myself, is of far greater importance. Kellogg and Bell,[3] Northrop,[4] Tangl,[5] Kopec, and others, working on different groups of insects, showed that inadequate feeding, qualitatively or quantitatively, prolonged the larval life of the insect concerned. The observations of Krizenecky[6] and of Szwajsowna[7] on mealworms, however, did not seem to support this conclusion. Thereupon I carried out a series of experiments on mealworms, and found[8] (*a*) that the first essential for the metamorphosis is the full growth of the larva, which under normal conditions is attained a few days before actual pupation, and during these few days the larva does not require any food; and (*b*) that metamorphosis is delayed or accelerated according as the larva is inadequately fed before or after it is full grown.

It is evident that, whether metamorphosis is accelerated or retarded, the metabolic rhythm is disturbed; therefore Mr. Dover's explanation of my observations, namely, "that a comparatively lengthy period of starvation, followed by an equal period of normal feeding, disturbed the metabolic rhythm to the extent of retarding growth", is not very helpful. With regard to his own observations, we note that when larvæ of *Orgyia turbata* were reared on *Crotolaria*, a plant to which they were not accustomed, and which was apparently unpalatable, a heavy mortality occurred among them, and those which survived completed the larval period sooner. From this he concludes that inadequate feeding accelerates metamorphosis. This conclusion is based on the assumption that *Crotolaria* is less nutritious than the usual food plant, which may not be necessarily correct. Before sending this communication for publication, Mr. Dover was good enough to discuss the subject with me. He informed me that he had not ascertained by weighing or otherwise whether the larvæ fed on *Crotolaria* were smaller or bigger than those reared on the usual food plant, nor had he followed the complete history of the individuals fed on *Crotolaria* in order to determine their power of reproduction. Without applying these simple tests, to assume that *Crotolaria* provided inadequate food and to suggest that an insect which has once gained a foothold on the unusual plant may be more numerous than on the favoured ones appears scarcely justified. In this connexion the observations of Parfentev[9] on another species of *Orgyia* are of more value. This author studied the question by a series of carefully controlled experiments, and concluded that inadequate feeding retards metamorphosis and prolongs the larval life, a conclusion which is in consonance with the views of many entomologists, including myself, and is entirely opposed to Mr. Dover's interpretations.

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[1] NATURE, **128**, 303, Aug. 22, 1931.
[2] NATURE, **116**, 938, Dec. 26, 1925.
[3] Kellogg, V. L., and Bell, R. G., *Jour. Exp. Zool. and Science*, N.S., **18**; 1904.
[4] Northrop, J. H., *Jour. Biol. Chem.*, **30**; 1917.
[5] Tangl, F., *Arch. ges. Physiol.*, **130**; 1909.
[6] Krizenecky, J., *Biol. Zentrbl.*, **34**; 1914.
[7] Szwajsowna, P., *C.R. Soc. Sci. Vars.*, **9**; 1916.
[8] Pruthi, H. S., *Brit. Jour. Exp. Biol.*, **3**; 1925.
[9] Parfentev, I. A., "Défense des Plantes", Leningrad I.; 1925.

The Spin of the Photon.

RECENTLY a number of papers have appeared on the question as to whether the phenomena of polarisation of light can be explained by the assumption of a 'spin' of the photon.[1] Kastler and Frisch deduce from their experiments that the photon possesses no spin, and Kastler argues further that the phenomena of polarisation should be explained on statistical grounds. Raman and Bhagavantam, on the other hand, argue that the interesting results obtained by Bär and Hanle[2] on the reversal of the state of polarisation of Raman lines when observed in the direction of propagation of the primary beam can be explained only on the assumption that the photons possess spin. They seem to link circular polarisation definitely with a spin of the photon about the line of propagation.

The arguments of Frisch and Kastler are based upon the Sommerfeld-Rubinowicz explanation of the selection principle for the azimuthal quantum number (principle of conservation of angular momentum of atom plus photon), but applying the same principle, and the principle that the atom-magnet can orient itself in any direction making certain definite quantised angles with the external field (as proved by Stern and Gerlach's experiment), it can be shown that the absorption of Zeeman components can never disappear with reversal of the field, but it will be modified on passing through two fields, whether parallel or antiparallel. Hence the experiments of Frisch or Kastler cannot be interpreted in the way supposed by them and show no light on the question of the spin. Secondly, and this is more important, a discussion of the Zeeman effect of the π-components of the D_1 line, assuming that the principle of conservation of angular momentum holds during radiation, shows that there may be photons without any 'spin' whatsoever, although they may show polarisation. It therefore seems unjustifiable to describe polarisation with the aid of a 'spin'. It appears that Bär and Hanle's results should be explained in some other way than that proposed by Raman and Bhagavantam.

A full discussion will appear later.

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[1] Frisch, *Zeit. für Physik*, vol. 61, p. 626; Kastler, *Jour. de Physique*, May 1931; Raman and Bhagavantam, NATURE, **128**, July 18, 1931.
[2] *Naturwiss.*, vol. 19, p. 463, 375; 1931.

Light Scattering in Liquids.

As was pointed out by Raman and Krishnan,[1] the nebulosity or wings which appear accompanying the original lines of the mercury arc in the spectrum of the light transversely scattered by liquids consist of nearly completely unpolarised light. These wings arise from an unresolved rotational Raman scattering, their intensity depends on the optical anisotropy of the molecules concerned, and they contribute in a not negligible degree to the total scattering by the liquid. Owing to the fact that it consists mainly of unpolarised light, the existence of rotational scattering affects the observed depolarisation of the total scattered light to a notable extent. This is illustrated by the figures given in Table I., in which measurements with carbon disulphide, benzene, and toluene are shown. The first column of figures gives the depolarisation, as measured with a nicol and a spectroscope with a *very wide slit*, so that the Rayleigh and rotational Raman scattering are superposed.

TABLE I.

Substance.	Total scattering (observed value).	Rayleigh scattering (observed value).	Spin theory (quantum).	Classical theory (Maxwellian).
Carbon disulphide	64·0	56·0	55·5	36·4
Benzene . .	41·5	33·3	33·1	20·6
Toluene . .	45·0	37·0	35·1	22·0

In the second column are given the values obtained using *a very narrow slit*, so that only the Rayleigh