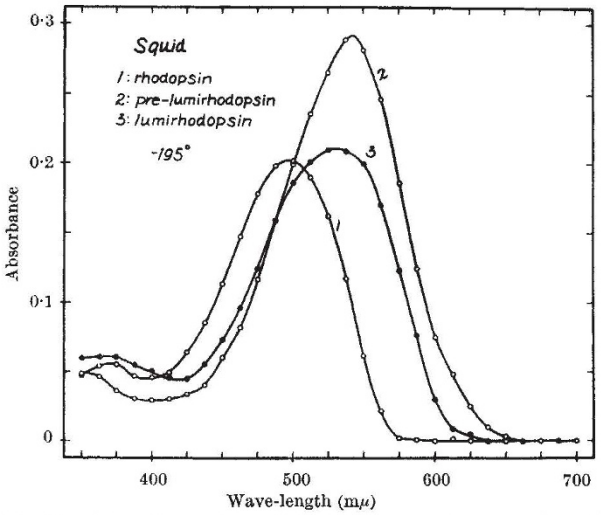

Fig. 11. Absorption spectra of equivalent concentrations of squid rhodopsin, pre-lumirhodopsin and lumirhodopsin at −195°. These spectra were computed from those of Fig. 10 by procedures similar to those used in Fig. 2. Lumirhodopsin at −195° has λ_{max} about 530 mμ, and its maximal absorbance is 1·03 times that of rhodopsin

is converted to lumirhodopsin. On re-cooling to −195° and re-irradiating at 436 mμ, the lumirhodopsin is re-converted to pre-lumirhodopsin. That is, cattle lumirhodopsin can be converted to pre-lumirhodopsin by irradiation at liquid nitrogen temperature.

Fig. 9 shows that the same is true of squid lumirhodopsin. Curve 1 of Fig. 9 is the absorption spectrum of squid rhodopsin at −195°. On irradiating at 579 mμ the spectrum moves to curve 2, almost wholly isorhodopsin. On re-irradiating at 436 mμ the spectrum moves to curve 3, representing the familiar steady-state mixture of rhodopsin, isorhodopsin, and pre-lumirhodopsin. This mixture is now warmed gradually to −90° in the dark, to allow the pre-lumirhodopsin to go over to lumirhodopsin. The mixture is re-cooled to −195° and its spectrum re-measured (curve 4). This now represents a mixture of the rhodopsin and isorhodopsin present in curve 3 and lumirhodopsin formed from the pre-lumirhodopsin of curve 3. On irradiating this mixture at 436 mμ the spectrum moves to curve 5, which is practically identical with curve 3, showing that this irradiation has converted the lumirhodopsin present in curve 4 to pre-lumirhodopsin.

To determine accurately the absorption spectrum of squid lumirhodopsin, the experiment shown in Fig. 10 was performed. Curve 1 shows the absorption spectrum of squid rhodopsin at 10° C. The preparation was cooled to −195°, then repeatedly warmed to −90° and re-cooled to −195°, until the spectrum of the product at liquid nitrogen temperature had settled down to a stable absorbance (curve 2). The preparation was now irradiated at 436 mμ to yield the steady-state mixture of rhodopsin, isorhodopsin, and pre-lumirhodopsin (curve 3). Then this mixture was warmed to −90° to allow the pre-lumirhodopsin to go over to lumirhodopsin (curve 4). The preparation was then warmed to 10° C, so that the lumirhodopsin bleached, mainly to alkaline metarhodopsin, leaving the usual residual mixture of rhodopsin and isorhodopsin (curve 5). Finally, these residual pigments were bleached at 10° and 546 mμ to yield curve 6, primarily alkaline metarhodopsin with a small admixture of acid metarhodopsin. By a computation similar to that described in connexion with Fig. 2, the baselines of all these spectra were corrected, and the proportion of rhodopsin and isorhodopsin in curve 5 was estimated. This was corrected as before to liquid nitrogen temperature. Subtracting it from curve 3 yielded the spectrum of pre-lumirhodopsin, and subtracting it from curve 4 yielded that of squid lumirhodopsin.

