Table 2. Effects of dexamethasone treatment in vivo on taurine uptake by teased flounder renal tubules.

	control fish	dexamethasone-treated fish	
taurine T/M	13.60 ± 1.03 (n=10)	20.18 ± 1.83 (n=10)	p<.01

T/M = tissue:medium ratios for taurine uptake by the isolated flounder renal tubules. The values are the means ± S.E. The number of fish in each group is indicated in parenthesis. The dexamethasone-treated fish were given intramuscular injections of dexamethasone (10 mg/kg-day) for 5 days. Significant difference between means is indicated by p values.

26 TAURINE SECRETION BY ISOLATED RENAL TUBULES OF THE WINTER FLOUNDER, PSEUDOPLEURONECTES AMERICANUS

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Taurine (2-aminoethane sulfonic acid) is an amino acid found in high concentrations in the tissues of many marine invertebrate and vertebrate species and is an important intracellular osmolyte for cell volume regulation. An investigation of the renal handling of taurine in vivo has indicated that there is a net secretion of taurine by the kidneys of flounder, dogfish and the little skate (Schrock et al., Am. J. Physiol., in press). The present study, along with the companion report (see King et al., this Bulletin), makes use of the isolated flounder renal tubule to examine the magnitude and mechanism of taurine secretion by the renal epithelium.

Renal tubules from the winter flounder were dissected and prepared for collections of in vitro secreted fluid as described by Beyenbach (this Bulletin). The Ringer's composition of the bath in which the tubules were suspended was NaCl 148 mM, KCl 2.6 mM, NaH_2PO_4 2.7 mM, $Cacl_2$, 1.26 mM, $MgSO_4$ 1.24 mM, $NaHCO_3$ 11.0 mM, gassed with 99% O_2/1% CO_2 to a pH of 7.8. After a control period to verify fluid secretion by the isolated tubule, ^{14}C-taurine was added to the bath (approximately 10 μCi/ml bath; specific activity 56.08 μCi/μmol). Tubular taurine secretion was measured from the appearance of the label in the collected secreted samples. Bath samples were taken to determine ^{14}C-taurine activity and taurine concentration calculated. At the end of the experiment, the tubules length and inner and outer diameters were measured and the tubule itself was harvested for the measurement of total C^{14} activity. Epithelia cell taurine concentration was then calculated as the difference of total C^{14}-activity and the lumen C^{14}-activity.

Results and discussion. The time course of taurine secretion for a representative tubule is shown in Table 1.

Table 1. TIME COURSE OF TAURINE SECRETION FROM A REPRESENTATIVE RENAL TUBULE EXPERIMENT

sample time (min)	$\dot{V}_s$ pl/min·mm	bath [TAU] mM	lumen [TAU] mM	L/B	TAU secretion rate fmole/min·mm
t=10	21.57	0.317	0.20	0.64	4.4
t=40	66.83	0.317	1.69	5.34	113
t=68	14.61	0.317	12.11	38.13	177
t=100	19.40	0.317	18.46	58.26	358
t=132	16.04	0.317	23.98	75.56	385
t=166	16.28	0.317	26.42	83.28	430
t=198	23.06	0.317	25.04	78.90	577

The sample times indicate the minutes elapsed after adding ^{14}C-taurine to the bath. At t=198 min., the last sample of secreted fluid was collected; the cell taurine concentration at this time was 84.96 mM.

$\dot{V}_s$ represents fluid secretion rates. L/B = lumen/bath taurine concentration ratios.

These data indicate that within minutes after adding ^{14}C-taurine to the bath, the label begins to appear in the secreted fluid exiting from the open end of the tubule. After 1 1/2 to 2 hours, taurine secretion rates and taurine lumen/bath ratios reached steady-state values for all tubules.

In all tubules, where these studies were attempted, taurine was secreted (Table 2). Only one experiment

Table 2. TAURINE SECRETION BY ISOLATED FLOUNDER RENAL TUBULES

tubules	$\dot{V}_s$ pl/min·mm	bath [TAU] mM	cell [TAU] mM	lumen [TAU] mM	L/B	C/B	C/L	TAU secretion rate fmole/min·mm
n=5	34.95 ±10.6	0.47 ±0.13	63.8 ±8.9	11.8 ±3.8	25	135	5.4	391±122

Values are means ± S.E. $\dot{V}_s$ represents fluid secretion rates. L/B = lumen/bath, C/B = cell/bath, and C/L = cell/lumen taurine concentration ratios.

was terminated early, due to epithelial cell lysis caused by dilution of the bath Ringer's with the temperature-control circulating water. Although the results of this experiment were in the same direction as the others, the magnitude of secretion was much reduced as expected. The results shown in Table 2 are steady-state data averaged from the last sample collections. Taurine secretion rates averaged 391 fmole/min·mm. The lumen/bath taurine concentration ratio for these tubules was 25 which is similar to the tissue/medium ratios for taurine uptake by teased flounder tubules (see King et al., this Bulletin). The taurine concentrations for bath, cell, and lumen were 0.47 mM, 63.8 mM, and 11.8 mM, respectively. Without knowledge of the taurine net electrical charge during secretion and the magnitude of the basolateral and apical membrane potentials, these data suggest an active step of taurine secretion across the basolateral membrane of the epithelium and a passive step from cell to lumen by passive or facilatated diffusion across the apical membrane.

EGG-OVIDUCT SIZE RELATIONSHIPS IN RAJA ERINACEA

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The little skate, Raja erinacea, spawns throughout the year in the North Atlantic and, like all skates, is oviparous (Richards et al., Bull. Bing. Oc. Coll. 18, 5-65, 1963). Characteristically shaped, leathery egg capsules are produced in pairs for periods up to six weeks by females of at least 200 grams. Egg development never progresses beyond the germinal ring stage in utero. Embryogenesis and fetal development are completed external to the maternal environment.

Egg case formation begins before ovulation and is nearly one third complete before the egg enters the shell gland. In passing through the shell gland, the egg is elongated and, with accompanying albumen, packaged in the egg case. The egg case enters the isthmus and is held there until oviposition. Egg case formation requires a minimum of 48 hours and in most cases is followed quickly by oviposition (Richards et al., op. cit.). The oviduct must facilitate passage of a rigid egg case unique in shape and larger in size than the egg (Figure 1). Eggs at ovulation measure 7/1 cm. in circumference while spawned egg cases average 8.2 cm. The reproductive tract could have either a circumference sufficient in size at all times to accommodate the egg case, or an ability to increase its natural circumference during follicle development or at spawning. This report investigates these possibilities.

The female reproductive tract of the little skate (Figure 1) consists of an anterior ostium, an albumen secreting oviduct, the shell gland, an isthmus or uterus and a vaginal constriction through which egg cases