

Table 1

Specimen	$\lambda = 1.27$ cm.		$\lambda = 10.0$ cm.		Remarks
	$\alpha$ (nepers/cm.)	$\beta$ (radians/cm.)	$\alpha$ (nepers/cm.)	$\beta$ (radians/cm.)	
Whole blood	9.5	31.0	0.65	4.6	Uncoagulated by 1/500 mgm. heparin
Blood serum	9.7	28.9			
Skin	10.3	34.7	0.84	5.3	Centrifuged specimen
	6.4	23.2	0.81	4.1	
Fat	6.3	25.4	0.65	4.5	Breast specimens free of areolar tissue
	1.95	9.2	0.73	4.6	
	1.0	8.6	0.21	1.45	
	1.5	8.7	0.20	1.70	
Bone	0.9	11.9	—	—	Breast specimens free of areolar tissue
	0.95	11.7			
	1.2	12.9			
	1.45	12.5			
Carcinoma of breast	8.1	28.6	0.73	4.8	Post-mortem specimens. Sections taken at different depths from the surface
	6.9	25.2	0.60	5.0	

Table 2

Specimen	$s$ (relative to air)			$\epsilon''$ (relative to air)		
	10.0 cm.	3.18 cm.	1.27 cm.	10.0 cm.	3.18 cm.	1.27 cm.
Whole blood	53	45	32	15	23	20
Blood serum	70	57.5	45.5	22.5	24	29
Skin	43.5	35.5	23	16.5	16	13
Fat	6.9	4.5	3.4	1.6	0.95	1.1
Bone	—	7.6	6.3	—	1.45	1.1

at 10-cm. wave-length and at the shorter wave-lengths is that the absorption constant  $\alpha$  tends to have a value approximately double that of water, indicating the significant contribution of the ionic conductivity absorption. Assuming equal contributions to total absorption at this wave-length by the polar water molecules and by ionic conductivity, a value of the order of  $10^{-2}$  mhos per cm.<sup>3</sup> is obtained for the typical tissue conductivity, which is in agreement with the values obtained from measurements at longer wave-lengths (summarized by Osborne and Holmquest<sup>2</sup>). The ionic conductivity contributions to power absorption in such tissues at wave-lengths of 3.18 cm. and 1.27 cm. would appear, by similar calculation, to be about 10 per cent and 2 per cent respectively, and would not be immediately evident in the measured constants.

The assistance of Dr. N. A. Sharples in selection and preparation of specimens is gratefully acknowledged.

T. S. ENGLAND

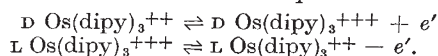
University of Durham,  
King's College,  
Newcastle upon Tyne.  
May 15.

<sup>1</sup> England, T. S., and Sharples, N. A., *Nature*, **163**, 487 (1949).

<sup>2</sup> Osborne and Holmquest, "Technic of Electrotherapy", 446 (1944).

## A Reaction for the Study of the Kinetics of Electron Transfer

THE isolation<sup>1</sup> of stable optical forms of the tris 2:2' dipyridyl osmium II ion,  $\text{Os}(\text{dipy})_3^{2+}$ , and of the tris 2:2' dipyridyl osmium III ion<sup>2</sup>,  $\text{Os}(\text{dipy})_3^{3+}$ , permits a unique demonstration of the dynamic electronic equilibrium between the oxidized and reduced forms of an ion. It is evident that when the *dextro* form of the osmium II complex ion is mixed with an equivalent amount of the *levo* form of the osmium III complex ion, the optical activity of both ions should vanish if such an equilibrium exists.



The experiment was carried out by mixing 10 mgm. of D, tris 2:2' dipyridyl osmium II perchlorate with 10.9 mgm. of L, tris 2:2' dipyridyl osmium III perchlorate in 20 ml. of water at 20° C. After two minutes, the osmium II complex was precipitated by the addition of 20 per cent sodium perchlorate solution, leaving a pink solution of the osmium III complex. Both the precipitate and the filtrate were found to be inactive.

Essentially the same experiment has been carried out in the studies of the ferrous/ferric and the tris ethylene diamine cobalt II/tris ethylene diamine cobalt III equilibria with radioactive iron<sup>3</sup> and cobalt<sup>4</sup>. However, the present experiment may also be used to determine the rate of electron transfer under varying conditions of temperature, concentration, and dielectric constant of the solvent without the necessity of altering the conditions by separation of the oxidant and the reductant.

Tris 2:2' dipyridyl osmium II perchlorate has  $[\alpha]_{5461}^{25} = 2200^\circ$ , while for tris 2:2' dipyridyl osmium III perchlorate,  $[\alpha]_{5461}^{25} = 200^\circ$ . The mixture of equivalent amounts of the D osmium II complex and L osmium III complex, at the instant of mixing, is therefore dextrorotatory, and the loss of activity consequent on electron transfer can be followed in a polarimeter. The intense green colour of the reduced form of the complex necessitated the use of very dilute solutions, and the maximum angle of rotation that could be comfortably observed was about 0.08°.

With the mixed solution  $5 \times 10^{-4} M$  with respect to both ions, the exchange was complete in less than 15 sec. at 25° C., but required approximately 65 sec. at 10° C. and 95 sec. at 5° C. The rate at 10° C. was very much greater in 2 N ammonium nitrate solution, but much slower in acetone, than in water. Both these effects are obviously related to the dielectric constant of the solution.

It is hoped to study quantitatively the effects of various factors, particularly concentration, with a photo-electric polarimeter.

F. P. DWYER  
E. C. GYARFAS

Department of Chemistry,  
University of Sydney.  
April 4.

<sup>1</sup> Burstall, F. H., Dwyer, F. P., and Gyarfias, E. C., *J. Chem. Soc.*, 953 (1950).

<sup>2</sup> Dwyer, F. P., and Gyarfias, E. C. (unpublished work).

<sup>3</sup> Van Alton, *J. Amer. Chem. Soc.*, **70**, 883 (1948).

<sup>4</sup> Lewis, N. B., and Coryell, C. D., Brookhaven Conf. Report. Chemistry, No. 2, 131 (1948).