A PRELIMINARY REPORT ON THE PHYTOTOXIC EFFECT OF RAT BLOOD[1]

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In research extending over the past several years, and for the most part as yet unpublished, the authors have found that water solutions of blood from persons with various types of cancerous conditions affect the rate of growth of corn seedlings to quite a different degree than do blood solutions from normal individuals. In repeated controlled experiments the growth rate of sets of fifteen matched corn seedlings was greatest in the water controls, least in normal blood solutions, and intermediate in solutions of cancerous blood.

The environmental conditions of aeration, temperature, and moisture were identical for all sets of growing seedlings in each experiment. Blood solutions used consisted of eight percent blood in distilled water. The corn seeds were sterilized in bromine solution, germinated for forty-eight hours in an incubator at twenty-five degrees centigrade, and individuals selected for root length of one centimeter. These were placed in ten milliliters of the various solutions on filter paper in sterile petri dishes. The dishes were placed in a random order in an incubator to grow for seventy-two hours at twenty-eight degrees centigrade. At the end of this period the entire root system was cut from each seedling, dried in an oven at 103° C. and the dry weights of each were determined on a Roller-Smith balance.

The dry weights were used as a measure of the growth of each seedling and compared as a means of determining relative growth rates. These weights varied from approximately six to forty-five milligrams, being quite uniform for all fifteen seedlings in each series, namely, the water grown controls, those grown in eight percent normal blood, and those grown in eight percent cancerous blood. Uniformly, the highest rates of growth were found in the water grown controls, the lowest rate in the normal blood solutions, and intermediate rates of growth in the cancerous blood solutions.

Surprisingly uniform results were obtained with numerous blood samples collected and tested during the past three to four years. However, during the course of these experiments certain difficulties became apparent with the acquisition of adequate blood samples presenting the major problem.

The majority of cancer blood samples were necessarily collected from aged hospitalized patients who frequently were suffering from other chronic diseases. These samples naturally caused concern as to what

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disease entity was primarily responsible for affecting a differential growth response. Further, in virtually every instance the metastatic growth was in an advanced stage. Obviously, it would be far more desirable to obtain samples from early cancer stages for if such blood samples were to offer equal growth responses as samples from the advanced cases, then there would be some possibility of a test for detection of an early malignancy.

It was decided that the use of laboratory animals such as mice or rats would offer possibilities of close control of the age and type of the tumors as well as individual sex, age, and weight. Laboratory mice are subject to cancer and their blood proved to give results in the inhibition of rate of growth of seedlings similar to those obtained with human blood. However, their small size made it impossible to obtain a minimal blood sample from a single animal sufficient for the technical procedure. Use of these animals for further work would have required a pooled sample of blood from several mice or the use of a reduced number of individual corn seedlings. Either of these expedients was considered undesirable.

The use of white rats is possible if rat blood causes variations in growth patterns similar to those caused by the phytotoxic effects of human blood or that from mice. White rats are not as susceptible to spontaneous carcinomas as are certain strains of mice. However, through the use of tumor transplants or chemical carcinogenic agents, malignant growths may be induced in rats.

In this experiment blood was obtained from two white rats. One sample was separated by centrifugation into the serum and red cell fractions. Procedure and controls were identical with those described above as used in studies with human blood. After a forty-eight hour germination period fifteen matched corn seedlings were grown in eight percent solutions of (1) whole rat blood, (2) the red cell fraction, (3) the serum fraction, and (4) in distilled water for the control series.

After the usual seventy-two hour growth period, the dry weights of the roots of each seedling were determined and these are shown for each group in Table I.

The check series gave a weight distribution very similar to those obtained in previous experiments with human blood, varying from twenty-five milligrams to thirty-seven and six-tenths milligrams. The distribution of weights of the roots of corn seedlings grown in whole blood solution shows a much lower set of values, varying from ten milligrams to twenty-three and eight-tenths milligrams. This distribution also compares very closely with those obtained in previous experiments using whole human blood from normal individuals. Roots of seedlings grown in the serum fraction closely approximate the check series in weight while those grown in the red cell fraction gave a series of weights very similar to those grown in the whole blood solution. It would seem that the factor or substance in blood which inhibits the growth of plants is associated with the red cells and not with the serum.

TABLE I

PHYTOTOXIC EFFECT ON RAT BLOOD

Dry Weights of Corn Roots Listed In Milligrams			
Check	Whole Blood	Serum Fraction	Red Cell Fraction
25.0	10.0	21.0	10.0
25.4	10.8	22.6	10.5
27.6	11.2	26.2	11.0
29.6	11.6	26.8	11.2
30.0	12.1	27.4	12.4
30.0	12.2	29.0	14.4
30.4	14.2	30.4	14.6
31.0	14.8	30.4	14.8
31.2	16.6	31.4	15.0
31.2	17.6	31.8	15.2
32.0	18.2	32.2	15.4
33.8	18.4	33.8	15.4
34.0	18.4	34.0	15.6
35.8	23.4	36.0	18.4
37.6	23.8	36.4	20.4

Two additional trials were conducted in an identical manner to that described to check the accuracy of the results given above. The results of these additional trials were similar and essentially identical with those listed.

Since blood from normal rats has a phytotoxic effect on plants similar to that produced by human blood it only remains to determine whether blood from rats with cancer will also show inhibiting effects similar to that caused by cancerous human blood. If this proves to be the case, further investigation of these phytotoxic effects can be carried out using laboratory rats as the blood source.[1]

[1]Since this report was read a number of blood samples from rats having methylcalanthrene-induced carcinoma have exhibited the same effect on growth of corn seedlings as that previously shown in the studies on blood from human cancer patients. Namely, less of a phytotoxic effect is apparents for the cancer blood than is exhibited by the blood from normal animals. These studies are being expanded and will be reported elsewhere.