and glucose significantly decreased tissue sugars, with values approximately 50% of control levels (Figure 1). This increase in secretion coupled with a decrease in tissue content suggests that phlorizin may be inhibiting reabsorption of 2-d-Gal. Such a mechanism is certainly possible in light of the extensive phlorizin-sensitive reabsorption of Gal previously described in the flounder *in vivo* (Am. J. Physiol., 231:603-607, 1976). Glucose too inhibits Gal reabsorption in the flounder, and may, like phlorizin, also inhibit 2-d-Gal reabsorption.

In summary, 2-d-Gal shows extensive net secretion by the winter flounder in vivo. Secretion is accomplished via a peritubular carrier-mediated mechanism which may be blocked by galactose. Results using phlorizin and glucose as inhibitors suggest that 2-d-Gal may also be reabsorbed by an apical transport mechanism of lesser magnitude, perhaps via the carrier which mediates galactose reabsorption.

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BILE SECRETORY FUNCTION IN ISOLATED PERFUSED LIVER OF THE LITTLE SKATE, *Raja erinacea* II

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Preliminary studies (Bulletin, MDIBL, 1974) of bile secretory function in the isolated perfused skate liver performed at ambient temperature (22-25°C), demonstrated a linear rise in bile production with increasing perfusion pressure, which was presumably related to hydrostatic filtration through "leaky" intercellular junctions into the bile canaliculus. We therefore modified the previously described technique by maintaining the perfusate at 12-15°C by circulation through a coil immersed in a refrigerated bath. Additionally, the portal vein was perfused through a large glass cannula (inside diameter 2.5-3.0 mm) and the liver was inverted on a perforated petri dish to avoid hilar compression of the portal and biliary system by the weight of the liver and thus to maximize perfusate flow.

Perfusate pressure was varied from 1.5 to 2.0, 2.5, 3.5 and 5.0 cm of H_2O and resulted in a linear increase in perfusate flow as seen in previous experiments at ambient temperature. However, perfusate flow rates were 3 to 4 times greater at each given perfusion pressure increment. Bile flow rates varied considerably but increased with increasing perfusate pressure from 2.2 ± .84 $\mu l\ hr^{-1}\ g^{-1}$ liver at 1.5 cm to 4.17 ± 2.17 at 5.0 cm. There was no relation between perfusate flow and bile flow. Bile/plasma ratios of ^{3}H-inulin (N=5) or ^{14}C-inulin (N=4) also demonstrated considerable variation between experiments, but tended to increase toward unity during the study (0.50-0.92 after 4 hours).

Despite these fluctuations in bile flow and inulin permeability, the isolated perfused skate liver efficiently removed ^{35}S-bromsulphalein (BSP) and ^{14}C-sodium taurocholate (NaTc) from the perfusate. The initial hepatic uptake of ^{35}S-BSP (5 μCi, specific activity 50.2 μCi/mg) demonstrated a $T_{½}$ of 13.5 ± 2.6 min in 9 experiments as compared to a $T_{½}$ of 16.6 ± 2.6 min for the plasma disappearance of BSP in the free swimming elasmobranch (Am. J. Physiol., 230:974, 1976). Although hepatic uptake of ^{35}S-BSP was virtually complete by 2 hours in the isolated perfused skate liver (98.2 ± 0.6% of the administered dose), only small amounts appeared in bile by 4-5 hours. In contrast, 200-400 mg of NaTc, which was also removed efficiently by the isolated perfused skate liver by 2 hours (92.5 ± 5.9% of the administered dose), was largely recovered in bile

5 hours after the initiation of the perfusion (78.5 ± 15.9% of the administered dose). Additionally, a significant increase in bile flow (7.12 ± 2.16 μl hr^{-1} g^{-1} liver) was observed in 7 studies during the 3 hours following NaTc administration as compared to controls (4.17 ± 2.32, $p < 0.0125$).

These observations indicate that the isolated perfused skate liver is a useful model for the study of bile secretion in elasmobranchs when maintained at the normal temperature of sea water.

EFFECT OF ANGIOTENSINS AND EPINEPHRINE ON VASCULAR RESISTANCE OF ISOLATED DOGFISH GUT

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Pressure/flow curves were obtained from 11 isolated dogfish gut preparations taken from fish averaging 5 kg in weight. The previously described preparations (Opdyke and Wilde, Am. J. Physiol., 229:1141-1146, 1975) were perfused via the coeliac artery with oxygenated dogfish blood-elasmobranch saline mixture adjusted to 12% hematocrit (Hct) (low end of normal Hct range in dogfish). The weight of the preparations averaged 278 gm (range, 142-358 gm). A calibrated positive displacement pump (Harvard 1405) was used to provide known inflow rates. Inflow and outflow pressures were monitored by carefully calibrated Statham P23AA strain gages and a CRO recorder system (Electronics for Medicine IR4). Outflow pressure was held constant by fixing the orifice of the portal vein outflow cannula at the level of the portal vein which was approximately 2 cm above zero pressure reference level. The pressure gradient, coeliac artery to portal vein, was measured in each preparation at 3 to 9 different rates of inflow. A pressure/flow curve was constructed from these data for each preparation.

Following the collection of the data necessary to characterize the pressure/flow relationship, each of seven preparations was perfused in turn with oxygenated blood-saline mixture containing 1 μg/ml of angiotensin I, angiotensin II or epinephrine. The perfusate containing each compound was recirculated for several minutes following which the preparations were perfused with fresh blood-saline mixture containing no additives for 10 minutes or more before commencing the next trial. Inflow and outflow pressures were monitored continuously throughout each trial and recovery period. Inflow rate was the same for all trials in each preparation. Thus, any change in pressure gradient indicated a change in the resistance to blood flow according to the relationship

$$R = (P_i - P_o/F) \times 1332$$

where R = resistance to blood flow in dyne sec/cm^5; P_i = inflow pressure; P_o = outflow pressure (both in mm Hg); F = blood flow rate in ml/sec and 1332 = the factor for converting to cm/gm/sec units.

Figure 1 shows the pressure/flow relationship in three representative experiments. The relationship appears to be a linear one over the range of inflows studied as indicated by the fit of the calculated linear regression lines and the correlation coefficients of each experiment (Table 1). Critical closing pressure (inflow pressure at cessation of flow) was between 2 and 6 mm Hg in 8 of the experiments which is reasonable for low pressure systems. By using the means of all our observations of pressure gradient (22.95 mm Hg) and inflow (0.496 ml/sec) the