We may say, therefore, that of the 16 animals all but 2 showed definite evidence of tubercle formation as the result of infection with the bovine strain of tubercle bacilli.

Of the 5 suprarenalectomized animals inoculated with the avian bacilli, all were found at autopsy to have extensive tuberculous lesions. In the previous experiment it was shown that only 50% of normal rats inoculated with the avian strain developed characteristic tuberculous lesions. It was, therefore, deemed unnecessary to use additional controls for this group.

It appears then that bilateral suprarenalectomy in the albino rat lowers the resistance so that subsequent inoculation with the bovine tubercle bacillus results in definite tissue reaction, with tubercle formation and caseation, resembling human tuberculosis. This does not occur in normal rats or in rats in restricted diet. Suprarenalectomy and, to a less extent, deficient diet increase the susceptibility of rats to the avian tubercle bacillus.

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Vitamin D in Tuberculosis.

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In 1926 in the course of our vitamin and calcification studies[1, 2, 3] the question arose repeatedly as to whether vitamins play an important rôle in the etiology and treatment of tuberculosis. Ultra-violet light within recent years has been found of value in the treatment of intestinal tuberculosis; heliotherapy has been used with success in other forms of tuberculosis; calcification often is found in healed tuberculous lesions. These considerations suggested a possible linkage between tuberculosis and the vitamin D content of the diet.

In the older literature, reviewed by Wells, DeWitt and Long,[4] cod liver oil is mentioned as having value in tuberculosis. The bene-

[1] Shear, M. J., and Kramer, B., *J. Biol. Chem.*, 1926, lxxi, 213.

[2] Kramer, B., Shear, M. J., and Shelling, D. H., *J. Biol. Chem.*, 1926, lxxi, 221.

[3] Shear, M. J., and Kramer, B., *J. Biol. Chem.*, 1928, lxxix, 105, 121, 125, 147, 161.

[4] Wells, H. G., DeWitt, L. M., and Long, E. R., "The Chemistry of Tuberculosis," Williams and Wilkins Co., Baltimore, 1923.

ficial results, sometimes obtained, may not have been due to the fat but to the vitamins present in the oil. The failures in the past may have resulted from the inability of the patient to tolerate the large amounts of fat which accompany the potent material in the oil. Or the patient may have been given cod liver oil devoid of vitamins.

In the present study only such materials were used as were shown to be antiricketically potent by biological assay. We prepared irradiated cholesterol and tested its potency on ricketic rats according to a previously described technique.[1, 2] We also used cod liver oil concentrate (Metz), obtained and tested as described in a preceding paper.[5] Also dried yeast powder (Fleischmann) was irradiated and biologically tested in an analogous fashion.

Subsequently, biologically assayed cod liver oil was added to the number of preparations studied. In the summer of 1926 we invited Dr. Bray and his staff, of the New York State Hospital for Incipient Tuberculosis at Ray Brook, to collaborate with us in that portion of the general vitamin-tuberculosis problem which pertained to human intestinal tuberculosis. They agreed to do the clinical testing of these materials at Ray Brook. They fed their patients daily, irradiated cholesterol, 2½ gm.; cod liver oil concentrate, 1 gm.; irradiated yeast, 10 gm. They[6] have so far reported to us that: orange or tomato juice aids in the retention of cod liver oil; the above mentioned agents, in conjunction with orange or tomato juice, are equally effective with the exception of irradiated cholesterol, which appears to be less effective than the others; 58 cases were treated, of which 50 received cod liver oil with tomato juice; the oral administration of these agents is at least as effective as artificial heliotherapy in the treatment of intestinal tuberculosis. The clinical details of this part of the work will be reported by Dr. McConkey, of Ray Brook.

In a separate series of cases we tested the efficacy of vitamin D unaccompanied by regular large additions of vitamins A and C. These clinical tests were carried out at the Neponsit Beach Hospital for Children.

Eighteen tuberculous children were divided into 2 groups of 9 each; one was the test group, the other the control. One child had tuberculosis of the skin, the others had active bone tuberculosis. All received a well-balanced diet. The treated children received daily 4 mg. irradiated ergosterol (Fleischmann) during the first 4 months

[5] Kramer, B., Kramer, S. D., Shelling, D. H., and Shear, M. J., *J. Biol. Chem.*, 1927, lxxi, 699.

[6] Personal communications from Dr. Bray and Dr. Smith.

and 7 mg. for the succeeding 8 months. (0.0001 mg. of the irradiated ergosterol per rat per day produced a continuous line in rickets rats in 7 days.)

Physical examinations of the children were made periodically as well as blood pressure readings, urine analyses, roentgenograms and analyses for serum calcium and phosphorus. The results may be summarized as follows:

1. The daily addition of a large amount of vitamin D did not produce any detectable acceleration of the healing process.

2. Such doses of irradiated ergosterol produced no discernible deleterious effects. According to some observers, toxic symptoms, *e. g.:* anorexia, vomiting, pallor, loss of weight, hematuria, hyperphosphataemia and hypercalcemia, follow the administration of this agent. Our cases showed no such harmful effects.

3. The administration of irradiated ergosterol for 12 months produced no increase in either serum calcium or phosphorus.

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Identification of Blood Serum by Precipitin Reaction.*

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The precipitin reaction has been used extensively in medico-legal work for almost 30 years. Nuttall[1] used the precipitin tests in zoological relationships and Boyden[2] confirmed the work of Nuttall and stressed the principle of reciprocal relationships. The methods used in medico-legal work have been entirely of the "trial and error" type and no satisfactory method is known for identification of the individual bloods of a mixture, often an important item in criminal trials. Zoological relationships based on serological evidence can give a basis for a less cumbersome technique in medico-legal work.

In verifying the principle of reciprocal relationships and the per cent values of relationships the methods of Boyden were used. Two per cent antigen solutions of human, horse, sheep, beef, pig, cat and

* The writer wishes to express his appreciation to Dr. A. A. Boyden of this University for his suggestions, aid and criticism of the problem investigated.

[1] Nuttall, G. H. F., Blood Immunity and Relationship, Cambridge University Press, 1904.

[2] Boyden, A. A., *Biol. Bull.*, 1926, vl, ...