ketones such as acetophenone, and the corresponding amines are interconvertible by these two reactions^{2,5}:

In the case of aldehydes, however, the Leuckart reaction does not stop with the primary amine, but gives the tertiary compound.

Details of our work will be given in a forthcoming publication.

S. J. ANGYAL
R. C. RASSACK

Department of Chemistry,
University of Sydney,
Jan. 9.

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² Graymore, J., and Davies, D. R., *J. Chem. Soc.*, 293 (1945).

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Chemistry of Visual Processes

In a recent article under the above title in *Nature*, Ball, Collins, Morton and Stubbs¹ discuss the relation between 'action spectra' and 'absorption spectra' of photosensitive pigments in the retina. They show that the 'action spectra' must—purely on account of the physical laws of light absorption—be broader when the optical density of the layer of the photosensitive substance is greater².

I may perhaps point out that this effect has been used by Hecht, Schlaer and myself³ in order to obtain an estimate of the absolute value of the percentage of light absorbed by the rhodopsin in the rods of the dark-adapted human eye. In this investigation, the shape of the rod spectral luminosity curve of the retina (plotted in terms of numbers of quanta) was compared to the shapes of calculated curves giving the percentage of light absorbed by layers of rhodopsin having various maximum optical densities. (The latter curves were called 'percentage absorption spectra': they correspond to the 'action spectra' α of Ball *et al.*¹.) An upper value of 20 per cent was thus arrived at for the maximum absorption of the rhodopsin in the living retina. The hypothesis on which such determinations rest is that equal numbers of quanta absorbed produce equal physiological effects in the retina, whatever the wave-length of the light.

In the sensitivity curves obtained by Granit⁴ for single fibres of, say, the frog retina, the complications due to selective absorption of light by the eye media are avoided, and it appears that the above comparison method would thus be likely to yield interesting results. In fact, Granit has found, for example, that "the curve for the frog was slightly broader than the visual purple [rhodopsin] absorption curve"⁵. Now the visual purple curve referred to here is a curve obtained *in vitro*, for a layer of solution having, of course, a particular optical density. It is then possible that a curve calculated for a higher density would give an accurate fit with the sensitivity curve of the frog. The particular density value giving such a fit could then be taken as an estimate of the optical density of the rhodopsin layer in this retina. Knowledge of the absolute value of this density is of intrinsic interest, since it makes it possible to calculate the number of quanta absorbed, that is, the number of rhodopsin molecules acted upon in the primary

photochemical process, under known conditions of stimulation of the retina.

M. H. PIRENNE

Department of Physiology,
University College, London.
April 10.

¹ Ball, S., Collins, F. D., Morton, R. A. and Stubbs, A. L., *Nature* 161, 424 (1948).

² It is of historical interest to note that Newton dealt with this effect in his "Opticks", Bk. 1, Pt. 2, Prop. x, 4th edit. (London, 1730; reprinted by G. Bell and Sons, London, in 1931).

³ Hecht, S., Schlaer, S., and Pirenne, M. H., *J. Gen. Physiol.*, 25, 819 (1942).

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⁵ Granit, R., *ibid.*, p. 270.

Variation of the Force Constant with the Ionization Potential and the Polarizability for some Halogen Compounds

VARIOUS attempts have been made to systematize the force constants of chemical linkages. In the formulae of Badger¹ and of Clark² relating the constant k_{A-B} with the interatomic distance r_{A-B} , there occur arbitrary constants the magnitudes of which depend on the positions of the atoms A and B in the Periodic Table, and in the later formula of Gordy³ the electro-negativities of A and B are involved. None of these relations holds very generally.

I have recently investigated systematics in the force constants of halogen compounds, and evidence has been obtained for the existence of a linear relation between the force constant k_{A-X} and the ionization potential V_i of the variable halogen atom X. The results for the series HX, CX₄, SiX₄, BX₃, PX₃ and CH₃X are shown in Fig. 1. For all except the first of these series the constants are ambiguous, there being several frequencies involving the halogen atoms. In CX₄ and SiX₄, k is obtained from the single totally symmetric Class A₁ mode, for BX₃ from the single totally symmetric Class A₁ mode, and in PX₃ from both P—X stretching modes, using a general potential function⁴; k_{C-X} in the methyl halides is obtained from ν_{C-X} on the assumption that the methyl group remains rigid in this mode.

Fig. 1