the important developments in study and research have been drawn upon and used with the older material to make a consistent whole. Several chapters have been completely rewritten and two new chapters have been added. Certain rearrangements have been made in the interests of teaching, which like other changes reflect the experience of the years of classroom use by the author and others, but the general sequence of topics followed in the first edition, which means a chapter devoted to each important type of food, is unchanged. In both editions the following subjects are treated: production and preparation for market with statistical and economic data; proximate composition and general food value, sanitation, methods of inspection and standards of purity; and composition, digestibility, nutritive value and place in the diet.

The last decade has witnessed a very great interest in vitamins and a large addition to the knowledge of them. This newer work is particularly well treated in the book and in such a way that it falls into line with other factors which make up food value.

A new chapter deals with food adjuncts, unclassified food materials and extra foods eaten between meals, as well as salt, spices, flavoring extracts, vinegar and household and commercial beverages, substances about which information is not readily available. There is also a new chapter on food budgets and food economics.

The appendices are an important feature of this volume, as of the earlier one, and have been increased by a table on food products as sources of vitamins A, B and C, and another dealing with food legislation.

The subject index which concludes the volume is full and well arranged.

It is evident that the author has taken unusual pains in the selection of his material and in its arrangement and presentation and it is a readable book as well as a text-book and work of reference for general use.

As should be the case the author in making this book has drawn largely on his own extensive and important research work and study of food and nutrition problems. This adds not only to the interest of the book but greatly to its value.

C. F. LANGWORTHY

WASHINGTON, D. C.

Evolution or Christianity. By WILLIAM M. GOLDSMITH, Ph.D. The Anderson Press, Winfield, Kansas. 50 cents.

UNDER the title of "Evolution or Christianity," Professor William M. Goldsmith undertakes to meet the various anti-evolutionists on their own ground. He considers patiently all those whose ideas are in print, showing in what degrees each can be convicted of ignorance or dishonesty. Meanwhile he upholds the belief that there is no necessary conflict between Christianity and evolution, except when one or both is grossly misunderstood. There is no conflict between verified knowledge, on the one hand, and the sense of awe, reverence, duty and love on the other. The warfare of science rages around non-essentials.

Dr. Goldsmith is a young teacher of science, well trained and well informed. His work is issued in cheap form for wide distribution. It is a response to a real need in these days, and it is a pity and a shame that such necessity exists.

DAVID STARR JORDAN

STANFORD UNIVERSITY

SPECIAL ARTICLES

ULTRAVIOLET LIGHT AND SCURVY

IN his most interesting "Treatise on Scurvy," written in 1757, Lind repeatedly emphasizes the fact that scurvy is more prevalent in northern latitudes and that it usually occurs in southern latitudes during the rainy season and is improved by change of weather. He speaks of the fact that in several channel cruises when the weather was fine there was no scurvy aftr 12 weeks, but that on two cruises during cold rainy weather scurvy broke out in a month. In view of the fact that ultraviolet light can prevent the occurrence of rickets, Lind's book at once suggests that it may have been the lack of sunlight rather than the presence of moisture which led to outbreaks of scurvy during the rainy season.

This possibility is strengthened by a review in the *Lancet* (Vol. 1, 1917, p. 462) which states that in the winter of 1915 the Turkish wounded, who were suffering with scurvy, were greatly improved by exposure to sunlight. These results naturally suggest that ultraviolet light might have a beneficial effect both in the healing and in the prevention of scurvy. However, three series of experiments on guinea pig scurvy have shown entirely negative results.

Experiment I: Twelve guinea pigs, weighing about 290 gms each, were divided into two lots, with some light and some dark animals in each group. Six were depilated once a week on one side over an area of approximately 15 sq cm and radiated daily for 10 minutes at a distance of 12 inches from a Hanovia Alpine Sun quartz mercury arc, running on 110 D.C. at 58 volts and 3 amperes (11 lithopone units of ultra-violet light). The guinea pigs showed a very marked erythema followed by desquamation. A control experiment showed that the depilation in itself did not affect the health or rate of growth of the animals.

The other six animals were used as controls and all twelve were given oats, hay and water ad libitum. Both sets showed loss in weight after the twelfth day, especially the radiated group. On the twenty-third day, two animals being dead in the non-radiated group, and three in the radiated group, radiation was stopped and orange and cabbage were added to the diet.

Autopsies showed approximately the same picture in both radiated and non-radiated animals. The molars were loose and there was marked hemorrhage of the shoulder joints. There was some beading of the ribs and a very marked white line at the epiphyseal junction. The intestines were practically empty, but there was no subcutaneous edema, such as is said to be present in death by starvation. There seemed no doubt that the animals were suffering from scurvy, in both the radiated and non-radiated group, although death may have been hastened by starvation.

