capacity to conjugate α-lipoic acid and the pyrimidine moiety of thiamin.

Soluble enzyme preparations from the mutant catalyze the dismutation of pyruvate only when lipothiamide pyrophosphate (LTPP), the amide of α-La and thiamin pyrophosphate (TPP), is present (Table I). Likewise, LTPP is required for oxidation of α-ketoglutarate by the cell-free extracts, as measured by succinylation of sulfanilamide[3] (Table II).

TABLE I

DISMUTATION OF PYRUVATE

System	μM Products per ml. in 90 min. Carbon dioxide	Acetyl phosphate	Lactate
A[a]	0.3	0.2	0.3
A + boiled extract of yeast[b]	3.1	2.3	2.7
A + LTPP,[c] 14γ	3.4	3.0	3.3
A + LT,[c] 11γ	0.4	0.3	0.3
A + LTP,[c] 12γ	0.6	0.5	0.6
A + TPP, 25γ	0.3	0.2	0.2
A + α-LA, 5γ, + TPP, 25γ	0.3	0.2	0.3

[a] System A contained per ml.: *E. coli* mutant extract, 3.2 mg. protein; potassium phosphate buffer, *p*H 6.0, 50μM; L-cysteine, 20μM; magnesium chloride, 2.4μM; manganese chloride, 1.6μM; coenzyme A (CoA), 5 units; diphosphopyridine nucleotide (DPN), 100γ; pyruvate, 50μM; lactic dehydrogenase, 1600 units; transacetylase, 5 units. Gas phase, nitrogen; temperature, 25°. [b] From 5 mg. dried yeast. [c] Crude synthetic preparations.[1] *E. coli* mutant extract prepared by method of Korkes, *et al.*[2]

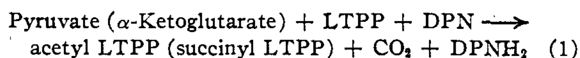
TABLE II

SUCCINYLATION OF SULFANILAMIDE

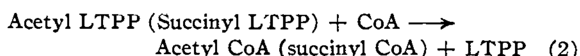
System	γ Sulfanilamide disappearing
B[a]	0
B + PL,[b] 0.3 ml.	4
B + PL + α-LA[c] + TPP[c]	2
B + PL + LTPP[c]	42
B + LTPP	1
B + boiled extract of yeast[c]	3
B + PL + boiled extract of yeast	36

[a] System B contained per ml.: mutant extract, 10.5 mg protein; sulfanilamide, 90γ; L-cysteine, 10μM; catalase, 0.25 units; magnesium chloride, 5μM; CoA, 10 units; sodium bicarbonate, 3μM; α-ketoglutarate, 5μM. Incubated 90 min. at 37°. [b] Pigeon liver acetone powder extract.[4] [c] Same levels as in Table I.

In view of these and other[2,3] results, it is proposed that Reaction 1 represents an initial step in the oxidative decarboxylation of pyruvate and α-ketoglutarate.


Pyruvate (α-Ketoglutarate) + LTPP + DPN ⟶ acetyl LTPP (succinyl LTPP) + CO_2 + $DPNH_2$ (1)

Transfer of the acyl group to CoA (Reaction 2) would provide the acyl CoA required in a number of known enzymatic reactions.


Acetyl LTPP (Succinyl LTPP) + CoA ⟶ Acetyl CoA (succinyl CoA) + LTPP (2)

The authors are indebted to Drs. E. R. Stadtman, A. Kornberg and F. Lipmann, respectively, for preparations of transacetylase, lactic dehydrogenase and CoA.

(2) S. Korkes, *et al.*, *J. Biol. Chem.*, **193**, 721 (1951).

(3) D. R. Sanadi and J. W. Littlefield, *ibid.*, **193**, 683 (1951); *Federation Proc.*, **11**, 280 (1952).

(4) N. O. Kaplan and F. Lipmann, *ibid.*, **174**, 37 (1948).

