patrick that the toxic factor in the two strains is identical. Although there are antigens common to both strains, our findings do not support the suggestion that the two toxic substances are identical.

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The Target Area of Mammalian Red Cells

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When a suspension of N red cells is placed in a beam of parallel light, its opacity depends in a complex way on the projected area, or "target area," which the cells present in the direction of the light (*3*). As extreme cases, all the cells might be oriented edge-on, or all face-on, and in the former case the opacity would be less than in the latter because the target area is smaller. When the cells are oriented at random, the target area, T, is somewhere between these two extremes. Although the mammalian red cell is a biconcave discoidal body, all its possible projections in a beam of parallel light are those of a similar discoidal body in which the biconcavities are replaced by two planes, one on each side of the cell, passing through the circles of points along the greatest thickness of the rim. We can thus obtain a simple solution of what has been hitherto a troublesome problem by using a little-known theorem which was proved by Cauchy and to which attention has recently been called (*1*): If a body is convex and has area A, A is equal to four times the mean of the area of the projection of the body on a plane for all orientations of the latter. To find the target area of a suspension of red cells oriented at random, we have therefore to find the area, A, of a body of the same shape as that of the average red cell, except that the biconcavities are replaced by the planes described; the target area, T, will then be equal to $NA/4$.

Computations of A have been made from scale drawings of the average red cells of several animals (*2*), using Pappus' theorem for the surface of a solid of revolution. The values are given in Table 1, which also gives the values of S, the surface area of the biconcave discoidal red cell.

The ratio A/S varies from 0.88 to 0.91 in these five types of red cell, and, while the mammalian erythrocyte is by no means constant in shape in all species, it is probably good enough for the purposes of opacimetry to take A as equal to 0.9 S.

TABLE 1

Cells of	A, μ^2	S, μ^2
Man	144	163
Rabbit	100	110
Elk	71	79
Sheep	60	67
Tahr	24	27

The target areas corresponding to the *spherical* forms of the red cells of man, the rabbit, and the sheep are $N \times 25\,\mu^2$, $18\,\mu^2$, and $12\,\mu^2$, respectively.

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Soil Nitrogen and Thrips Injury to Spinach

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That the nutritive qualities of agricultural crops are influenced by the fertility of the soil on which they are grown is a well-established fact. Also, that a relationship exists between soil fertility and the production of plants resistant to, or unsuitable as food for, insect pests has been demonstrated by recent work at the Missouri Agricultural Experiment Station (*2*). Some of the possibilities in this as yet little explored field of entomology have recently been suggested by a striking relationship observed between the amount of soil nitrogen provided for spinach plants and their "resistance" to attack by the common greenhouse thrips (*Heliothrips haemorrhoidalis*).

New Zealand spinach was grown under controlled conditions in gallon glazed crocks using colloidal clay cultures (*1*). A series of 16 soil treatments was prepared by supplying calcium and nitrogen levels each of 5, 10, 20, and 40 milliequivalents per crock with all possible (*i.e.* 16) combinations in these amounts of the two nutrients. Each series was replicated 10 times. Calcium acetate and ammonium nitrate were the respective sources of the variable elements, and all other nutrients were provided in constant amounts for all treatments. The plants were placed in a greenhouse infested with thrips, the insects being left free to choose whatever plants they wished. During the first month of growth, of the 320 plants in the experiment, not one of the 160 plants grown at the two higher nitrogen levels was noticeably attacked by the insect. This condition was in sharp contrast to that observed on an equal number of plants grown at the two lower nitrogen levels, of which practically all were seriously damaged. It was also of significance that when the calcium supply was increased, the insect attacks on the low-nitrogen groups were less serious.

As the same plants matured and the transition from vegetative to reproductive development was initiated, an unexpected phenomenon characterized the feeding habits of the thrips. In the two lower calcium series they shifted from the plants grown on soils low in nitrogen to those highest in this nutrient, while the damage in the higher calcium groups practically ceased for all treatments. As a result of greater vegetative growth, the plants with low calcium and originally supplied with adequate nitrogen had probably approached the unbalanced nutritional status characteristic of those provided with the least nitrogen at the beginning, since no additional nutrients had been added during the course of the experiment. The insects invariably selected as food those plants of a lighter green color. Even on the same plant, the thrips always chose the older, more mature leaves in preference to those younger and higher in nitrogen. In general, as long as the crops made a vigorous luxuriant growth as a result of an adequate nitrogen supply, they were practically immune from insect attack.

For a proper interpretation of these observations, one should be mindful of the following items of interest: (a) most insects have specific hosts, signifying, perhaps, that they have definite food requirements to satisfy; (b) the nutrient contribution of the host plant may be altered tremendously by soil fertility, especially, as in this case, when the nitrogen is varied (*3*); (c) the long-recognized value of crop rotation in pest control may be, in part, a result of better maintenance of soil fertility and consequent greater "plant resistance"; (d) the explanation as to why some crop pests, such as codling moth, become more serious as fruit trees are grown continuously on the same soil without a complete renewal of the nutrients removed may be found, in part at least, in soil deficiency; and (e) possibly the continuing need for the creation of new insecticides to hold in check greater and more destructive ravages of insect pests is aggravated by the gradual, but general decline in soil fertility from year to year.

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Obituary

D. F. J. Lynch
1891-1945

Final rites for D. F. J. Lynch, director of the Southern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry, U. S. Department of Agriculture, were held in New Orleans, Louisiana, on 16 October 1945.

Mr. Lynch, a native of Boston, Massachusetts, died at his residence on 15 October 1945 following a week's illness. He was 54 years old.

Widely known as a chemist, Lynch came to New Orleans six years ago when the Southern Regional Research Laboratory was built. He had been connected with the U. S. Department of Agriculture for twenty years and had gained fame for developing a method for the production of cellulose from sugarcane bagasse.

Lynch was chairman of the Louisiana chapter, American Institute of Chemists, a member of the American Chemical Society, and an active member of the Army and Navy Club of New Orleans. He was a veteran of World War I.

In 1934–35, Mr. Lynch supervised the construction and operation of a semicommercial plant in Hawaii for the production of cellulose and in 1938 directed a survey of research being carried on in the Southern States by federal, state, and private laboratories on industrial utilization of agricultural commodities. Prior to assuming his post at the New Orleans laboratory, Mr. Lynch directed the U. S. Government By-Products Laboratory at Ames, Iowa.

He received his A.B. and A.M. degrees in chemistry from Harvard University and LL.B. and LL.M. from the Georgetown law school in Washington, D. C.

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