in Ringer solution and on ice for one or two days is smaller than can be exactly measured. (2) The penetration of ultra violet light is stronger than given in the older literature, particularly by Hasselbalch,[1] and smaller than suggested by Macht and his co-workers.[2, 3] (3) The various layers of skin (horny layer, epidermis, corium, sub-cutaneous fat, connective tissue, plasma, blood, melanin, etc.) exert a very different absorption and show characteristic selective absorption bands. (4) The corrected skin sensitivity curve toward erythema, as observed by Hausser and his co-workers[4] can be explained by the passive absorption of ultra violet by the horny layer and the active absorption by the proteins in the skin.

[1] Hasselbalch, K. A., *Strahlentherapie,* 1913, ii, 403.

[2] Macht, D. I., Bell, F. K., Elvers, C. F., PROC. SOC. EXP. BIOL. AND MED., 1925, xxiii, 210.

[3] Macht, D. I., Anderson, W. T., Bell, E. K., *J. Am. Med. Assn.*, 1928, xc, 161.

[4] Hausser, K. W., and Vahle, W., *Strahlentherapie,* 1921, xiii, 41.

## 3900

## Digestive Function in Avitaminoses.

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McCarrison[1] and others have observed marked pathological changes in the gastrointestinal tracts of animals kept on diets deficient in vitamins and other substances. From such observations it has been inferred that lesser degrees of vitamine deficiency continued over long periods of time might be responsible for various gastrointestinal disturbances in man. Farmer and Redenbaugh[2] prepared extracts of the pancreas and upper intestines of polyneuritic pigeons and found a decrease in the digestive enzymes as compared with controls.

The present paper represents the first of several attempts to obtain a quantitative index of various gastrointestinal digestive functions in animals and man based on the principle of feeding an excess of difficultly digestible food substances and estimating the percentage digestion by fecal analysis. Iron oxide was used as a key substance to simplify the utilization determinations.[3]

Eight groups of albino rats and 3 groups of guinea pigs were used, each group consisting of 6 animals. Severe conditions of

avitaminosis were induced by feeding diets deficient in vitamins A, B, C and D. The effect of cod liver oil administration and treatment with ultraviolet light was also studied.

As a test of digestive efficiency there was added to the diets in successive periods definite amounts of raw potato starch and elastin or ground horn. The feces were analyzed for starch or protein and for iron and utilization calculated, a correction for metabolic nitrogen being made.

Starch digestion was in the neighborhood of 90% for all animals including controls. For protein digestion values of 51% for animals on -B diet and 60% for rachitic diets as compared with 68% for controls were the greatest variations noted. It is not believed that these differences are great enough to support the view of an early or specific impairment of digestive function in these avitaminoses. Neither did iron reduction tests[4] indicate increased intestinal bacterial activity in these conditions.

[1] McCarrison, R., *J. Am. Med. Assn.*, 1922, lxxviii, 1.
[2] Farmer, C. J., and Redenbaugh, H. E., *Am. J. Physiol.*, 1925-26, lxxv, 45.
[3] Bergeim, O., *J. Biol. Chem.*, 1923, lxx, 29.
[4] Bergeim, O., *J. Biol. Chem.*, 1924, lxii, 45.

## 3901

## Duodenal Drainage of the Human Gall Bladder.

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During the last 5 years both the theory and the efficacy of the Meltzer-Lyon test have been frequently challenged, but as yet no adequate measurements of the amount of bile discharged from the gall bladder following the injection of $MgSO_4$ and other substances into the duodenum, seem to have been made.

In view of the consensus of opinion that $MgSO_4$ is not absorbed by the intestine and believing that evacuation of the gall bladder might be induced by mechanical stimulation, we injected air into the duodenum through a Reyfuss tube and then x-rayed the patient at short intervals—computing the volumes of the gall bladder according to the method employed in previous publications.[1] In 3 out of 4 individuals subjected to this procedure, the gall bladder showed measurable reduction in size after inflation of the duodenum (Fig.