On the specificity of the ATP-effect.*

by

F. B. STRAUB.

Actomyosin, in 0,6 *M* KCl, is split into actin and myosin by the addition of small amounts of ATP. This is evidenced by the fall of the viscosity, the original high viscosity returning if the ATP is removed. We find that the same effect is also produced by inorganic pyrophosphate. This is shown in Table I. Adenylic acid, ortophosphate and metaphosphate were found to be without any effect. ADP did not show any effect if pure myosin and actin were used for the preparation of actomyosin, it was however active, if impure myosin and actin were used. This is most likely due to contamination of myosin in the latter case by the enzyme system, which brings about the transformation of ADP into some other compound with a pyrophosphate group.

Table I.

Added substance	Relative viscosity of actomyosin in 0,6 *M* KCl at 0°
None	1,70
0,0007 Mol/lit ATP	1,28
0,00002 „ „	1,28
0,0006 „ Na-pyrophosphate	1,28
0,00006 „ „	1,29
0,00001 „ „	1,375
0,000003 „ „	1,425

There is some difference between the effect of ATP and inorganic pyrophosphate. Whereas the effect of ATP is almost

* This work was aided by a grant from the Duke ESTERHÁZY.

instantaneous, the effect of pyrophosphate takes some time to develop, especially so at smaller pyrophosphate concentrations. As pyrophosphate is not split by the myosin, its effect is permanent, in contrast to the effect of ATP, which is soon abolished, due to the splitting of ATP by the myosin. If, however, the actomyosin, to which pyrophosphate was added, is precipitated and washed with dilute saline solution, pyrophosphate can be removed and the actomyosin shows again a high viscosity. Thus the effect of inorganic pyrophosphate is reversible.

The action of pyrophosphate depends on the temperature. At 0° and at 6,5° it acts like ATP in very dilute solutions. At 23° however, inorganic pyrophosphate has no effect at all, even in 3.10^{-3} *M* concentration. ATP is fully active not only at this temperature, but at 37,5° also.

If 6.10^{-4} *M* inorganic pyrophosphate is added to a solution of actomyosin at room temperature (22°), there will be no change in its viscosity. If this solution is cooled to 0° its viscosity will become low, just as if ATP would be present. Bringing the solution back to 22°, its viscosity will rise again and can be lowered by the addition of ATP.

From these data it appears that it is the pyrophosphate group of the ATP which is responsible for the viscosity effect. It might therefore be concluded that adenosinediphosphate, prepared through dephosphorylation of ATP by myosin, does not contain a pyrophosphate residue.

It may also be concluded that the splitting of ATP is not involved in its viscosity decreasing effect, since pyrophosphate has the same effect and is not split by myosin.

Dr T. Erdős has found in this laboratory (unpublished) that on addition of inorganic pyrophosphate actomyosin threads do not contract at 1,3°, whereas addition of ATP brings about their contraction.