BIOCHEMICAL INSTITUTE AND
DEPARTMENT OF CHEMISTRY
UNIVERSITY OF TEXAS, AND
CLAYTON FOUNDATION FOR RESEARCH
AUSTIN, TEXAS

LESTER J. REED
BETTY G. DEBUSK

RECEIVED JUNE 23, 1952

ON VISCOSITY MEASUREMENT IN THE ULTRACENTRIFUGE[1]

Sir:

During the course of a study on sodium desoxyribonucleate (DNA) attempts were made to measure viscosity by the rate of sedimentation of macromolecules. In view of the striking results with DNA and the interest in the problem of viscosity in connection with ultracentrifugation, a preliminary account of our results seems warranted.

The rate of sedimentation, s_0, of various macromolecules and particles, hereafter called Indicator Particles (IP), through a solvent medium is compared with the sedimentation rate, s, of the same IP through solutions containing an additional viscous component such as DNA. The ratio, s_0/s, gives some measure of the relative viscosity of the solution containing the asymmetric molecules. Several factors aside from viscosity, such as density, backward flow and the effect of covolumes on viscosity, contribute to the ratio s_0/s, and a detailed study of them is now under investigation.

Experiments have been conducted with a variety of IP such as polystyrene latex (PSL), bacteriophage (T3) and bushy stunt virus (BSV), in solutions containing different concentrations of fibrinogen and DNA. Whenever possible, viscosities of the solutions were also determined in a capillary viscometer of shear gradient about 300 sec.$^{-1}$.

Table I shows representative data obtained on a freshly prepared solution of fibrinogen using BSV as IP. The agreement between columns 3 and 4 suggests that the ultracentrifuge method may yield valuable information regarding the viscosity of solutions.[2]

TABLE I

VISCOSITY OF FIBRINOGEN SOLUTIONS

Fibrinogen concn., g./100 cc.	Solvent	η/η_0, capillary	s_0/s BSV
1.0	0.3μ NaCl-cacodylate, *p*H 7	1.23	1.22
2.0	0.3μ NaCl-cacodylate, *p*H 7	1.55	1.64
3.0	0.3μ NaCl-cacodylate, *p*H 7	2.16	2.10

When DNA was used as the viscous component, strikingly different results, shown in Table II, were obtained. The apparent viscosities with PSL are much higher than the capillary values or any viscosities previously reported except those of Katz and Ferry.[3] When particles smaller than PSL were used, however, regardless of the ionic strength or the *p*H employed, the IP sedimented

(1) This work was supported in part by grants from the Rockefeller Foundation and Lederle Laboratories.

(2) In preliminary experiments with tobacco mosaic virus as the viscous component, η/η_0 from capillary measurements was slightly less than s_0/s using PSL as IP.

(3) S. Katz and J. D. Ferry, abstracts, A.C.S. meeting, March, 1952.

TABLE II

VISCOSITY OF DNA

DNA concn., g./100 cc.	Solvent	η/η_0 capillary	s_0/s BSV	T3	PSL
0.0023	0.3μ KCl-cacodylate, *p*H 7	1.1	..	...	1.9
.023	0.3μ KCl-cacodylate, *p*H 7	1.83	1.06	1.10[a]	4.6
023	1.0μ KCl-cacodylate, *p*H 7	..	1.08	...	..
.023	0.3μ acetate, *p*H 4	1.99	1.10	...	..
.094	0.3μ KCl-cacodylate, *p*H 7	..	1.21	...	32

[a] Solvent was 0.3μ phosphate, *p*H 7.

at a rate only slightly less than their rate in solvent. The results to date can be interpreted tentatively on the assumption that the thread-like molecules of DNA form a loose entanglement which permits T3 or BSV to pass through readily but slows down PSL.[4,5]

More work is in progress to enable a more precise interpretation of the results with DNA and permit an evaluation of the various factors involved in order to test this ultracentrifuge method as a useful measure of viscosity.

(4) The diameters of PSL, T3 and BSV are about 2600, 450 and 300A, respectively.

(5) W. Kuhn, *Makromol. Chem.*, **6**, 224 (1951), has drawn similar conclusions for the structure of rubber based on viscosity determinations using diffusion of foreign particles of varying size.