The weight curves of two surviving animals in each group are plotted in Fig. 1. No radiation was given for a week, but then, all the animals being apparently well on the way to recovery, the radiated set were radiated again and given the same dose every other day. They immediately stopped gaining weight, developed severe diarrhea and eventually died. The first one to die still showed signs of scurvy on autopsy, but the other showed no scorbutic lesions at the time of death.

Experiment II: In the second experiment six guinea pigs were placed on a diet of oats and bran (two thirds oats and one third bran) to which 3 per cent. of butter fat was added to give an adequate supply of vitamin A. Three animals were kept as controls and the other three were depilated and radiated for 10 minutes at 12 inches from the quartz mercury arc (11 lithopone units) every other day.

There was a rapid fall in weight after the eighteenth day and all animals in both groups showed a severe diarrhea, which may have been due to too large a percentage of butter fat in the diet. On the twenty-fourth day one animal died in each group, so the butter was discontinued and orange and cabbage added to the diet. The picture on autopsy was only slightly different from that in Experiment I.

The non-radiated group began to improve as soon as the diet was changed. The two radiated animals, on the other hand, though not radiated any more continued to lose weight and suffer from diarrhea, and both died at the end of another week.

The results of this experiment indicate that a plentiful supply of vitamin A keeps up the weight of the animals for two weeks or more, but on this diet, as on the preceding one, radiation with ultraviolet light proved ineffectual in preventing or postponing scurvy and seemed to prevent a cure when the diet was changed.

Experiment III: In this experiment an attempt was made to supply a diet which had an adequate supply of vitamins A and B and also a proper salt ration. Insufficiency of the antirachitic vitamin should have been compensated for by the ultraviolet light. The diet consisted of 91 per cent. oats, 2 per cent. butter fat, 2 per cent. calcium lactate, 2 per cent. sodium chloride and 3 per cent. dried yeast (Fleischmann's).

There were four groups, with six animals in group II and five in each of the other groups. They were given the following treatment.

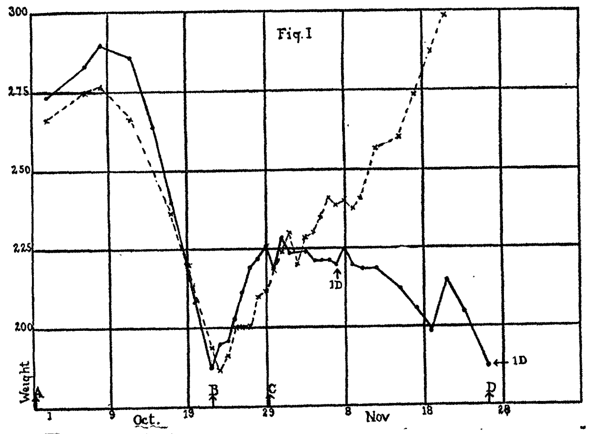

FIG. 1. Weight curves of two surviving guinea pigs in each group in Experiment 1. x - - - - - - - x not radiated .————. Radiated (A-B) and (C-D). Diet started at (A) and cabbage and orange added at (B).

Group I: Controls, scorbutic diet, no radiation.

Group II: Scorbutic diet, exposed to sunlight one half hour every clear day, area depilated on back.

Group III: Scorbutic diet, side depilated and radiated every other day with 5.5 lithopone units if white, and 11 lithopone units if dark.

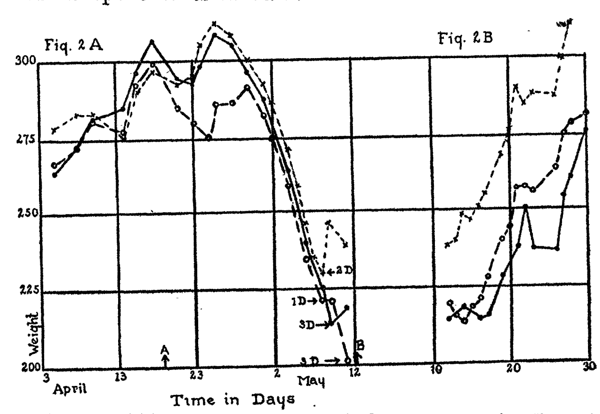

FIG. 2 (A) Weight curves of three groups in Experiment III. x - - - - - x not radiated, o ——— o radiated with sunlight .————. radiated with quartz mercury arc. Diet started at (A) and cabbage and orange added at (B). 2 (B) Recovery curves of surviving animals in groups I, II and III. (Experiment III.)