Fig. 11 shows the results of this computation: the relationships at equivalent concentration among the spectra of squid rhodopsin, pre-lumirhodopsin and lumirhodopsin. Squid lumirhodopsin possesses λ_{max} about 530 mμ, and a maximal absorbance 1·03 times that of rhodopsin.

Thermal stability ranges. We have in several experiments observed the temperatures at which, on gradual warming, squid pre-lumirhodopsin goes over in the dark to lumirhodopsin and then metarhodopsin. Whereas cattle pre-lumirhodopsin is stable between −195° and −140°, squid pre-lumirhodopsin seems to have a narrower stability range, and to be converted appreciably to lumirhodopsin at temperatures above −170°. As was shown earlier[3], squid lumirhodopsin is converted in the dark to metarhodopsin at temperatures above −20°.

This work was supported in part by the U.S. National Science Foundation and the Office of Naval Research. We also thank Dr. Ruth Hubbard for gifts of squid retinæ and permitting us the use of unpublished results; and Mr. Paul K. Brown for assistance with designing the equipment and help with using it.

[1] Yoshizawa, T., Kitô, Y., and Ishigami, M., *Biochim. Biophys. Acta*, **43**, 329 (1960); Kitô, Y., Ishigami, M., and Yoshizawa, T., *ibid.*, **48**, 287 (1961); Grellman, K.-H., Livingston, R., and Pratt, D., *Nature*, **193**, 1258 (1962).

[2] Yoshizawa, T., and Wald, G., *Nature*, **197**, 1279 (1963).

[3] Kropf, A., Brown, P. K., and Hubbard, R., *Nature*, **183**, 442 (1959).

[4] Absorbance (extinction, optical density) = $\log_{10} I_0/I$, in which I_0 is the incident and I the transmitted intensity of light.

[5] Hubbard, R., and St. George, R. C. C., *J. Gen. Physiol.*, **41**, 501 (1957–58).

[6] Hubbard, R., and Wald, G., *J. Gen. Physiol.*, **36**, 269 (1952–53).

[7] Dowling, J. E., and Hubbard, R., *Nature*, **199**, 972 (1963).

[8] Hubbard, R., *J. Gen. Physiol.*, **39**, 935 (1955–56). Hubbard, R., and Kropf, A., *Proc. U.S. Nat. Acad. Sci.*, **44**, 130 (1958). Kropf, A., and Hubbard, R., *Ann. N.Y. Acad. Sci.*, **74**, 266 (1958).

[9] Hubbard, R., *J. Gen. Physiol.*, **42**, 259 (1958–59).

NEWS and VIEWS

Physics Group, Royal Radar Establishment: Dr. D. H. Parkinson

Dr. D. H. Parkinson has been appointed to the new post of head of Physics Group, Royal Radar Establishment, with the rank of deputy chief scientific officer. Dr. Parkinson, aged forty-five, was educated at Gravesend County Grammar School (1929–37) and Wadham College, Oxford (1937–39 and 1945–49). In 1939 he joined the Royal Artillery, was commissioned in 1940 and in 1942 seconded to Army Operational Research Group, with which he served for the rest of the War. On returning to Oxford in 1945 he worked under Sir Francis Simon until 1949, when he was awarded his Ph.D. He joined the then Telecommunications Research Establishment (now Royal Radar Establishment) in 1949 as senior scientific officer, was promoted to principal scientific officer in 1951 and senior principal scientific officer in 1956, latterly holding the post of head of the Magnetics and Low-temperature Research Division in the Physics and Electronics Department, Royal Radar Establishment. Recently, on behalf of the Department of Scientific and Industrial Research, he has been responsible for a design investigation of a national High Magnetic Field Laboratory.

Organic Chemistry at University College of South Wales and Monmouthshire: Prof. L. Crombie

Dr. L. Crombie, who has been appointed to the newly created chair of organic chemistry in the University College