The simplest explanation for these facts is that a phosphorylated intermediate, capable of exchanging oxygen with water, is formed in the myosin portion of the actomyosin. The actin can then attack this intermediate with formation of an actin–myosin bond which holds the protein in contracted form.

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RECEIVED MARCH 28, 1958

FORMATION OF VOLATILE COMPOUNDS BY Pb^{212} RECOILING FROM ALPHA DECAY[1]

Sir:

The discovery that tritium and halogen atoms, recoiling from nuclear processes, undergo substitution reactions in the gas phase in high yield has prompted us to investigate the possibility of gas-phase reactions for metallic atoms undergoing nuclear recoil.[2-4] Our experiments demonstrate the formation of volatile organo-lead compounds by Pb^{212} atoms from the alpha decay of Po^{216} in a methane atmosphere.

The thoron (Em^{220}) daughter activity in equilibrium with Th^{232} was removed from thorium nitrate solution by sweeping with carrier gas. The carrier gas flowed through a cold trap, a 200-ml. storage bulb, and then was vented. After the system reached equilibrium, the bulb was shut off and bypassed, and became a vessel for reaction of thoron decay products with sweep gas. The steady-state concentration of Em^{220} in the bulb was determined from a gas aliquot taken immediately after isolation from the flow system.

The formation of volatile Pb^{212} compounds was studied by isolating the reaction bulb until the decay of thoron to Pb^{212} was essentially complete ($\geq$ 15 min.). An aliquot of the gas then was examined for Pb^{212} activity. An appreciable amount of the Pb^{212} in methane sweep gas was transferred with the aliquot. The results of these experiments are summarized in Table I. In similar experiments

TABLE I

PER CENT. VOLATILE Pb^{212} FROM Po^{214} RECOIL IN GASEOUS ATMOSPHERE

Gas	Delay time min.	Volatile activity, %
Methane	15	38
	30	20
	45	14
	60	19
	330	5
Helium	15	0
	30	0

with helium carrier, no Pb^{212} activity entered the proportional counter. The range of Pb^{212} (128 k.e.v. recoil energy) is < 1 mm. in methane or helium at STP,[5] but long enough to ensure equilibrium in charge-exchange processes. Therefore, essentially no recoils will strike walls before thermalization, while all should be neutralized before chemical reaction.

The Em^{220} concentration was reproducible to $\pm$ 40%—each run was compared to a zero-delay run immediately preceding. The decay curve in each case showed the growth of Tl^{208} and Bi^{212} daughters of Pb^{212}, as well as Em^{222} from Ra^{226} in solution.

The nature of the organo-lead compound(s) has not been established—the lower volatile percentages with longer delay times probably are caused by further reactions of the original species, leading to less volatile compounds.

Volatile metallic products may prove useful for quick chemical separations of nuclear recoils from thin films. They may also help to explain low gaseous diffusion coefficients observed for Tl^{208},[6] and are important in measurements of bond-breaking accompanying β^- decay such as in $Pb^{210}(CH_3)_4$.[7] Other metallic recoil atoms are being studied.

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RECEIVED APRIL 29, 1958

INTERCONVERSIONS OF POLYRIBONUCLEOTIDES AND NUCLEOSIDE TRIPHOSPHATES[1]

Sir:

Ribonucleoside diphosphates have been shown to be the precursors of polyribonucleotides in the polynucleotide phosphorylase reactions.[2] Enzymes catalyzing this reaction have since been demonstrated in extracts from a variety of microbial and plant sources,[3] and purified from several different bacteria.[3-5] An enzyme catalyzing the phosphorolysis of adenylic polynucleotide to ADP[6] has recently been isolated from nuclei of mammalian liver.[7] Some evidence has been accumulated, however, which suggests that the incorporation of AMP into polymeric material catalyzed by soluble extracts from mammalian sources may utilize ATP as the substrate.[8-11]

(1) Supported by grants-in-aid No. H-2177 from the National Heart Institute, USPHS, from the National Science Foundation, and the Eli Lilly Research Laboratories. Presented in part at the Meeting of the American Society of Biological Chemists, Philadelphia, April, 1958.

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(6) Abbreviations used: tris,tris-(hydroxymethyl)-aminomethane, P_i, inorganic phosphate, PP_i, inorganic pyrophosphate, ATP, adenosine 5′-triphosphate, ADP, adenosine 5′-diphosphate, GTP, guanosine 5′-triphosphate, UTP, uridine 5′-triphosphate, CTP, cytidine 5′-triphosphate, RNA, ribonucleic acid or mixed polyribonucleotide, c.p.m., counts per minute above background, corrected for self-absorption.

