

Intact, unfertilized sand dollar eggs were chosen for this investigation. Although these eggs were found to be impermeable to many solutes including several amino acids, acetamide and propionamide penetrated freely. Some preliminary evidence was obtained for interaction between these two solutes in experiments where one solute was allowed to equilibrate between the eggs and external medium before the second solute was added. Theoretical equations were derived which indicate the reciprocal effects to be expected in the interaction of the solutes on each other. Further experimental work is planned on both fertilized and unfertilized eggs, as well as on individual cells from embryos dissociated in calcium-free media at the two and four cell stages.

### **Interacting Flows in Diffusion Across the Cell Membrane of Sand Dollar Eggs**

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Additional data were obtained on the interactions between flows of solvent and one or more permeable solutes across the cell membrane of unfertilized sand dollar eggs. Measurements with an ocular micrometer were supplemented by photographic studies which permit more complete measurement of individual eggs and allow direct comparisons to be made among different eggs.

Definite solute-solvent interactions were demonstrated. Thus in one type of experiment, eggs equilibrated in sea water solutions were transferred to other solutions having the same freezing point, but having the impermeable salts replaced in part by a permeable solute, acetamide. The rate of water penetration accompanying the solute penetration was much greater than would be predicted from the osmotic imbalance resulting secondarily from the solute penetration. Some preliminary evidence for solute-solute interaction between different permeable solutes was also obtained.

### **Interacting Flows in Diffusion Across the Cell Membrane of Sand Dollar Eggs**

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Studies on interacting flows in diffusion across the cell membrane of unfertilized sand dollar eggs were extended to mixtures of sea water, ethylene glycol, and propylene glycol. These solutes are superior to acetamide and propionamide in their apparent lower toxicity to the eggs.

Experiments with ethylene glycol and propylene glycol separately showed marked solute-solvent interaction. The magnitude of this inter-

action may be expressed by "sigma," the ratio of concentration of impermeable solute to concentration of penetrating solute necessary to maintain zero volume flow. Sigma values for ethylene glycol and propylene glycol were 0.9 and 0.65 respectively. Further experiments performed with both solutes present simultaneously showed effects which are consistent with solute-solute interactions.

### **Renal Transport of Urea and Some Carbohydrates in (*Lophius Piscatorius*)**

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Previous studies by others on the goose fish with non-electrolytes have led to the following conclusions. 1. The U/P ratio for exogenous urea is greater than 1.0, and probably is indicative of urea secretion. 2. The renal tubular epithelium is impermeable to sugars. Our work this summer has shown that urea U/P ratios were 1.0 when urea was injected into muscles of the head region and were greater than 1 only when injected intramuscularly in the tail. We feel that the apparent discrepancy results from the fact that the kidney in *Lophius* is supplied almost entirely by venous blood from caudal regions. If urea is injected IM into tail muscle, blood perfusing the kidney would have a higher concentration of urea than that in mixed venous or arterial blood. Earlier investigators injected into tail muscle and used heart blood for computing plasma urea concentrations. Consequently, they calculated erroneously high U/P ratios. The present data give no basis for postulating urea secretion by goose fish.

We were also able to show that significant quantities of D-arabinose, L-arabinose and fructose are able to diffuse across the tubular epithelium. The appearance of such substances in urine might have resulted from either exchange diffusion or passive diffusion along a chemical gradient. U/P ratios for L-arabinose and D-arabinose were similar, suggesting that passive diffusion predominated, since L-arabinose is transported more readily than D-arabinose in several other systems possessing exchange diffusion mechanisms.

### **Calcium and Iron Transport in the Shorthorn Sculpin and Fundulus**

Thomas Manis and James Manis

Active transport mechanisms for calcium and iron have been demonstrated in the small intestine of the rat using everted gutsacs *in vitro*. Similar experiments were carried out at the Mount Desert Island Biological Laboratory during August of 1961 using the intestine of two teleost fishes.