time. Moreover, narcosis is accompanied by extreme relaxation both of the circular and of the longitudinal muscles of the worm. Full extension of the worm is therefore made possible. So great is the relaxation of the circular muscles that the body wall is thrown into a series of deep longitudinal wrinkles. These, however, entirely disappear during treatment in the hardening solution. The removal of mucus and foreign matter is easy, due to the fact that the strongly coherent coagulum does not adhere to the worms. If the worms are placed in running water the coagulum floats away as the mass is gently agitated. This method gives rapid narcosis, ease in freeing the specimens from foreign matter and mucus, and plump, well-hardened specimens.

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SPECIAL ARTICLES

THE EFFECTS OF SELECTIVE SOLAR RADIATIONS ON GROWTH AND DEVELOPMENT

TEN chicks (banded) were selected from each of the eight groups used by Higgins and Sheard in their investigations on the parathyroid glands as influenced by selective solar radiations. The filters used were: amber (Pittsburgh No. 48), blue (Pittsburgh No. 56), ordinary window-glass and vitaglass, each about 2 mm. in thickness. To the diet of half of the chicks, 2 per cent. (by weight) of cod-liver oil was added. The standard diet was the Wisconsin all-mash ration, consisting of eighty pounds yellow corn, twenty pounds shorts, five pounds bone-meal, five pounds limestone grits and one pound salt.

The growth of the chicks was estimated from the average weight of the same ten chicks from each of the eight compartments, respectively, the weights being taken biweekly. During the first eighty days it was found that the curves showing the relationship between average weight and age practically coincided when 2 per cent. cod-liver oil was added to the ration, and that similar curves of weight when the standard ration only was fed exhibited the greatest departure from normal (vitaglass or standard ration with cod-liver oil) in the case of the chicks under the amber filter, with blue-glass next. The influence of unfavorable weather conditions (heat and humidity) on the average weight was least marked under vitaglass and most noticeable under the blue and amber filters. The experiments over the eighty-day period indicate that cod-liver oil compensates, in a large part, for the absence of vitamin D, and that the presence of ultra-violet rays of short wave-length (300–330 millimicrons) is an added factor in overcoming various degenerative tendencies.

At the end of six months it was found that the average weight was practically the same (within 3 per cent.) under each of the filters if cod-liver oil was added to the diet. Without cod-liver oil, no departure in average weight was found under vitaglass, 10 per cent. under ordinary glass, 20 per cent. under blue-glass, and 30 per cent. under the amber filter. By reason of the percentages of transmission of solar energy through these filters, together with the fact that the blue-glass used transmits slightly lesser wave-lengths than does ordinary glass and a slightly greater percentage of ultra-violet light, we are forced to the conclusion that the presence of both the longer and shorter (ultra-violet) wave-lengths of sunlight is essential to normal growth.

These results also emphasize the rôle which the parathyroids play in the growth and development of chicks. Hyperplasia of these glands occurs under blue and amber filters in the absence of cod-liver oil. We may postulate that hyperplastic parathyroids develop in an attempted rectification of hypofunctioning through an increase in the size of the glands in order to produce as nearly normal metabolism and development as is possible. Initially, normal growth and development are accomplished through a multiplicity of the functional units. These ultimately break down, causing metabolic disturbances and deficiency diseases.

Our experiments, insofar as they parallel the investigations of others, are not in accord with conclusions commonly accepted. In the experiments of Bovie, young chicks were taken and variously grouped under an environment of sunlight and of light through a greenhouse roof. Their rations consisted of so-called regular feed, regular feed and green stuff, regular feed and cod-liver oil. At the end of the sixty-fifth day it was found that the total weight of the chickens receiving sunlight only through the greenhouse roof is about one-half of the total weight of all the chickens exposed to outdoor sunlight or to the light from the ordinary quartz lamp.

