Theorem I has been applied[4] to the study of the famous deviation problem (a particle falling from rest to the earth allowing for rotation or ellipticity). Our new extended theorems will also have applications, direct and indirect, in physical situations dealing with interacting particles. The forces need not be conservative.

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A STUDY OF LAMPBRUSH CHROMOSOMES BY THE ELECTRON MICROSCOPE

LAMPBRUSH chromosomes have been photographed by the electron microscope. The nuclei were removed from the oocyte according to the method of Duryee[1] and were placed on the collodion film suspended on the wire mesh which is used in place of the slide in the electron microscope. The nuclei were torn apart so that the enclosed material spread over the film. The membrane was then removed since it was too thick for penetration by the electron beam when collapsed. The preparation was allowed to dry in air.

The photographs seem to verify early descriptions. Some chromosomes appeared to be highly branched and subbranched. They were fern-like in appearance. The threads were crystalline and single. Other chromosomes showed less numerous, thicker, more globular side branches. Many side branches had been lost between the first and second type. Finally some showed no branches. There were as many as four threads twisting about one another separating into twos at some points and rejoining at others.

No loops, as described by Duryee, were seen. However, chromosomes from full-sized eggs only have been examined. Further investigations, in which the nuclei of half-sized eggs will be used, are in progress. It may be that these will verify the loop theory as put forth by Duryee.

Blanks were run in which only cell debris, from which the nucleus had been removed previously, and the nuclear salt solutions were dried and photographed. No similarities between these preparations and those of the nucleus were observed.

The investigations are being extended in the belief that they will throw added light on the structure of such chromosomes and will clear up such problems as the time at which the chromomena thread becomes doubled.

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[4] W. H. Roever, *Bull. Amer. Math. Soc.*, 456, 1915.

[1] W. R. Duryee, "Cytology, Genetics and Evolution," University of Pennsylvania Press, Philadelphia, 1941.

CONSIDERATION OF THE ADEQUACY OF BIOMICROSCOPY AS A METHOD OF DETECTING MILD CASES OF VITAMIN A DEFICIENCY

RECENTLY Dr. H. D. Kruse has reported on "The ocular manifestations of avitaminosis A with especial consideration of the detection of early changes by biomicroscopy."[1] He has suggested that "xerosis conjunctivae probably precedes night blindness as an early sign of avitaminosis A," and recommends biomicroscopic examination as a "simple, convenient, objective method" for the detection of avitaminosis A in surveys.

In view of the importance of finding reliable tests for detecting mild degrees of the various avitaminoses, it is relevant to call attention to certain discrepancies between the above-mentioned observations and those reported in a study by Booher, Callison and Hewston in which impaired dark adaptation was produced in five adults by the consumption of a diet adequate in every known dietary essential except vitamin A.[2] The Hecht and Shlaer Adaptometer was used to determine the dark adaptation curves of these subjects. Dysadaption occurred in from 16 to 124 days after the vitamin A-deficient diet was begun and for four subjects was allowed to proceed until the visual threshold after 30 minutes of dark adaptation was elevated by 1 logarithmic unit; subject I of this group was continued on the experimenal diet until the 30-minute threshold was 4 logarithmic units above normal, while at this time of greatest visual impairment, the rod structures were not functioning at all below the scotopic threshold of the cones. Thus, there was no question of the existence of hemeralopia in any of the five subjects.

During the period of greatest impairment in retinal function, a slit-lamp examination was made on subject I by Dr. Alan C. Woods, of the Wilmer Ophthalmological Institute of The Johns Hopkins Hospital. There was no evidence of abnormality. The remaining four subjects were examined with the slit-lamp by Dr. William M. Rowland of the same institution both before and during impaired adaptation, as well as after that function had returned to normal following the administration of moderate amounts of vitamin A. Neither did any of these subjects show conjunctival or corneal changes at any of the examinations.

Attention should also be called to the work of Youmans *et al.*, who conclude that mild degrees of vitamin A deficiency can exist without any modifica-

[1] H. D. Kruse, *The Milbank Memorial Fund Quarterly*, 19: 207, 1941.

[2] L. E. Booher, E. C. Callison and E. M. Hewston, *Journal of Nutrition*, 17: 317, 1939.

tion of the ocular epithelia, as diagnosed by microscopic examination of conjunctival smears.[3] Similar observations have been made in this laboratory.

