tion but this needs further investigation. The cellular lysis of senile regression involves an apparent time dependent activation in vivo. The in vitro analysis suggests the enzyme is present in maximum levels in mature hydranths presumably in a controlled low functional level which changes to a high functional level as aging occurs.

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1966 #27

THE MOVEMENT OF FOREIGN ORGANIC COMPOUNDS ACROSS THE GILLS OF MARINE ANIMALS

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It has been assumed (B. B. Brodie, The Pharmacologist 6:12, 1964) that the gills and/or skin of fish constitute a typical lipoid membrane permeable to the passage of lipoid soluble agents. The apparent lack of drug metabolizing enzymes in fish may be explained by the assumption that fish would not need specialized mechanisms to excrete lipid soluble foreign agents from their body. A number of recent studies have indicated that drug metabolizing enzymes are indeed present in teleost and elasmobranch fish. It is the purpose of this communication to record observations on the permeability of fish gills to foreign organic compounds.

The plan of the experiment was as follows. A foreign organic compound was administered via the caudal artery or intramuscularly to a medium sized dogfish, Squalus acanthias. One to two hours later the fish was placed in a box packed with a small amount of ice. The cephalad portion of the fish, including the mouth and gills, was enclosed in a plastic bag secured around the abdomen well anterior to the cloaca. The bag contained exactly 2 or 3 liters of sea water. Vigorous bubbling by forcing air or oxygen through a large porous stone occurred throughout the course of the experiment. The temperature of the fish and the accompanying sea water was maintained close to 10° C throughout the experiment. Sea water and arterial plasma obtained from an indwelling catheter were sampled in the first 15-60 minutes. In the sculpin (Myoxocephalas scorpius) experiments a similar arrangement was followed except that the cloaca was stitched shut and the small sculpin were allowed to swim around in one liter of oxygenated sea water. The excretory pores of the lobster (Homarus vulgaris) were occluded by a rubber band and the lobsters were allowed to swim in one liter of sea water after intravascular injection of the drug. In a single experiment, a constant flow of sea water (1.3 L/min) was maintained through the gills of a dogfish. The outflow was monitored for drug excretion in one minute timed periods.

It may be seen that approximately 1/2 to 1% of the dose per hour was excreted when sulfadiazine and paraaminobenzoic acid were the compounds in question. This represents a clearance of from 3-16 milliliters per hour. With lipoid soluble antipyrine, between 2-5% of the dose per hour was excreted and the clearance ranged from approximately 50-150 milliliters per hour. The estimated gill blood flow of these fish was 3 to 4 thousand milliliters per hour. In the single constant flow experiment clearance was 150 ml/hr and 5% of the dose was excreted per hour. Clearances were not calculated for the lobster or sculpin, but it can be seen that approximately

Pl. conc. μg/ml	Sea water conc. Δ μg/ml	Elapsed time (min)	Clearance ml Pl/hr	% dose lost per hr
Dogfish		Sulfadiazine		
1040	0.5	20	3.0	1
400	0.35	15	6.5	1
Dogfish		p-Aminobenzoic acid		
168	0.65	60	8	1/2
112	0.90	60	16	1/2
104	0.12	45	3	<1/2
Dogfish		Antipyrine		
69	0.8	15	139	5
88	0.7	30	48	2
104	2.2	45	85	2
Sculpin		Antipyrine		
400±	4.5	30		11
400±	4.0	30		10
400±	4.3	30		11
Lobster		Antipyrine		
132	3.5	30		14
80	4.0	30		24
308	1.0	22		6

10% of the dose per hour of antipyrine was excreted by the sculpin and between 6 and 24% per hour of antipyrine by the lobster.

These results suggest that the gills of these three animals are relatively impermeable to a substance as lipoid soluble as antipyrine.

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CLEAVAGE OF SAND DOLLAR EGGS WITH CONSTRAINED SURFACES

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In dividing echinoderm eggs new surface is produced by stretching the old. Normally the pattern of stretching is predictable, the greatest amount taking place at the poles of the cell and the least in the furrow. This specific pattern has been invoked as an intrinsic part of several hypothetical cell division mechanisms. An experimental analysis of the relation between cleavage and the normal stretch pattern was, however, lacking. The purpose of this investigation was to determine whether cleavage could occur in cells whose surface had been manipulated to dis-