32 cell stage are beneath the surface at the completion of ingression. The subsequent role of these cells in development of the embryo is unknown. The yolk-free cells which eventually form the ventral shield aggregate on the macromere side of the egg. Destruction of the macromeres at the eight cell stage results in absence of cells characteristic of the ventral shield. However, following destruction of the micromeres at the same stage, the appearance and aggregation of ventral shield cells takes place at the same time as in unoperated embryos indicating that the majority of the cells of the ventral shield are the progeny of macromeres.

Plasma Volumne, Cardiac Output and Circulation Time Studies on the Seal (Phoca vitulina) During the Dive Reflex

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During the dive reflex of the seal, when the heart rate drops from 150 beats/minute to 10 - 15 beats/minute, the femoral vein-to-right heart and the right heart-to-femoral artery circulation times are markedly increased, cardiac output is reduced to 1/3 to 1/4 of the control and circulatory mixing is slowed. The dive reflex also results in a hemoconcentration and loss of plasma, during the dive, which persists for at least an hour after the dive. Resting plasma volumes are a constant percentage of the body weight in the same seal determined over a month's time and in the face of a simultaneously decreasing hematocrit. The blood volume of seals (200 ml/KBW) is approximately twice that of man and his total blood oxygen can be calculated to be about four times that of man.

Characteristics of the Blood-Brain and Blood-Spinal Fluid Barriers in Squalus acanthias

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A study has been made of the capacity of several substances to pass from the blood into the central nervous system and cerebro-spinal fluid (CSF) of S. *acanthias*. Previous work on the dog had shown that sulfanilamide appears in the CSF and brain of the dog in roughly the same concentration as in plasma water; that sulfanilic acid is almost completely excluded from the CSF and brain and that endogenous ascorbic acid is present in much higher concentrations in brain and CSF than in plasma Observations were made during the summer of 1953, on the distribution

of those substances in plasma, muscle, brain and cerebro-spinal fluid of the dogfish. It was found that the pattern established for dog CSF, was also true for the brain of *S. acanthias*; the steady state distribution ratios* were 0.37 for sulfanilic acid; 1.39 for sulfanilamide and 68.5 for ascorbic acid. However this pattern was not found in muscle or in CSF. The ratios for CSF were sulfanilic acid 1.17, sulfanilamide 0.93 and ascorbic acid 0.95. Similar values were found for muscle. The concentrations of these substances in CSF apparently are close to those of plasma water, whereas the concentrations in brain show a relative exclusion of sulfanilic acid and accumulation of ascorbic acid. This relationship agrees with the studies of H. W. Smith on electrolyte distribution between the CSF and plasma of several elasmobranchs.

The central nervous system of elasmobranchs differs from mammals both in regard to a different organization of arterial circulation (Craigie, Asso. Res. Nerv. and Ment. Dis. **18**, 3, 1938.) and in that the cartilaginous fishes have primitively developed meninges (Ariens Kappers, C. U., Huber, G. C. and Crosby, E. C. The Comparative Anatomy of the Nervous System of Vertebrates Including Man. 1936). The correlation between these anatomical differences and the absence of a blood-spinal fluid barrier cannot be stated in full on the basis of the present data.

* Distribution ratio equals $\frac{\text{Concentration in tissue}}{\text{Concentration in plasma water}/0.93}$