1,2-Propanediol-2-Phosphate in Ascaris lumbricoides

Abstract. *No phosphagen is present in the body-wall muscle of* Ascaris lumbricoides. *A stable phosphorus compound, which on the basis of its chemical reactions seems to be 1,2-propanediol-2-phosphate, constitutes more than half of the acid-soluble phosphorus compounds.*

During a study of the acid-soluble phosphorus compounds in the body-wall musculature of *Ascaris* we found little, if any, phosphagen; the amount of phosphorus set free by 1-minute hydrolysis in 0.06*N* sulfuric acid (treatment which leads to complete hydrolysis of phosphoarginine) scarcely exceeded that expected to be liberated from adenosine triphosphate. Colorimetric determinations of free and bound arginine confirm these findings. Stable phosphorus compounds were present in unusually high amount; in 20 experiments, the content of acid-soluble phosphorus compounds was 32.0 ± 7.1 μmole/g and only 11.8 ± 3.2 μmole/g were hydrolyzed by boiling in 1.0*N* sulfuric acid for 180 minutes.

The bulk of stable phosphate was not precipitated either by barium alone or after addition of alcohol (*1*). The amount of nonhydrolyzable phosphorus remaining in the supernatant depended on final concentration of the solution: in two extracts, 7.7 and 6.7 μmole/g, respectively, remained in solution; the corresponding values for the same extracts after a 1:10 dilution were 14.5 and 13.4 μmole/g. Apparently the stable compound in *Ascaris* muscle forms a more soluble salt than most other phosphates, but, even so, its solubility is slight.

Alcohol was evaporated from the supernatant, barium ions were removed by a cation-exchanger (Dowex 50 W), the acetic acid remaining after addition of barium acetate was extracted with ether, and the sample was concentrated by lyophilization and subjected to electrophoresis on Whatman No. 3 paper. Salicylate buffer (0.1*M*, *p*H 3.9) was used because it allows the paper to be stained with sulfosalicylic acid–ferric chloride without decomposing compounds on the paper. The strip was cooled with carbon tetrachloride saturated with salicylic acid to prevent extraction of the salicylic acid from the buffer, which was also saturated with this acid. The compound appeared as a single spot with a mobility of 0.83 with respect to inorganic phosphate. It was very stable, judged by its resistance to hydrolysis in 5*N* sulfuric acid at 100°C; after 2, 4, 8, and 16 hours respectively, the corresponding degree of hydrolysis was 3.85, 5.65, 11.2, and 23.9 percent.

Properties of the unknown compound indicated that it might be propanediol phosphate, which is also very stable to acid hydrolysis (*2, 3*); its barium salt is a little more soluble in alcohol than the barium salts of other phosphorus compounds of biological origin (*1, 4, 5*). Both the extracted compound and synthetic propanediol phosphate prepared from propylene oxide and phosphate (*6*) had identical mobility values.

Upon paper chromatography with a mixture of propanol, ammonia, and water (*7*), the synthetic compound forms one main spot (R_F with respect to inorganic phosphate, 1.57) and sometimes another spot with an R_F of 1.28 with respect to inorganic phosphate. Formation of two spots is believed to be caused by the presence of two isomers of propanediol phosphate (*6*). The extract from *Ascaris* formed a spot with an R_F of 1.28, which suggests the presence of 1,2-propanediol-2-phosphate.

The synthetic compound was treated with bromine (*8*), and the reaction product was subjected to ionophoresis. Two spots appeared: a large one (mobility 0.90), corresponding presumably to acetol phosphate formed from the 1-isomer (that is, propanediol-1-phosphate) and a smaller spot (mobility 1.10), corresponding to lactic acid-2-phosphate derived from propanediol-2-phosphate (*8*). The compound extracted from *Ascaris lumbricoides* and purified by ion-exchange chromatography gave only the spot with a mobility of 1.10 when treated with bromine. This is further evidence that the extracted compound is 1,2-propanediol-2-phosphate.

Propanediol phosphate found in small amounts in brain (*2, 5*), liver and kidney (*1, 9*), Flexner-Jobling carcinoma (*4, 10*), and in the lens (*11*) has been reported to be the 1-phosphate, but little is known of its physiological function (*8, 12, 13*). The high accumulation of the compound in *Ascaris lumbricoides* suggests other than metabolic functions. It may, for example, contribute as nonpermeating anion to the osmotic balance of the cells.

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Glucagon, Starvation, and the Induction of Liver Enzymes by Hydrocortisone

Abstract. *Glucagon selectively potentiates an effect of hydrocortisone: when injected into adrenalectomized rats it increases fourfold the induction by hydrocortisone of tyrosine transaminase, but not of tryptophan pyrrolase. Glucagon alone doubles the basal level of tyrosine transaminase and decreases that of tryptophan pyrrolase. The effects of glucagon on both enzymes resemble those of starvation.*

Since the first observation on the induction of rat liver tyrosine transaminase by a glucocorticoid (*1*) in 1955, additional inducers have been found (*2*), but none more effective than hydrocortisone. The enhancement, by starvation, of the hydrocortisone induction of tyrosine transaminase that was recently observed (*3*) led us to identify glucagon as a new regulatory factor of this enzyme.

Figure 1 shows the different effects