The cases reported by Dr. Kruse were obtained from a low-income group of which a dietary survey was being made. In such a group multiple dietary deficiencies are the rule rather than the exception. Therefore, it is important that further investigation of conjunctival and corneal changes be made on subjects with uncomplicated experimental vitamin A deficiency before complete reliance is placed in the biomicroscopic examination as a routine method of detecting mild cases of vitamin A avitaminosis.

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SOME FACTORS IN THE NUTRITIONAL DETERMINATION OF HISTORY

IN his paper concerning the social implications of vitamins, Williams[1] suggested that the enjoyment of a more generous supply of thiamin and other vitamins by the Germans than by other peoples of Western Europe might explain the present European situation. Thiamin has also been referred to by others as "the morale vitamin." However, I am inclined to agree with Clendening[2] that the importance of vitamins in national nutrition is being grossly exaggerated. False hopes of simple solutions of nutritional problems appear to be raised by an over-emphasis on the value of vitamins. Indeed, it remains to be seen whether the use of "enriched" foods and vitamin preparations will do much more in the long run than increase the incidence of obesity, diabetes and other disorders promoted by over-nutrition.

The developments in Europe during the past 25 years nevertheless seem to present excellent illustrations of the effects of some nutritional factors, independent of the vitamin supply, on the rise and decline of nations or cultures throughout the ages. That is, a nation or culture can develop only when or where a sufficient supply or surplus of food becomes available. In a society with constructive or progressive tendencies, a sufficiency or surplus of food serves, in part at least, to provide leisure for some to develop the arts. Among even the most primitive arts has been that of catering to the appetite. This art has conspicuously manifested itself in tribal feasts, in the Roman banquets and, in recent Europe, by French cuisine. The Roman banquets probably sealed the fate of the Roman Empire and French food and wine were very likely factors in the fall of France. In short, too much food or an excessive catering to the appetite can wreck an empire just as surely as it can ruin an individual.

On the other hand, seasonal variations in the food supply, periodic famines, wars and more or less fasting under religious influences in the past apparently served to avert an otherwise precipitate decline of some nations or cultures because of the common tendency to self-indulgence in the midst of plenty. Thus, in India and China, a relatively steady state or balance between the supply or use of food and cultural attainment has long been maintained. In the first World War, German resistance cracked partly because of simple undernourishment due to the food blockade and, shortly after that, Russia came close to complete collapse because of famine conditions in that country. However, it does not seem to be sufficiently realized that the outburst of the German spirit since the first World War and the recent stubborn resistance of the Russians to invasion are explainable as physiological and psychological consequences of more liberal food supplies following periods of enforced food restriction or starvation. The observations of Carlson,[3] Kunde,[4] Glaze[5] and McCay[6] indicate that a manifestation of physical and/or mental improvement is to be expected with re-alimentation after periods of fasting or food restriction. Moreover, the results of my personal experience, which involves a total of about 600 days of fasting during the past 33 years and also some observations on others, lead me to believe that the most striking after-effects of fasting or food restriction occur between the ages of about 20 and 35. In the German and Russian experiences, this means in those who are now between about 40 and 60 years of age and therefore in active control.

If the foregoing views are correct, it would seem of more importance in America to guard against the insidious effects of dietetic excesses among the "well-fed" millions than to concentrate on raising the nutritional standards of the extremely poor. In any case, so-called deficiency diseases may often be excess diseases—due to excessive intakes of carbohydrates, fats and/or proteins. I believe that a sufficiently keen appetite is about all that is needed to lead one to choose an adequate diet and that the appetite can best be kept keen by occasional periods of voluntary food restriction or fasting. More studies ought to be made on the after-effects of fasting and simple undernutri-

[3] J. B. Youmans, M. B. Corlette, M. G. Corlette and H. Frank, *Jour. Lab. and Clin. Med.*, 23: 663, 1938.
[1] SCIENCE, 94: 502, November 28, 1941.
[2] *Jour. Am. Med. Assn.*, 117: 1035, 1941.
[3] "The Control of Hunger in Health and Disease." Chicago. 1916.
[4] *Jour. Metabolic Research*, 3: 399, 1923.
[5] *Am. Jour. Psychol.*, 40: 236, 1928.
[6] "Chemical Aspects of Aging." In Cowdry, "Problems of Ageing." Baltimore. 1939.