The difference in experimental data and conclusions may be due either to difference in quality of stock or the character of the ration or to both. Obviously, inferior stock will succumb to conditions which will have no effect on superior stock. The matter of ration is evidently important. Our ration was high in its content of minerals (calcium). Biweekly determinations showed that the calcium was about 12 mg for each 100 cc. of serum and the phosphorus about 6 mg. for each 100 cc. of serum during the first three months of observation, irrespective of the character of the light filter.

In conclusion, we have found from experimental data on the quality and quantity of energy in solar

radiation transmitted by the various filters and calculations made therefrom, due regard being given to the experimental results on the influence of selective solar irradiation upon the parathyroids, that an energy-equivalent of the short or so-called vital rays (290 to 320 millimicrons) of 0.045 gram calorie per each square centimeter each minute is ample to produce normal development.

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VITAMIN B—A QUESTION OF NOMENCLATURE

RECENT literature on the composite nature of vitamin B has been very confusing, partly through the failure of some investigators to accept, or at least make clear, the idea that neither of the two factors now believed to be contained in what was originally called water-soluble B and later vitamin B promotes growth in the absence of the other and partly through lack of conformity in naming the two factors.

The question of the identity of the antineuritic vitamin and vitamin B had always been a puzzling one, so closely did they resemble each other in many ways. In 1919 Mitchell[1] in a critical review of the literature on the subject called attention to certain discrepancies in solubility, stability and occurrence of the two vitamins which, in his opinion, cast considerable doubt on their identity and suggested the need of more quantitative experiments in which the same materials should be tested for the prevention of polyneuritis in pigeons and the promotion of growth in young rats—the criteria commonly employed for the study of the antineuritic vitamin and vitamin B, respectively.

Later work, chiefly along the lines suggested by Mitchell, including studies by Emmett and Luros,[2] Funk and Dubin,[3] Heaton,[4] Levene and Muhlfeld,[5] and Hauge and Carrick,[6] strengthened the growing belief in the non-identity of the two vitamins and threw some light on their relative distribution in nature. One or two of these papers contained suggestions to the effect that vitamin B might not be a single substance, but might include the antineuritic vitamin in its make-up, but these received little attention at the time on account of lack of evidence or emphasis on other points. In 1926, Smith and Hendrick[7] called attention to the supplementing action of autoclaved yeast for rolled oats as a source of vitamin B and a similar supplementing action of the autoclaved yeast for the Seidell antineuritic vitamin concentrate and suggested the possibility that a heat-stable vitamin was necessary in addition to vitamin B for the growth of rats. Their experimental work was confirmed by Seidell[8] and by Goldberger, Wheeler,

NOMENCLATURE OF THE HEAT-LABILE AND HEAT-STABLE FACTORS OF VITAMIN B

Author	Heat-labile factor	Heat-stable factor
Goldberger *et al.*	Vitamin B *sensu stricto*	P–P factor
Sherman	Vitamin F	Vitamin G
Randoin and Lecoq	Antineuritic factor	Maintenance or functioning factor
Salmon	Vitamin B–P	Vitamin P–P
Chick and Roscoe	Antineuritic vitamin	Vitamin B *sensu stricto*
Plimmer *et al.*	B_1	B_2
Plimmer *et al.*	Vitamin B	Vitamin P–P
Evans and Burr	Antineuritic vitamin B	Growth-promoting vitamin B
Williams and Waterman	Heat-labile factor	Heat-stable factor
Eddy	Antineuritic factor	Antipellagric factor

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[4] Heaton, T. B., 1922: "On the Vitamin D." *Biochem. J.*, 16, 800.

[5] Levene, P. A., and Muhlfeld, M., 1923: "On the Identity or Non-identity of Antineuritic and Water-Soluble B Vitamins." *J. Biol. Chem.*, 57, 341.

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[8] Seidell, A., 1926: "Comparison Between the Pigeon and the Rat Methods of Testing for Antineuritic Vitamin." Bul. soc. chim. biol., 8, 746.