substrate for the enzymatic reduction of pyruvate to lactate at neutral pH.

In contrast to solid lithium pyruvate, a solution of sodium pyruvate in heavy water shows a strong infra-red carbonyl absorption at 1,710 cm.$^{-1}$ (Fig. 1). A C—H bending peak at 1,358 cm.$^{-1}$, typical of a methyl ketone, as well as the strong carboxylate absorption at 1,610 and 1,410 cm.$^{-1}$, are also evident. Similar carbonyl peaks were found in deuterium oxide solutions of pyruvic acid (1,725 cm.$^{-1}$), α-keto-glutaric acid (1,722 cm.$^{-1}$) and sodium α-ketoglutarate (1,710 cm.$^{-1}$) and for sodium pyruvate in a potassium bromide pellet (1,715 cm.$^{-1}$). Furthermore, the ultra-violet absorption maximum of aqueous pyruvate[2] at 330 mμ is similar to that of α-ketoglutarate[3], oxalacetate[3], pyruvic acid[4] and ethyl pyruvate[4], and has the location and intensity expected for a carbonyl group in the alpha position to an unsaturated group[5].
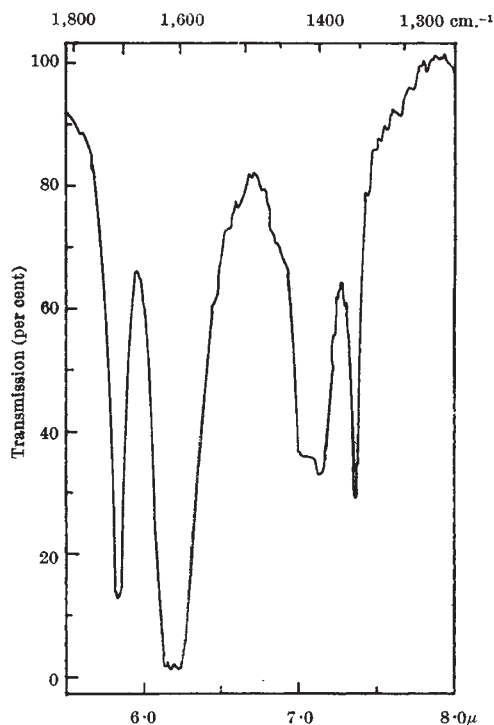

Fig. 1. Infra-red spectrum of 0·5 M sodium pyruvate in deuterium oxide; 0·05 mm. path-length; calcium fluoride cells; Perkin-Elmer model 21 double-beam spectrophotometer

It is concluded that pyruvate as well as pyruvic acid exist in the carbonyl form in aqueous solution, which is in accord with the low electron withdrawing ability of the negatively charged carboxylate group compared to a carboxylic acid group[6] (cf. also ref. 1) and is consistent with the chemically attractive mechanism postulated for the enzymatic reduction of pyruvate by transfer of a hydride ion from reduced diphosphopyridine nucleotide to the partially polarized, unsaturated carbonyl group[7]. The existence of solid lithium pyruvate in the hydrated form may be due to increased electron withdrawal by the concentrated positive charge of the lithium cation, or to hydration of the lithium ion by the hydroxyl groups of hydrated pyruvate in the crystal lattice, which would be favoured by the exceptionally large energy of hydration of the lithium ion.

WILLIAM P. JENCKS
JOAN CARRIUOLO

Graduate Department of Biochemistry,
Brandeis University,
Waltham 54, Massachusetts.

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Faraday Fading of Earth Satellite Signals

THE rate of fading of Earth satellite signals caused by the ionospheric Faraday effect was used by British workers[1][2] to make estimates of the integrated electron content of the ionosphere up to the height of the satellite. The values obtained were, however, apparently too high. A possible reason for this is failure to take into account the radial velocity component of the satellite which, for certain portions of the orbit, can cause an appreciable contribution to the fading.

The complete expression for the rate of fading due to the Faraday effect is :

$$\frac{d\varphi}{dt} = 2 \cdot 36 \times 10^4 . f^{-2} . B \left\{ \frac{\partial}{\partial t} (\cos \theta \sec \delta) \int_{h_0}^{h_s} N(h) dh + (\cos \theta \sec \delta) \frac{dh_s}{dt} . N(h_s) \right\} \text{ radians sec.}^{-1}$$

where f is the transmitted frequency in c./s., B the Earth's magnetic field in gauss, θ the angle between the direction of propagation and the magnetic field, δ the zenith angle, and $N(h)$ the electron density per cm.^{3}. This expression arises from the fact that h_s, the upper limit of the integral (the height of the satellite), is a function of time. The rate of fading therefore consists of two terms, one of which depends upon the integrated electron content up to the height of the satellite, and the other upon the electron density at the satellite. The second term of the equation vanishes only at perigee and apogee or for a circular orbit (and, of course, when $N(h_s)$ is zero). For the general case, however, the two terms cannot be evaluated independently from observed rates of fading. A value of $\int N dh$ computed on the assumption that the rate of fading depends only upon the first term would be too high. For the two orbits used for the estimates of $\int N dh$ referred to, the contribution of the second term apparently cannot be neglected.

A detailed discussion of these considerations will be published elsewhere.

FRED B. DANIELS
SIEGFRIED J. BAUER

U.S. Army Signal Research and
Development Laboratory,
Fort Monmouth, New Jersey.

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