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TABLE I

INCORPORATION OF LABELED PYROPHOSPHATE INTO RIBONUCLEOSIDE TRIPHOSPHATES

0.1M tris pH 7.5, 0.1M KF, 0.01M $MgCl_2$, 0.005M PP_i (75,000 c.p.m. in A; 41,000 c.p.m. in B, 150,000 c.p.m. in C). In A, 50–100% $(NH_4)_2SO_4$ cut of embryonic heart supernatant (S_H) (4.1 mg. protein), 120 γ of S-RNA. In B, 3.125 μmoles ATP, 0.025 μmole each of GTP, CTP and UTP per ml.; enzyme: a 60–95% $(NH_4)_2SO_4$ cut of 14 day embryonic liver supernatant (S_L), (3.3 mg. protein), S-RNA as in A. In C nucleotide mixture of B; mixed soluble and microsomal fractions of 14 day chick liver, no RNA added.

Expt.	Material added	Amount	Duration min.	C.p.m. incorporated[a]
A	Mixture of triphosphates	0.5 μmole total (0.125 μmole each)	5	1745
	ATP	0.50 μmole	5	2385
	GTP	0.50 μmole	5	1295
	CTP	0.50 μmole	5	1200
	UTP	0.50 μmole	5	1935
B	S-RNA	None	20	260
	S-RNA	12γ	20	648
	S-RNA	57γ	20	1876
	S-RNA	232γ	20	2656
	S-RNA	348γ	20	3456
C	Mixture of triphosphates	0.50 μmole total	30	2960
	Mixture of diphosphates	0.50 μmole total	30	688
	Triphosphates + 18 amino acids	0.50 μmole total	30	0

TABLE II

INCORPORATION OF ATP-8-C^{14} INTO POLYMERIC MATERIAL

10 μmoles tris pH 7.5, 5 μmoles $MgCl_2$, 0.026 μmole ATP-8-C^{14} (Schwarz Labs. 1.926 $\times$ 10^5 c.p.m.), 0.25 μmole each of GTP, CTP and UTP. In exp. F 2.3 mg. of 60–100% $(NH_4)_2SO_4$ cut of S_H, in G crude enzyme freed of RNA by prior pyrophosphorolysis.

Expt.	Reaction mixture	S-RNA	Duration, min.	C.p.m. incorporated
F	Complete	None	10	145
	Complete	120γ	5	253
	Complete	120γ	10	473
	Complete	120γ	20	760
G	Complete	None	20	40
	Complete	120γ	20	138
	ATP-C^{14} only	120γ	20	15
	Complete	420γ	20	200
	ATP-C^{14} only	420γ	20	304

Soluble, crude enzyme preparations, from the non-sedimentable fraction of homogenates of embryonic chick hearts and livers catalyze the following three reactions: (1) the incorporation of PP_i^{32} into ribonucleoside triphosphates; (2) the pyrophosphorolysis of S-RNA, a polyribonucleotide obtained from the non-sedimentable fraction of homogenates of embryonic liver by a phenol method[9,12]; (3) the incorporation of ATP-8-C^{14} into an $HClO_4$-insoluble, presumably polymeric fraction: Table I indicates that reaction 1 specifically requires the presence of ribonucleoside 5′-triphosphates either singly or in combination; if a more highly purified enzyme preparation, low in endogenous RNA, is used the reaction becomes dependent on added S-RNA. Reaction 2 occurs with PP_i but not with P_i, and appears to favor S-RNA over other polyribonucleotides.[13] Table II indicates that reaction (3) requires either the presence of a mixture of ribonucleoside triphosphates, or of polyribonucleotides, presumably as a source of the latter. The relation of the three activities to each other and to the net synthesis of polyribonucleotide is under investigation.

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RECEIVED APRIL 19, 1958

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(13) ATP has been identified as a product in this reaction.

THE HEXOSAMINE MOIETY OF N-ACETYLNEURAMINIC ACID (SIALIC ACID)

Sir:

As previously reported,[1] an enzyme obtained from *Clostridium perfringens* (N-acetylneuraminic acid aldolase; NANaldolase) catalyzes the following reversible reaction: N-acetylneuraminic acid = pyruvate + N-acetyl-D-mannosamine (N-AcMm). In contrast to these results, data from other laboratories[2-4] indicated that the hexosamine moiety of N-acetylneuraminic acid (NANA) is N-acetyl-D-glucosamine (N-AcGm). The present studies suggest that the apparent discrepancy in the results obtained by the enzymatic[1] and chemical[2-4] techniques is due to the interconversion of N-AcGm and N-AcMm under the alkaline conditions used for the chemical work.

Treatment of *either* N-AcGm or N-AcMm with pyridine and nickelous acetate under the conditions used for the degradation of NANA[2] gave a mixture of N-AcGm and N-AcMm (approximately 8:2) as well as traces of unidentified components which were apparent by paper chromatography, but were not identified. Thus, 36 mg. of synthetic N-AcMm,[1] 2 ml. of anhydrous pyridine, 0.12 g. of nickelous acetate, heated at 100° for 1.5 hr. yielded 6 mg. of first crop crystalline material. The crystals were identified as N-AcGm by: (1) m.p. (202–203°, uncor., dec.; no depression on admix-

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