These comparative data are evidence that the crystals from the microbiological source and vitamin $B_{12}$ are identical.

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## Cultivation Is Necessary

The tremendous interest in the use of the various growth-regulating chemicals has brought forth imposing problems regarding unfavorable soil conditions in crop production. Inspection of a number of carrot fields in eastern Pennsylvania in 1947 revealed a very compact and unsatisfactory soil condition resulting from, among other things, a lack of satisfactory cultivation. This was due primarily to the lack of the necessity for cultivation to control weeds because of the use of certain weed-control substances. The yields were phenomenally low. It was believed that a part of this low yield was due to a lack of aeration and unsatisfactory soil conditions.

Experiments with carrots were designed in 1948 to study the influence of cultivation on the growth of the crop. These experiments were located on a Woodstown sandy loam at Cinnaminson, New Jersey, and on a Steinsburg silt loam near Newtown, Pennsylvania. One thousand pounds of a 5–10–10 fertilizer/acre was disked in after plowing in each case. Each of these experiments was carefully replicated 5 times and consisted of (1) hand-cultivation and hand-weeding and (2) no cultivation, with the use of oil spray and hand-weeding to control weeds. The following table gives the mean yield of carrots (lbs/acre):

| Treatment | Steinsburg silt loam | Woodstown sandy loam |
|---|---|---|
| Cultivation and hand-weeding | 11,658 | 11,126 |
| Oil and hand-weeding and no cultivation | 1,204 | 7,007 |

The above differences in yield were highly significant and leave no doubt that under the conditions of these experiments cultivation was a deciding factor in crop yield. Each of the uncultivated soils became extremely compact and unfavorable for root growth. It is realized that some cultivation is practiced by most growers, but in 1947 many soils in eastern Pennsylvania where carrots were grown became extremely compact, and the yields were low on these soils. The same was true to a lesser extent in 1948. Because of this fact and in view of the tremendous interest in chemical weed-control methods at this time, the above information is pertinent and warrants careful consideration by all concerned with crop production.

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## "Serology" and "Immunology"

In a recent communication (*Science*, October 8, pp. 377–378) M. S. Marshall discusses the uses of the terms immunology and serology and their interrelations. He pleads for "separation of the concept of immunity and the phenomena of serology." With much of what he says the writer is in agreement, for it long ago became evident that some of the content of "immunology" had nothing directly to do with immunity. In other words, "immunology" became a term of misrepresentation and was, therefore, contraindicated. The solution made was to take the newer term "serology" to refer to that branch of biology which deals with the nature and interactions of antigens and antibodies (A. Boyden. *Sigma Xi Quart.*, 1936, **24**, 154; *Physiol. Zool.*, 1942, **15**, 109). On this basis serology is the broad term referring to *all phases* of the nature and reactions of antigens and antibodies. Immunology should, then, properly be of a different kind of inclusiveness and refer to those matters, serological or otherwise, which relate to problems of immunity in organisms.

On this basis clarity and truthfulness of thought in both fields can be attained, and the human capacity to confuse with words to some extent held within limits. It would, moreover, be a great mistake to belittle serology and to attempt to restrict it to matters of the technique of handling antigens and antibodies, and nothing of this kind was the intent of Dr. Marshall's remarks. There is a distinct need for the broad term serology to cover the growing field of biology in which the nature and reactions of antigens and antibodies play their part. As in all other branches of biology, "observation and reflection" should go together and the term serology would include both. There has already developed a considerable body of fact, theory, and fundamental principle in serology and especially in systematic serology.

I commend Dr. Marshall for his critical analysis of the possible relation or lack of relation between immunity and serological reactions, and I trust that we will not sacrifice the gains already made in establishing serology as a broad term covering the nature and interactions of antigens and antibodies together with all the applications and implications of such knowledge. In this broad sense serology would include some phases of immunology and would overlap many other fields of biology, but so do genetics and evolution, and ecology, and all other biological subdivisions. However, each of these fields is to some extent distinctive in methods and results and entitled to a place in biology.

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