Group IV: Given same mixture as other groups with addition of greens, two animals depilated and given 5.5 lithopone units every other day, other three not radiated. This group showed very clearly that, on a normal diet, ultraviolet light did not hinder growth.

Groups I, II and III gave almost identical results. After the eleventh day there was a rapid loss of weight at exactly the same rate in all three groups. Only one or two animals, however, showed any sign of diarrhea. The results plotted in Fig. 2 (A) show conclusively that on this diet, as on the two preceding ones, ultraviolet light had no effect in preventing or postponing scurvy and sunlight seemed equally ineffectual.

The autopsies showed the same lesions as in the previous experiments. The recovery curves of the three animals left in group I and the two left in each of groups II and III, after the addition of orange and cabbage to the diet, are given in Fig. 2 (B), groups II and III being radiated as before. All three groups recovered at approximately the same rate so that after the production of scurvy on this diet subsequent radiation with ultraviolet light did not prevent recovery. This may have been due to the better diet but may also have been due to the fact that less radiation was given than before.

CONCLUSIONS

Three experiments with different scorbutic diets showed that ultraviolet radiation is entirely ineffectual in preventing or postponing scurvy. With diets in which other factors, besides the scorbutic vitamin, were lacking, ultraviolet light hastened loss of weight and death from scurvy somewhat and prevented recovery after orange and cabbage were added to the diet. This, however, was not true when a diet lacking only in the antiscorbutic vitamin was used.

JANET H. CLARK
SCHOOL OF HYGIENE AND PUBLIC HEALTH,
THE JOHNS HOPKINS UNIVERSITY

EFFECTIVE DUST TREATMENTS FOR THE CONTROL OF SMUT OF OATS

THE use of copper dusts for the control of certain smuts of cereals has received considerable atttention by investigators in America during the past four or five years. The report of Darnell-Smith, of Australia, in 1919 provided the stimulus for a change of the trend of research in this connection, by diverting attention from the sprinkling and soaking methods previously employed, to the use of dusts. This form of treatment presents a new idea in seed disinfection. By the use of a weak, slowly available fungicide, infection is prevented coincident with the germination of the grain in the soil, yet by reason of the low solubility of the chemicals used, the seed is not likely to be injured.

Most effective and consistent results have been obtained in the control of covered smut of wheat with copper carbonate. In the case of covered and loose smuts of oats, results have been variable. While copper and nickel compounds used as dusts have greatly reduced the amount of smut in nearly all instances, their fungicidal efficiency has not been sufficient to provide commercial control and to merit general recommendations.

After three years of trial in Ohio, no copper or nickel compound used alone as a dust has been found adequate for the control of oats smut. On the other hand, when combined with mercuric chloride the mixture proved to possess a fungicidal value which compared very favorably with formaldehyde.

In treating grain it is not only desirable that the fungicide used should be effective for the control of smut, but also that the germination of the seed should be stimulated or, at least, not impaired. The data presented in the table indicate that with the copper and nickel compounds combined with mercuric chloride there was marked stimulation in the germination of the grain. This is not apparent in the plots treated with formaldehyde.

In the preliminary tests one part of the copper or nickel salt and two parts by weight of mercuric chloride were thoroughly mixed and ground together. This mixture was used at the rate of three ounces per bushel for treating grain. The mercuric chloride, when used alone, was found to have very poor adhesive properties; also, because of its high comparative cost and extreme degree of toxicity, it would be less desirable than when used with some other compound which would serve as a carrier. The basic idea involved is to add just enough of the mercuric chloride to the copper or nickel salt that the fungicidal value of the mixture may be raised to the required efficiency for oats smut control. Further trials will be necessary to more accurately determine the minimum amount of the salts that may be effectively

RESULTS OF SEED TREATMENTS

The table gives in the first column the per cent. of smut; in the second the per cent. stand on basis of check, and in the third the per cent. of gain or loss due to treatment

Check	32.	100.	—32.
Formaldehyde sprinkling method	00.	87.5	—12.5
Formaldehyde diluted 1-1 with water	.01	97,2	— 2.7
Formaldehyde dry diluted 1-10 with water.	.007	94.2	— 5.7
Copper carbonate	4.6	105.3	+ .7
Copper carbonate plus mercuric chloride.	.05	101.5	+1.45
Copper sulphate (not anhydrous)	11.4	102.0	— 9.4
Copper sulphate plus mercuric chloride...	.7	112.7	+12.0
Nickel carbonate	3.6	100.7	— 2.9
Nickel carbonate plus mercuric chloride..	.5	111.1	+10.6
Copper acetate	8.0	107.0	— 1.0
Copper acetate plus mercuric chloride...	.5	116.0	+15.5