DEPARTMENT OF BIOCHEMISTRY
VIRUS LABORATORY
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA

H. K. SCHACHMAN
W. F. HARRINGTON

RECEIVED MAY 29, 1952

OCCURRENCE OF THE L-ARABINOSE UNIT IN SAPOTE GUM

Sir:

In all heretofore known instances when L-arabinose occurs as a component of polysaccharides the furanose ring structure prevails. Apparently this is not invariably the case, as is illustrated in sapote gum.[1] This polysaccharide forms slowly in the wounds made in the sapote tree following the flow of latex. It is a heteropolysaccharide composed of D-xylose, L-arabinose and D-glucuronic acid units.[2] The components resulting from methanolysis of the methyl ether derivative[3] have been separated and one of these proves to be methyl 2,3,4-trimethyl-L-arabopyranoside. The free sugar and corresponding lactone have not been obtained in crystalline form, although the latter furnishes a well-characterized amide when treated with methanolic ammonia. The amide has m.p. 103°[4] and specific rotation +24° (*c*, 1.5 in water at 20). With phenylhydrazine the lactone forms 2,3,4-trimethyl-L-arabonic acid phenylhydrazide, m.p. 156°[5] and not depressed upon admixture with an authentic specimen.[6]

When the free sugar is oxidized with nitric acid 2,3,4-trimethyl-L-araboglutaric acid is produced in good yield, identified through the corresponding ester as the crystalline diamide; m.p. 233°,[7] specific rotation +42.6° (*c*, 3.5 in water at 20°).

A report of the investigation of sapote gum is planned in a later issue of THIS JOURNAL.

(1) Probably from *Sapotaceae achras*.

(2) E. Anderson, *J. Am. Pharm. Assoc.*, **40**, 623 (1951).

(3) Prepared from the original gum by the Haworth method by four separate methylations with intermediate dialysis and concentration.

(4) J. Pryde, E. L. Hirst and R. W. Humphreys, *J. Chem. Soc.*, **127**, 356 (1925).

(5) F. Smith, *ibid.*, 747 (1939).

(6) Sample kindly supplied by Professor Smith.

(7) E. L. Hirst and G. J. Robertson, *J. Chem. Soc.*, **127**, 362 (1925).

THE INSTITUTE OF PAPER CHEMISTRY
APPLETON, WISCONSIN

ELWOOD V. WHITE

RECEIVED JUNE 27, 1952

BOOK REVIEWS

Annual Review of Biochemistry. Volume 20. By J. MURRAY LUCK, Editor, Stanford University, HUBERT S. LORING, Associate Editor, Stanford University, and GORDON MACKINNEY, Associate Editor, University of California. Annual Reviews, Inc., Stanford, California. 1951. ix + 648 pp. 16 × 23 cm. Price, $6.00.

The burden of maintaining contact with the contemporary chemical literature lies heavily on the teacher and on the investigator. *Chemical Abstracts* has been the traditional medium through which the chemist has kept in touch with affairs in his own particular field of interest. It continues to serve that purpose effectively. The difficulty is to find means to follow and comprehend the changing trends of ideas in areas outside the particular competence of the reader. This need for help in epitomising the literature has been recognized particularly in the physiological field and has given birth to two new types of journal. One of these may be referred to as the "Recent Advances" type. It consists of, the periodical publication of monographs on selected topics which are treated comprehensively and project contemporary ideas against the background of their development. It follows the pattern of Chemical Reviews and serves the same admirable purpose.

The second type of synoptic literature is the "Annual Review." This publication expects the reader to provide his own background for what can be little more than a predigest of Abstracts for the period under review. Annual Reviews is a guide to the library stacks rather than an armchair companion.

The Annual Review of Biochemistry is the oldest and best known of the Series. During the past 20 years it has given notable service to investigators, teachers and advanced students. Its purpose is evident from a glance at the pages of the 1951 Review. This volume contains 475 pages of text and 123 of bibliography, comprising some 4500 references. There are 23 chapters. The average chapter consists of 20 pages reviewing about 200 original papers. Through this fine sieve few significant contributions are likely to escape. On the other hand, there is little scope for critical analysis in so wide a coverage.

Many of the subjects are reviewed annually. These cover such fields as the Chemistry and the Metabolism of the Carbohydrates, the Fats, the Proteins, the Vitamins, and the Enzymes. The treatment of such recurring themes is inevitably staccato. To follow the trend of ideas the reader must often turn back to preceding volumes. A few reviewers do manage to avoid the compendium approach by reso-