

beyond the 2 cell stage; while in the alkaline solution all segmented and reached the 8 or even 16 cell stage. It should be added that the eggs of *Arbacia* will develop in a neutral solution of Na+K+Ca to the blastula stage.

I found also that in mixtures of Na+Mg or Na+Sr or Na+Ba more eggs of *Arbacia* segmented and reached a higher stage of segmentation, when the solutions were slightly alkaline than when they were neutral. These experiments seem to indicate that for the fertilized eggs of the sea urchins the antagonistic action of Ca to NaCl makes itself felt mostly in such processes in which a concentration of HO ions higher than 10^{-7} N is required, while the K ions act antagonistically to NaCl through their participation in processes which may take place in neutral or even slightly acid mediums.

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Digestion of protein in the stomach and intestine of the dogfish.

By **DONALD D. VAN SLYKE** and **GEORGE F. WHITE.**

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Dogfish were fed by a tube with chopped, coagulated beef, and killed after 6, 12, 24, 48 and 72 hours. In the contents of the intestine and stomach determinations were made of (a) insoluble nitrogen, (b) soluble nitrogen, (c) soluble nitrogen in amino form,¹ and (d) soluble nitrogen in amino form after complete hydrolysis. The ratio $d : c$ indicates the average size of the peptides composing the peptone mixture.

During the first six hours about one half the ingested protein is dissolved and one fourth absorbed. The unabsorbed peptones are, on the average, of pentapeptid complexity. Very little transfer of stomach contents to the intestine occurs.

At the end of 12 hours 30-45 per cent. of the protein in the tract, including both solid and dissolved matter, is found in the intestine. The peptone in the stomach is broken down to the tripeptid stage, that in the intestine slightly farther.

¹Van Slyke, these *Proceedings*.

After 24 hours 40–70 per cent. of the nitrogen has disappeared, presumably by absorption, and of that left, in both stomach and intestine, 65–85 per cent. is in solution. The peptone in both stomach and intestine is midway between the di- and tripeptid stages. It remains at this stage until absorption is complete, which occurs in 48–72 hours. After 48 hours, in two cases out of three, only 14 per cent. of the ingested nitrogen remained in the tract.

Urea is constantly present in the intestine. It is excreted with the bile, which contained, in the samples analyzed, 1.7 per cent. of urea, in which form over 70 per cent. of the total bile nitrogen is found.

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Absorption and excretion of alimentary nitrogen.

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Beef and different forms of fish flesh were fed to a dog in nitrogenous equilibrium, the daily diet containing 3 grams of nitrogen, in the form of chopped meat, 65 grams of starch, and 26–27 grams of fat. The animal was catheterized 3, 6, 9, 12 and 24 hours after feeding, and the daily feces were separated by addition of lamp black to the diet. The rise in the rate of nitrogen excretion in the urine was taken as an index of the rate of absorption, the excretion of nitrogen in the feces as a measure of the completeness of absorption. The significance of the results is shown by the following figures:

Food.	Boiled Cod.	Fried Cod.	Boiled Beef.	Boiled Trout.	Boiled Eel.	Boiled Weakfish.	Boiled Mussel.	Boiled Salt-cod.	Boiled Litorina.
Nitrogen in urine during first 9 hrs. after feeding.	1.50	1.36	1.29	1.28	1.24	1.23	1.23	1.07	1.00
Nitrogen absorbed in 24 hrs.	1.98	1.80	2.58	2.55	1.91	2.53	2.40	2.58	2.37
Nitrogen excreted in urine in 24 hours.	2.51	2.48	2.76	2.35	2.20	2.34	2.22	2.29	1.90
Nitrogen retained.	-.53	-.68	-.18	+.20	-.29	+.18	+.18	+.29	+.47

The foods in the table are arranged in rank according to the