

errors in determined red cell electrolyte concentrations. In addition, the possibility of passive distribution of K^+ in this red cell was considered. Blood was obtained from six seals, and plasma and erythrocytes were processed for the determination of H_2O , Na^+ , K^+ , and Cl^- contents (J. Cell. & Comp. Physiol. 64:409, 1964). These values are presented in Table 1. Water content of the red cells was 62.6 ± 0.5 (S.D.)%. Plasma water content was 91.6 ± 0.3 (S.D.)%.

Table 1

mEq/L plasma H_2O		mEq/L red cell water	Concentration ratio
Na^+	161 \pm 4 (S.D.)	147 \pm 8 (S.D.)	$\frac{Na^t_e}{Na^t_i}$ 1.10 \pm 0.04 (S.D.)
K^+	4.2 \pm 0.3 (S.D.)	8.3 \pm 0.6 (S.D.)	$\frac{K^t_e}{K^t_i}$ 0.50 \pm 0.03 (S.D.)
Cl^-	116 \pm 3 (S.D.)	70 \pm 3 (S.D.)	$\frac{Cl^-_i}{Cl^-_e}$ 0.61 \pm 0.02 (S.D.)

Assuming that Cl^- is in thermodynamic equilibrium across the plasma membrane, both Na^+ and K^+ appear to be distributed against electrochemical gradients. However the narrowness of these gradients suggested low energy requirements for Na^+ and K^+ transport.

Accordingly Na^+ efflux studies using Na^{22} and K^+ influx studies using K^{42} were performed at 39°C using washed seal erythrocytes. Sodium efflux averaged approximately 18.9 mEq/Kg red cells/hr and potassium influx was approximately 0.6 mEq/Kg red cells/hr. In addition, ouabain $10^{-4}M$ did not measurably alter Na^+ efflux or K^+ influx in seal erythrocytes.

The seal erythrocyte appears to be an important model for studying the coupling of energy generation to cation transport in a cell with relatively low energy requirements for this function.

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BLOOD VOLUME DURING DIVING IN THE HARBOR SEAL (*Phoca vitulina*)

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The oxygen dependency of the central nervous system of the seal determines that the duration of diving is limited by the oxygen stores available at the time of diving. The magnitude of the blood volume, with its contained red cell mass, is an important determinant of available oxygen stores. In addition, sequestration of blood during diving could limit the available oxygen stores by preventing the oxygen in the sequestered volume from reaching the oxygen dependent central nervous system.

Studies were designed to determine the blood volume of the seal and to determine if a major fraction of this volume is sequestered from the circulation during diving. Blood volume during and following diving was determined in four young male harbor seals. Blood was obtained

from the seal to be studied, the red cells were labeled using Cr^{51} , and the labeled red cells were administered intravascularly to the seal at onset of diving using a calibrated syringe. By following the dilution curve of the labeled red cells during the following diving a significant sequestration of blood from the circulation should become apparent after termination of diving by the appearance of a second dilution curve produced by the increase in circulating blood volume when sequestered blood is returned to circulation. Accordingly, blood samples were obtained via an extradural vein catheter at 2, 4, 6, 8, and 10 minutes of diving and 2, 4, 6, 10, 20, 40, and 60 minutes following completion of the 10 minute dive. The blood samples and an aliquot of the labeled red cells infused were counted using an auto-gamma counter.

The radioactivity dilution curve during and following diving was plotted to assess any difference in effective blood volume between dive and post-dive periods. The indicated increase in circulating blood volume after diving was less than 20% indicating that only a small volume of blood could have been trapped in small vessels by the arterial constriction that occurs with diving.

Equilibration of radioactivity had occurred by the 20 minute post-dive blood sample. Total blood volume was calculated using the radioactivity of the post-equilibration blood samples. Total blood volume was 127 ± 9 (S.D.) ml/Kg body weight. This value represents 12.7% of body weight and is somewhat lower than the value of 16% reported by Irving and co-workers (*J. Cell. & Comp. Physiol.* 20:189, 1942) using plasma volume methods. Red cell mass calculated from blood volume and hematocrit was 77 ± 6 (S.D.) ml/Kg body weight. These values for blood volume and red cell mass are in good agreement with the increased non-lung oxygen stores in the seal when compared to man (*J. Clin. Invest.* 46:1048, 1967 and Abstract #9, this bulletin issue).

It is clear that no complete sequestration of blood occurs in this animal during diving despite profound arterial constriction. It appears that the function of the large hepatic venous sinuses and extradural veins may be to act as reservoirs for that fraction of the blood volume which is no longer contained within the constricted arterial system.

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BLOOD VOLUME OF THE DOGFISH (*Squalus acanthias*)

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Previous measurements of blood volume of the dogfish were performed using T-1824 (*Physiol. Zool.* 31:16, 1958). In general, methods using T-1824 give rise to blood volumes which are significantly greater than those found using red cell labeling (*Blood and other Body Fluids. Biol. Handbooks*, Wash., D. C. 1961, pp. 1-10). This report presents blood volume determinations in the dogfish using Cr^{51} labeled erythrocytes.

Blood was obtained from the catheterized dorsal artery of the dogfish and labeled with Cr^{51} (as NaCrO_4) via standard techniques. After the final wash, the cells were resuspended in dogfish Ringers and injected into the catheter via calibrated syringe. A small amount of Ringers was used to flush the catheter. Samples were drawn at timed intervals and 1 ml aliquots were counted using an auto-gamma counter. Equilibrium was obtained within 20 minutes of injection of labeled red cells. By determining the dilution of the tagged cells as measured in the 20 min-