of potassium and other metals on sperm motility. The results will be reported elsewhere[12].



The distribution of semen samples, according to their potassium content

Résumé. Il est connu que la motilité et le métabolisme des spermes de mammifères sont sous influence des ions inorganiques, spécialement des ions de potassium. Nous avons étudié le contenu de potassium dans des échantillons de personnes fertiles et infertiles. Nous avons observé que les échantillons dont 30% de spermes étaient motiles, ont la teneur de potassium peu élevée. Les résultats indiquent que le potassium est un des constituants importants du plasma séminal et qu'il a une forte influence sur la motilité des spermes.

A. R. SHETH and SHANTA S. RAO

Reproductive Physiology Unit, Indian Cancer Research Centre, Parel, Bombay (India), April 16, 1962.

[8] W. MARDEN and N. T. WERTHESEN, Fert. and Steril. *7*, 508 (1956).
[9] S. ROZIN, Acta med. orient. Jerusalem *17*, 1 (1958).
[10] J. MACLEOD and M. FREUND, J. appl. Physiol. *13*, 501 (1958).
[11] A. R. SHETH and S. S. RAO, unpublished data.
[12] *Acknowledgment.* We are deeply grateful to Dr. V. R. KHANOLKAR, Director, for his invaluable help and encouragement in the course of this work.

The Influence of Sodium Transport on Glucose Transport by an *in vitro* Intestinal Preparation

It is well established[1,2] that glucose transport through the intestinal wall is an active process, because glucose can be accumulated in the cells as well as in the serosal medium against the concentration gradient. Furthermore, sodium active transport appears to be necessary for active sodium transport[3].

In order to investigate the interrelations existing between sodium and glucose transport, we have performed a series of experiments on an intestinal *in vitro* preparation. The isolated small intestine of albino male rats was perfused with isosmotic Krebs-Henseleit bicarbonate buffer solutions containing different sodium concentrations and the net sodium transfer from the mucosal to the serosal side, as well as the total glucose disappeared and the glucose transported to the serosal side, were determined.

The method of perfusing the intestine is similar to that described by SMYTH and TAYLOR[4]. In order to maintain the same osmotic pressure of the perfusing fluid and to diminish the sodium content, NaCl was partially substituted by isosmolar amounts of urea, mannitol or KCl.

The results so far obtained are collected in the Table. Sodium net transfer decreases in the same way as sodium concentration in the outer solution (mucosal medium), as was observed by other authors[5,6]. The ratio between transported sodium and glucose through the same intestine in any condition does not substantially deviate from the control values. In the experiments in which urea or mannitol were used, the reduction in glucose transport seems not to be due to a minor glucose concentration in the epithelial cells because the glucose utilisation remains at the same level as in the controls. On the other hand, in the experiments in which NaCl was substituted by KCl, the glucose utilisation as well as the glucose transport decrease in the same time as sodium concentration. CRANE et al.[1] have reported similar results with regard to sugars accumulation when sodium was substituted by potassium. Therefore the results of CRANE et al. on sugars accumulation and our data on glucose utilisation seem to

[1] R. K. CRANE, D. MILLER, and I. BIHLER, Proc. Symp. on Membrane Transport and Metabolism (Ed.: A. KLEINZELLER and A. KOTYK, Prague 1960), p. 439.
[2] D. H. SMYTH, Proc. Symp. on Membrane Transport and Metabolism (Ed.: A. KLEINZELLER and A. KOTYK, Prague 1960), p. 488.
[3] T. Z. CZAKY and M. THALE, J. Physiol. *151*, 59 (1960).
[4] D. H. SMYTH and C. B. TAYLOR, J. Physiol. *136*, 632 (1957).
[5] P. F. CURRAN, J. gen. Physiol. *43*, 1137 (1960).
[6] B. E. VAUGHAN, Amer. J. Physiol. *198*, 1235 (1960).