

### Absorption Spectra of Chlorophylls *a* and *b* at Room and Liquid Nitrogen Temperatures

THE absorption spectra of ether solutions of chlorophylls *a* and *b*, prepared by the method described earlier<sup>1</sup>, were photographed at the temperature of liquid nitrogen. A Steinheil spectrograph and panchromatic plates were used for the spectral region  $\lambda$  4100–6700 Å. Pyrex glass absorption cells with internal thickness of 1 mm. contained the solutions. Four plane quartz windows in the walls of the Dewar vessel permitted parallel light to pass from the Mazda source through the liquid nitrogen bath and the solid solution of chlorophyll in ether, to the spectrograph slit. The slit width was 0.02 mm. The photographs were taken as soon as possible after freezing the solutions because the development of cracks in the solid ether solution caused it to become rather opaque in two hours.

In the following table is a comparison of the absorption maxima measured at room temperature by a spectro-photoelectric method<sup>2</sup> and those measured at  $-196^\circ\text{C}$ . by the photographic method. The bands at room temperature are listed in order of their decreasing absolute intensities. The band intensities at  $-196^\circ\text{C}$ . are listed in decreasing order as they appear on the plates.

	Wave-lengths of Absorption Maxima	
	at $25^\circ\text{C}$ .	at $-196^\circ\text{C}$ .
Chlorophyll <i>a</i>	4275 Å.	End absorption to 4520 Å.
	6600	6640
	4100	4920
	6125	6320
	5725	6180
	5275	6015
	4975	5769
		5365
Chlorophyll <i>b</i>	4525	4770
	4300	6510
	6425	4420
	5925	6000
	5675	6350
	5475	5760
	5025	5480

At  $-196^\circ\text{C}$ . the absorption bands are considerably narrower than at room temperature and their maxima are shifted. Absorption spectra of "fraction *c*"<sup>1</sup> at  $-196^\circ\text{C}$ . were intermediate between those of components *a* and *b*.

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<sup>1</sup> Zscheile, F. P., Jr., *Bot. Gaz.*, to appear in June 1934.

<sup>2</sup> Zscheile, F. P., Jr., Hogness, T. R., and Young, T. F. J., *Phys. Chem.*, **38**, 1; 1934.

### Investigation of Parapsychical Phenomena

A CERTAIN interest in the physical aspects of psychical research has recently been shown in these columns<sup>1</sup>. In view of the fact that the controversy seems to turn mainly upon the alleged paranormal or extra-contemporary-physical powers of Rudi Schneider, it may be worth while briefly to record a series of experiments with that medium, although the results are merely of a negative character. Full experimental details will in due course be published in the *Proceedings of the Society for Psychical Research*.

Sittings were held about twice a week from October 1933 until March 1934 inclusive in the *séance*-room of that Society. No evidence of absorptions of a beam

of infra-red light of the type recorded by Osty<sup>2</sup> and Herbert<sup>3</sup> could be obtained, notwithstanding frequent announcements by the trance personality that the 'force' had entered the ray. The apparatus used was (1) a Moll galvanometer with Moll thermopiles, and (2) a Westinghouse copper-copper oxide photoelectric cell in series with an Einthoven galvanometer. In both cases the sensitivity and the precautions taken against electrical leaks, vibration, and stray heating effects were such that an absorption of one half per cent could be detected. All visible light was excluded from the beam by a sheet of ebonite of thickness of 0.005 cm., or by a filter of 1 cm. of a saturated solution of iodine in carbon disulphide in a glass vessel, or by both. For this solution Coblenz gives the following transmissions:

Transmission Per cent	Transmission Per cent
0.75 $\mu$	0
1.0 $\mu$	80
1-2.5 $\mu$	90
	3 $\mu$
	4 $\mu$
	5 $\mu$
	60
	10
	0

This filter was used because the photographic work of Rayleigh<sup>4</sup> and Herbert indicated that absorptions did not occur at wave-lengths shorter than 1 $\mu$ , while Herbert and Osty, using photocells which cannot have been sensitive beyond 5-6 $\mu$ , both recorded absorptions. The thermopiles should have been both sensitive and rapid enough to detect absorptions of the type previously recorded, and the surface density of illumination was kept low, as this is supposed<sup>5</sup> to increase the chance of observing absorptions. The possibility of short-period absorptions was negated by the use of the photocell.

A cinema camera was installed with a film sensitive to the infra-red, supplied by Messrs. Iford, and it was found possible to obtain sharply defined moving pictures in a feeble red light. By increasing the flood-lighting, and using horn or ebonite filters, it is confidently expected that cinema films could be taken in total absence of visible light. By this means, motion pictures of telekinetic phenomena could be obtained in a light that is innocuous to the medium. No evidence, however, could be obtained of the telekinetic phenomena recorded by Price<sup>6</sup> and others, with the exception of a considerable number of movements, not exceeding 10 cm., of a hanging curtain. In order to determine whether these were due to draughts, a strip of tinfoil about a foot in length was so hung, about 5 mm. from a vertical metal plate, that a slight draught brought them into contact and rang an electric bell. The whole was so placed that the 'force' had ready access to it and that draughts could not affect it. Under these conditions the bell did not ring, though the curtain continued to move.

The 'force' on several occasions was announced by the medium in trance to have gone into one of a pair of cotton wool lagged boxes and remained there for a period of some 15 minutes. If any change in the difference of temperature between the two boxes was produced during this period a copper-constantan thermocouple showed that it was less than 0.003 $^\circ\text{C}$ .

During a period of half an hour the 'force' could produce no significant difference in the rate of growth of two strains of *Bacillus fluorescens* or in the fermenting power of yeast.

A comparative investigation of the medium's personalities normally and in trance was undertaken by means of the word association test in conjunction with the observation of the psychogalvanic reflex. A preliminary scrutiny of the results shows that 'Olga',