end arm from natural or artificial sap in the other. Sea water, $CHCl_3$, and sap correspond to (A), (B), and (C) above, and the $CHCl_3$ is supposed to correspond to the plasma membrane of a living cell. All are stirred. Dyes are placed in the sea water and their relative rates of entry into both (B) and (C) noted.

As indicated above, the time-distribution relations of the dye in the artificial cell are not determined by partition coefficients alone. Furthermore, since partition coefficients were not determined, the artificial cell affords no evidence at all as to the part played by them. It is not therefore allowable to conclude that partition coefficients account for the general parallelism between artificial and living cells. Such parallelism is better correlated with other well-defined characteristics of the dyes used. No dye with a formula weight exceeding 456, nor any acid dye, was found in the sap of either the living or artificial cell at the time of the only recorded observation (3 hours). Among the basic dyes, the most highly ionized penetrated slowest; and all the acid dyes tested are strong acids. Formula weight, ionization, or sign of charge might account for the failure to enter the cells.

Confirmation of the above criticisms was obtained by applying similar tests to a series of redox indicators and other dyes: we used 4 indophenols, 3 indigo sulphonates, methylene blue, erythrosine, and brilliant cresyl blue. Many discrepancies between the artificial and living cells were found. In particular, all the indophenols went into the $CHCl_3$ of the artificial cell; all except one entered living *Valonia* cells, but none went into the "sap" of the artificial cell. The multiple partition coefficient hypothesis therefore, rests upon unsound theoretical and experimental bases.

6052

Effect of Liver Poisoning on the Action of Parathyroid Extract.

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The mechanism by which parathyroid extracts increase the level of the blood calcium is almost completely unknown. Sendroy and Hastings[1] have shown that *in vitro* such extracts have no effect on

[1] Sendroy, J., and Hastings, A. B., *J. Biol. Chem.*, 1927, **71**, 783, 797.

the solubility of slightly soluble calcium salts. Similarly, we found that parathyroid extract did not increase the calcium content of serum incubated with fresh bone preparations. Bodansky, Blair and Jaffe[2] have shown that in the living animal the increase of the blood calcium on prolonged treatment is brought about by dissolution of the bone salts.

Since the effect of the extracts does not seem to be on the bone directly, the idea suggests itself that some other organ or tissue may be also involved in the action of the parathyroid hormone. Because the liver carries on so many of the chemical functions of the body, it was decided to first make some attempts to test whether the liver might be involved in the action of parathyroid extracts. The choice of the liver was made more attractive by the findings of Minot and Cutler[3] that calcium reserve is a protection against acute carbon tetrachloride and chloroform poisoning.

We determined the response of dogs with experimentally induced liver injury, to parathormone injection.* To date only phosphorus has been employed to produce liver damage, and in these animals it has been found that the normal response to parathormone disappears.

A typical protocol of the results obtained with phosphorus poisoning is the following:

Dog B. Weight 11 kilos. Normal Control Period. Date, 12-10-1931.
100 units of parathormone injected subcutaneously. Blood drawn immediately and at 6 and 24.5 hours after the injection.

	Analyses.			
Time after injection, hours	0	6	24.5	
Calcium mg./100 cc.	11.7	14.3	17.3	Inorganic serum phosphate in control sample, 5.0 mg. per 100 cc.

First Phosphorus Period.

12-15-1931	2:30 P. M.	5 mg. P in olive oil injected subcutaneously
12-16-1931	10:00 A. M.	6 mg. P in olive oil injected subcutaneously

100 units parathormone injected

Analyses of blood samples

Time after injection, hours	0	6.5	24
Calcium mg./100 cc.	12.9	14.7	13.7

Dog recovered and was quite comfortable. Allowed a rest period to 1-14-32.

Second Phosphorus Period

1-14-32	9:30 A. M.	5 mg. P in olive oil injected
1-15-32	9:30 A. M.	8 mg. P in olive oil injected

100 units of parathormone injected

Analyses of Blood Samples

Time after injection, hours	0	7	11.5	24	77
Inorganic serum phosphate mg./100 cc.	5.05	4.60	4.05	2.95	2.45
Calcium mg./100 cc.	11.40	11.85	11.70	11.65	9.50

[2] Bodansky, A., Blair, J. E., and Jaffe, H. L., *J. Biol. Chem.*, 1930, **88**, 629.

[3] Minot, A. S., and Cutler, J. T., *J. Clin. Inves.*, 1928, **6**, 369.

* The parathormone used in these experiments was kindly furnished us by Eli Lilly and Company.

1-18-32 2:30 P.M. The dog sacrificed 77 hours after last injection period. A blood sample was taken at this time with the results given in last column. The serum of this blood sample was highly jaundiced.

Autopsy. The liver was of a pale brownish yellow color, very soft and friable with all the characteristic signs of phosphorus poisoning. Kidneys seemed normal.

These results necessarily must be taken with caution but they do seem to point to a connection between the liver and parathyroid action. The effect of other liver poisons is now being studied.

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Studies on Arginine II. Phosphoarginine as a Possible Precursor of Creatine.

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Arginine was first suggested as the mother substance of creatine by Czernecki.[1] From theoretical considerations the hypothesis has been generally regarded as an attractive one. It is in accordance with the fact that arginine, creatine and creatinine are the most abundant of the guanidine derivatives present in the animal organism. It is possible to postulate a series of plausible reactions by which the conversion of arginine to creatine might conceivably be accomplished.[1] It is also in harmony with the mutually exclusive occurrence of arginine and creatine as demonstrated by Kutscher and Ackermann.[2] These investigations have shown that creatine, a characteristic constituent of vertebrate muscle, is replaced by arginine in invertebrate muscle. Indeed the corresponding phospho esters, in which the muscle arginine and creatine largely occur, are even functionally equivalent.[3, 4]

Nevertheless, efforts to demonstrate the origin of creatine from arginine have been unsuccessful, almost without exception. Numerous investigations, described in Hunter's monograph,[5] and others referred to by Hyde and Rose[6] have been entirely negative in result or open to serious criticism upon some crucial point.

1 Czernecki, W., *Z. physiol. Chem.*, 1905, **44**, 294.

2 Kutscher, F., and Ackermann, D., *Z. Biol.*, 1926, **84**, 181.

3 Meyerhof, O., and Lohmann, K., *Naturwissenschaften*, 1928, **16**, 47.

4 Lundsgaard, E., *Biochem. Z.*, 1930, **230**, 10.

5 Hunter, A., *"Creatine and Creatinine,"* Longmans Green, 1927.

6 Hyde, E. C., and Rose, W. C., *J. Biol. Chem.*, 1929, **84**, 535.