rotation through 180°, reversing this small flux gradient, results in only small changes in the growth-rates of the two sides (by redistribution of the materials being supplied from below) leading to a sluggish reversal of the positive phototropic curvature. When, however, the sporangiophores are illuminated either along one flank by a grazing pencil of light[6], or unilaterally under paraffin (refractive index, 1·47, giving a complete reversal of the lens effect), or are exposed to unilateral ultra-violet light of about 280 mμ wave-length (for which the absorption coefficient, α, is high), then there is a high rate of photon absorption on the illuminated side and a much lower rate on the other. With such marked differences in flux, and consequently in adaptive levels, rotation of the sporangiophore might be expected to lead to the sharp reversal of curvature found in these cases.

Turning now to the suggestion made by Carlile, it should be pointed out that, while it is true that the curve plotted by him shows a good approximation to the absorption spectrum of riboflavin, there is a danger of error in taking the phototropic curvature of a relatively transparent organ as an index of photodynamic effectiveness when determining the action spectrum. This is because the value of the absorption coefficient, α, changes with wave-length, thus changing the gradient of the corresponding photon absorption per unit volume. This, as Carlile suggests, presumably explains the change from positive to negative phototropism with diminishing wave-length in the ultra-violet.

If with ultra-violet radiation of 302 mμ wave-length there is a positive light-growth reaction in previously darkened sporangiophores, but not phototropic curvature because Castle's critical value for α is reached, then clearly the true action spectrum for a photo-response should not drop to zero as does the graph of angle of phototropic curvature that Carlile plots. A better curve for the primary photo-response could be obtained by the lengthy process of measuring the average light-growth response when passing suddenly from darkness to a standard flux of radiation of each of an extensive series of wave-lengths. With relatively transparent organs there is an inherent error when using either phototropic curvatures or null-deflexion methods with opposed sources of light of different wave-lengths as an index of photodynamic effectiveness. Add to this the probability of ineffective absorption in shadow-producing pigments, of which carotene may be one, and it is clear that great caution should be exercised when such results are compared with known absorption spectra.

Brauner[7] suggested that the positive light-growth reaction and phototropism in *Phycomyces* might arise through partial light-induced destruction of a previously supra-optional concentration of indolyl acetic acid. Results of experiments now in progress, some devised in discussion with him, do not seem to support this suggestion. Lanolin paste and sodium alginate gel containing 10 μgm. and 100 μgm./ml. of indolyl acetic acid have been applied with a micro-manipulator to one side of the growing zone of sporangiophores which either (1) had previously been subjected to intense illumination with blue light or (2) were, after indolyl acetic acid treatment, illuminated from the side opposite to that treated. Case (1) sporangiophores after further growth in red light having no phototropic action showed no significant response compared with controls treated with plain paste, and in case (2) the positive phototropic response was not reduced: these experiments need to be extended to cover a wider range of conditions.

Riboflavin may indeed be the photoreceptor in *Phycomyces*, and photo-absorption may either reduce the extent to which it checks indolyl acetic acid oxidation, or even directly promote this oxidation, but this assumption is not yet firmly grounded, and there is as yet no good evidence that internal indolyl acetic acid is a myco-auxin regulating the growth of chitin-walled hyphæ.

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The primary purpose of my previous communication[1] was to show that the reversal of phototropism at about 300 mμ reported by Curry and Gruen[2] is explicable in optical terms, and that it was not necessary to postulate a novel photochemical reaction occurring in the far ultra-violet. I also felt that it was useful to point out that Curry and Gruen's results on the relative effectiveness of different wave-lengths when plotted as an action spectrum give a curve similar to the absorption spectrum of riboflavin. I agree with Banbury as to the dangers inherent in this procedure, and realize that observations on the effectiveness of a range of wave-lengths in promoting the light-growth response would, if available, provide a better guide as to the nature of the photoreceptor substance.

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Limited Multiplication of *M. lepraemurium* in Tissue Culture

M. lepraemurium causes rat leprosy, which possesses many of the characteristics of the human disease. So far, attempts to culture the causative organism of either disease in bacteriological media or in tissue cultures have not provided convincing evidence of multiplication.

The minimum period required to maintain tissue cultures if the growth of *M. lepraemurium* is to be detected, can be inferred from the generation time *in vivo*. This was found to be 13 days[1,2]. Such relatively long periods of maintenance would result in a changing and variable cell population. On the other hand, since *M. lepraemurium* persists in a stainable form, the bacilli would, even without multiplication, become redistributed among the changing cell population. Previous methods for detecting multiplication, which have usually depended on the distribution of bacilli in tissue cells, are open to errors. To determine accurately, therefore,

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