lined with a dark gray necrotic membrane. The contents of the abscess had a very foul odor. Cultures of the material from the cavity of the abscess of this animal were made on 12 different kinds of culture media and grown under 3 different forms of anaerobiosis besides the usual aerobic cultures. We were unable to grow aerobic organisms from this material but we were able to isolate 5 different anaerobic organisms which were obtained in pure culture. Each of the 3 types of anaerobiosis yielded the same group of organisms. These pure cultures of anaerobic organisms have been used in the same manner as the original material from the gum margins of the patient with *pyorrhea alveolaris* and some of these pure cultures of anaerobes have given rise to chronic abscesses of the lung that were similar to the lesion described for Dog 39. A further report on the end results of these experiments will be published later. In the rest of the 14 animals from which pathologic specimens were obtained at autopsy definite localized lesions were found which were similar to the chronic lesion described for Dog 39.

Evidence is therefore submitted that the chronicity of the experimental abscess of the lung in dogs is dependent upon the presence of a certain group of anaerobic organisms commonly found at the gum margins of patients with *pyorrhoea alveolaris.*

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Relation of Dietary to Effects of Relatively Large Amounts of X-Rays on the Organism.

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In a study of the effects of x-rays on animals fed normal dietaries, diets varying in the content of vitamins A and B and diets varying in relative amounts of the basic constituents, protein, fat and carbohydrates, certain findings have been obtained.

As reported formerly,[1] 10 MAM (13 "e" units) of x-rays given twice a week to a full grown or growing rat, prolongs and increases growth on a deficient vitamin B ration. 25 MAM (34 "e" units) increase growth and lengthen life on a ration deficient in either

[1] Burrows, M. T., Jorstad, L. H., and Ernst, E. C., *J. Am. Med. Assn.*, 1926, lxxxvii, 86.

vitamin A or vitamin B. On 50 MAM (68 "e" units) the increase in normal growth and length of life is more marked in the series fed a dietary deficient in vitamin A than in one fed a dietary deficient in vitamin B. When larger doses than the above are given, such as 75 MAM (102 "e" units) or 100 MAM (136 "e" units) the life of the animal is shortened on either of these deficient rations. On a balanced laboratory ration life is shortened in each case, the degree of shortening being in direct ratio to the amount of x-rays given. On a stock ration consisting of dog biscuits, lettuce, carrots, meat and corn, the average length of life of a 90 gm. rat with the latter dosage is 90 to 120 days.

As discussed in the communication cited above, these observations indicate that x-rays act to cause a protoplasmic breakdown within the cell. The apparent stimulation with the smaller dose is due to a predominance of the protoplasmic disintegration from which the energy of life is derived. When larger doses of x-rays are given, the greater splitting off occurs between the protoplasm and the ergusia, or vitamin A. With the smaller dose the splitting off occurs between the water soluble elements of the cell and the intercellular substances. In that a high vitamin A dietary does not wholly protect against these larger doses other structural elements of the cell must be destroyed also. This is illustrated by the observation that the usual balanced vitamin dietary protects for a shorter period of time than the well rounded stock ration.[2]

Our present studies indicate that if in addition to the stock ration a certain amount of vitamin A is added, greater increase in growth rate and further prolongation of life is noted. With the addition of cream to the dog biscuits in the usual laboratory ration, the growth rate reaches a certain maximum at 50 days, and then remains at this level until a period of 180 days. At this time a slight loss in weight occurs, but the animals are still living 215 days after the beginning of the experiment. This can be contrasted to the weight curve of a rat on a diet to which has not been added the cream. In this case the maximum increase in weight is reached at 40 days and from that time there is a gradual decline until death at 90 to 120 days. On a similar ration in which 3% cod liver oil is substituted for the cream, there is a slow but gradual increase in the weight curve after the 30 days period following the beginning of the x-ray dosage and this gradual increase in the weight curve has continued throughout the course of the experiment, 215 days. These animals appear normal to date. Former studies have shown that an increase in the vita-

[2] Burrows, M. T., Jorstad, L. H., and Ernst, E. C., *Radiology*, March, 1928.

min A fraction alone does not protect these animals against the destructive action of the x-ray. These latter studies seem to indicate that the destructive action of the ray is prevented in direct proportion to the amount of fat soluble vitamin added to a well balanced diet. With our present source of vitamin A we are not able to introduce enough in the system so as to protect absolutely against higher dosages, because with the giving of 125 MAM (170 "e" units) twice a week the protective action of 3% cod liver oil in the ration is not marked. At present we are studying the effects of these dietaries to which is added a vitamin A concentrate. The question arises as to whether the body is able to utilize or metabolize these high concentrates.

It was found in our studies of x-ray burns that a well marked burn will protect an animal against a vitamin A deficiency for a considerable period of time.[3] These rats did not develop a xerophthalmia until a period from 4 to 6 months after being placed on a diet deficient in vitamin A, while control rats on this dietary develop this eye symptom within 30 days. As we have stated in previous papers, certain dosages of x-ray are not different in their action on the system from the ultraviolet ray. It is quite well known at present that the continued administration of ultraviolet to an individual on a ration deficient in vitamin A will enhance the production of vitamin A deficiency. In our studies the same relation is found to exist between the x-ray and these vitamins. The x-ray does not produce or add vitamin B or vitamin A to the system, but it increases their availability or utilization. This would account for the increase in duration of life in direct ratio to the amount of vitamin A added to the dietary. These later studies confirm these findings and our present studies on vitamin A concentrates will be interesting in that they will demonstrate how concentrated a form of vitamin A can be utilized by the system.

Conclusions. Provided a well balanced dietary is given, the destructive action of x-rays on the organism is protected in direct ratio by the concentration of vitamin A added to or available in the animal body.

[3] Jorstad, L. H., and Lane, C. W., to be published in *J. Am. Med. Assn.*