The results obtained in our studies show that: -the uptake of D-glucose into the brush border membrane vesicles strongly depends on the presence of sodium in the extravesicular medium; -the effect of sodium can be nearly completely abolished by 0.2 mM phloridzin in the extravesicular medium; -the uptake of D-glucose in the presence of sodium decreases if valinomycin is added. This suggests that the ionophore valinomycin rapidly creates an inside positive potential by providing an electrogenic shunt for potassium and thus decreases the sodium dependent influx of D-glucose. These results strongly suggest that the sodium dependent D-glucose transport is an electrogenic process; -the stimulation of D-glucose by sodium is reciprocal, i.e., it is also possible to demonstrate enhancement of the sodium uptake by a D-glucose gradient.

In addition to these results the presence of a sodium-potassium ATPase only in the basolateral membranes suggests that the mechanism of transepithelial D-glucose transport in the Atlantic hagfish includes the basic mechanisms found in higher vertebrates. Thus, D-glucose would enter the cell through the luminal membrane by a sodium co-transport system with the driving force being a transmembranal sodium gradient [in vivo concentrations amount to an extracellular sodium of 450 mM/l and 150 mM/l intracellular, (A. Brodal and R. Faenge, The Biology of Myxine, Universitetsforlaget, Oslo, 1963)], which is maintained by the Na^+K^+ATPase, i.e., D-glucose transport in the Atlantic hagfish archinephric duct is a secondary active transport. Supported by DFG and NIH.

THE EFFECT OF ESTRADIOL ON THE VERSCHLUSSVORRICHTUNG OF SQUALUS acanthias

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Introduction

The dogfish oviduct posterior to the shell gland coils before inserting in the wall of the uterus (Fig. 1). In 1907 Widakowich described this structure as a closing mechanism (Verschlussvorrichtung) and speculated that its function during pregnancy was to prevent uterine fluid from flowing through the oviduct and into the peritoneal cavity (Widakowich, V., Zool. Anz. 31, 636-643, 1907). He also pointed out the size discrepancy between the Verschlussvorrichtung of pregnancy and the maturing ova and further recognized that in order for eggs to traverse that portion of the oviduct a means of opening the oviductal lumen would be necessary. This report examines the possibility that hormones are involved in regulating the size of the Verschlussvorrichtung.

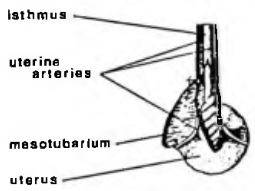

Figure 1.--The Verschlussvorrichtung in the oviduct of Squalus acanthias (after V. Widakowich, 1907).

Methods and Results

Pregnant state A (embryos < 4 cm) and stage C (fetuses > 19 cm) Squalus acanthias were randomly assigned to one of the following treatment groups: control, 17β-estradiol, relaxin, insulin, estradiol plus relaxin or estradiol plus insulin. 1 mg 17β-estradiol was adminstered in sesame or vegetable oil on days one and three of the treatment protocol. 500 μg porcine relaxin (N.I.H.) or 100 IU/kg bovine insulin (Sigma Chem. Co.) dissolved in 0.9% NaCl with 0.1% Benzopurpurine-4B were administered in a single dose on day five. All hormones were given via intraperitoneal injection. Animals were sacrificed on day six, three days after the second estradiol treatment or twenty-four hours after peptide hormone administration. The maximum circumference - that circumference at which the tissue ruptures - of the Verschlussvorrichtung was measured on 1 cm wide loops of tissue as previously described (Koob, et al., The Bulletin 21, 46, 1981). Cross-sectional areas were calculated using these data and assuming a circular shape. The area data are presented in Figure 2.

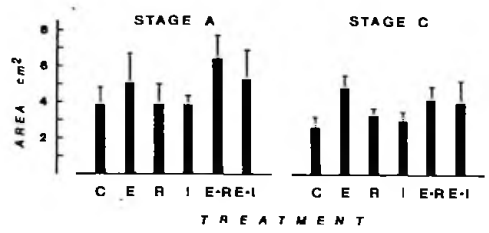

Figure 2.--Cross-sectional area of the Verschlussvorrichtung in Squalus acanthias treated with vehicles (C), 17β-estradiol (E), relaxin (R), insulin (I), estradiol plus relaxin (E+R) and estradiol plus insulin (E+I).

In stage A females, none of the hormone treatments significantly affected the maximum cross-sectional area of the Verschlussvorrichtung. Only estradiol alone was effective in stage C females in significantly increasing luminal cross-sectional area ($p < .05$). Relaxin and insulin had no effect either alone or after estradiol priming. In both stages of pregnancy, however, all groups receiving estradiol averaged larger cross-sectional areas than groups receiving vehicles or peptides. When the individual values were averaged on the basis of estradiol treatment, the means presented in Table 1 were obtained. For both stages of pregnancy the maximum cross-sectional area was significantly larger in the estradiol treated females ($p < .05$).

Table 1.--Cross-sectional area of the Verschlussvorrichtung in estradiol treated female Squalus acanthias

	Stage A		Stage C	
Group	n	area (cm^2)	n	area (cm^2)
no estradiol	13	3.86 ± 0.50	15	2.97 ± 0.28
estradiol	16	5.87 ± 0.81	17	4.36 ± 0.51

While it appears that estradiol is capable of increasing the luminal cross-sectional area of the Verschlussvorrichtung, the magnitude of the response is less than that necessary to allow passage of eggs which at ovulation measure 11 cm^2. Whether this is due to temporal and quantitative inadequacies in the estradiol treatment or to a lack of additional humoral factors is uncertain. It is clear, however, that the Verschlussvorrichtung of pregnancy must change in mass or material properties before egg transport can occur. Supported by NSF PCM 81-04144 to I.P.C.

PHYSIOLOGIC AND MORPHOLOGIC RENAL ADAPTATIONS TO A REDUCED PROTEIN INTAKE IN RATS

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Earlier findings in several mammalian species have shown that a low but adequate protein intake have the following renal effects: 1) the urea clearance is reduced relative to the glomerular filtration rate, as a result 2) the plasma urea concentration is not reduced in proportion to the reduction in the nitrogen intake, (B. Schmidt-Nielsen, Am. J. Physiol. 181:131-139, 1955; B. Schmidt-Nielsen, Physiol. Rev. 38:139-168, 1958), 3) the distribution of urea in the renal medulla differs markedly in animals on low and normal protein diets (B. Schmidt-Nielsen and R. O'Dell, Am. J. Physiol., 197:856-860, 1959; B. Truniger and B. Schmidt-Nielsen, Am. J. Physiol., 207: 971-978, 1964), 4) the recirculation index for urea (as defined by H. Valtin [Am. J. Physiol. 233:F491-F501, 1977], the fraction of filtered urea present in the distal convolutions) is significantly greater in the rat on low than in the rat on high protein diet (R.A. Danielson, B. Schmidt-Nielsen and C. Hohberger In: Urea and the Kidney, Excerpta Medica Press, pp 375-384, 1970). 5) More urea is reabsorbed from the collecting ducts by passive and active mechanisms (R. A. Danielson, B. Schmidt-Nielsen and C. Hohberger, Am. J. Physiol. 233:130-137, 1972; K.J. Ullrich, G. Rumrich and B. Schmidt-Nielsen, Pflugers Arch. 295:147-156, 1967). The present studies were undertaken to determine if renal anatomical changes may occur in the vascular bundles in the inner stripe of the outer medulla of the kidney when a rat is maintained for 30 to 40 days on a reduced protein diet. The increased