bathing media. Na-dependent Cl accumulation has also been demonstrated for rabbit gallbladder (Duffey et al., J. Memb. Biol. 42:229, 1978) and renal proximal tubule (Spring and Kimura, J. Memb. Biol. 38:233, 1978).

The intracellular Na activity in flounder small intestine is not known, but is almost certainly much lower than that in the mucosal solution. However, even if $(Na)_m = (Na)_c$, the potential difference derived entirely from ψ_{mc} of 69 mV is more than enough to propel Cl entry against its calculated electrochemical potential difference, i.e.,

$$\Delta\tilde{\mu}_{Cl} = (RT/F)\ \ln\ [(Cl)_c/(Cl)_m] - \psi_{mc} = 32\ \text{mV}$$

Thus, the present findings and the findings by Frizzell et al. (J. Memb. Biol., in press) which suggest that the unidirectional influx of Cl is coupled to the influx of Na constitute compelling evidence that the downhill Na-gradient across the mucosal membrane at the very least contributes to the energy necessary for the uphill accumulation of Cl by the cell and is more than sufficient to entirely energize this movement!

The mechanism responsible for Cl exit from the cell across the baso-lateral membranes is unknown but, at present, simple diffusion cannot be ruled out. In any event it seems highly likely that Cl absorption by flounder intestine is entirely energized by coupling to the electrochemical potential difference of Na across the mucosal membrane which, in turn, is established and maintained by a mechanism that actively extrudes Na from the cell across the baso-lateral membrane. While the active extrusion of Na is directly coupled to a source of metabolic energy, no direct coupling between Cl transport and metabolic energy need be invoked. Supported by research grants from the NIH-NIAMDD (AM-16275 and AM-18199) and the Wechsler Research Foundation.

INTRACELLULAR ELECTRICAL POTENTIALS AND CHLORIDE ACTIVITIES IN THE PERFUSED RECTAL GLAND OF *Squalus acanthias*: A REPORT OF PRELIMINARY DATA

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The in vitro perfused rectal gland of *Squalus acanthias* is capable of actively secreting Cl from the perfusate (serosal solution or plasma) into the ductal fluid; many of the central characteristics of this secretory process have been described by Silva et al. (Am. J. Physiol. 233:F298-F306, 1977).

The purpose of the preliminary studies described in this report was to determine the intracellular electrical potential and the thermodynamic activity of cell Cl under control conditions.

Methods

Rectal glands were isolated and perfused through the rectal gland artery with dogfish-Ringer's using the methods described by Solomon et al. (MDIBL Bull. 17:59-63, 1977). The glands were simply submerged in the perfusion fluid at 15°C contained in water-jacketed glass reservoirs. A 3 mm^2 section of the capsule was removed from the outer surface of the gland to expose the contraluminal surface of the tissue for impalements with conventional (KCl-filled) and Cl-selective microelectrodes.

The methods of fabricating and calibrating microelectrodes and recording data have been described in detail (Duffey et al., J. Memb. Biol. 42:229-245, 1978).

Results

Two glands were studied. The electrical potential difference across the contraluminal membrane determined in 7 successful impalements averaged -81 ± 4 mV and was remarkably uniform (average value for one gland was -88 mV and that for the other was -77 mV). The electrical potential difference recorded by the Cl-selective microelectrode in 10 successful impalements averaged -52 ± 1 mV and also was remarkably consistent. The intracellular Cl activity calculated from these values as described previously (Duffey et al. J. Memb. Biol. 42:229-245, 1978) is 60 mM, a value nearly 9 times that which would be predicted by the Nernst equation for an equilibrium distribution in the presence of an extracellular activity of 206 mM (290 mM x 0.71 =).

Silva et al. (unpublished observations) have found that the intracellular concentration of Cl in shark rectal gland averages 91 ± 8 mM (16 glands). Thus, the apparent activity coefficient of cell Cl is (60/91) = 0.66, a value only slightly lower than 0.78, the activity coefficient of an aqueous solution of 100 mM NaCl. This suggests that, given the uncertainties involved, there is not likely to be much sequestration or binding of cell Cl.

Conclusion

Silva et al. have proposed a model for active Cl secretion by dogfish rectal gland which involves the uphill movement of Cl into the cell across the contraluminal membrane coupled to the downhill entry of Na. The present finding that cell Cl is, in fact, well above the value predicted for an equilibrium distribution is consistent with this model. Additional studies designed to explore the Na-dependency of Cl accumulation are clearly indicated. Supported by research grants to R.A.F. and S.G.S. from the NIH-NIAMDD (AM-16275 and AM-18199) and the Wechsler Research Foundation and by research grants to F.H.E. and P.S. from the National Science Foundation (PCM 77-01146) and the NIH-NIAMDD (AM-18078).

EFFECTS OF CRUDE OIL FRACTIONS ON HERRING GULL CHICKS (*Larus argentatus*)

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Perhaps the most alarming effect of crude oil on young marine birds (i.e., gulls and guillemots) is the prolonged reduction in growth observed after ingestion of a single small dose (Science 199: 315-317, 1978; Bull. MDIBL 17:40-42, 1977, and this volume). The specific compound(s) responsible for this effect is unknown. Crude oil is a complex mixture of hundreds of organic compounds, and a reasonable approach to solving this problem appears to be testing of oil fractions in the sensitive gull chick system. We present here results of such experiments with South Louisiana crude oil (SLC).

Herring gull chicks were collected from either Old Man Island or Little Duck Island, Maine, and maintained as previously described (Science 199:315-317, 1978). Experimentals received a single oral dose (stomach tube) of 1 ml SLC or that amount of a given fraction found in 1 ml of whole oil; controls were not dosed. Birds were weighed daily after dosing. At day 7 birds were sacrificed and tissues were weighed and frozen for residue analyses (data not yet available). Two crude oils were used, both supplied as SLC by the American Petroleum Institute; one oil was obtained in 1976 (SLC-76; used in previous studies) and the other in 1978 (SLC-78). Oils were fractionated on alumina into aliphatic and aromatic fractions.

Neither SLC-78 nor its fractions had any effect on chick growth. In contrast, SLC-76 and its aromatic fraction did significantly inhibit growth (Table 1). Although 7 day body weights for the SLC-76 aliphatic gulls were somewhat lower than controls, the difference was not significant. Adrenal and nasal salt gland weights for aliphatic dosed gulls were significantly higher than controls, but were significantly lower ($p < 0.05$) than either whole oil or aromatic dosed birds. Analysis of oil samples by capillary gas-liquid chromatography and mass spectrography showed that SLC-78 lacked