deviation 1.26%). Broken lines indicate values of the mean plus and minus twice the standard deviation. It is evident that the decrease of albumin during inactivation expressed as a percentage of the albumin fraction of unheated serum is significantly higher in cancer sera. The 5 cases where this ratio is found to be less than 6.7% were cancer of the skin (open squares), 3; cancer of the cervix, 1; cancer of the cervix *in situ,* 1. Under the described conditions the results obtained with pregnancy sera are similar to those of cancer.

The conclusion has been advanced from electrophoresis studies of normal horse serum that a "colloidal aggregation product" with an approximate mobility of β-globulin is formed during heat inactivation at the expense of the serum globulins and that if "produced in large amounts it adsorbed considerable quantities of albumin" (*3*). The decrease of albumin during heating of human serum may be due to adsorption of albumin on globulin after denaturation, the extent of the adsorption depending on the nature of the proteins in each particular condition. When the individual values of albumin concentration after inactivation are plotted against the ratio of albumin decrease to globulin (all values in g/100 ml) and curves of mean values are constructed (Fig. 2), a relationship can be demonstrated expressed by

$$\log A_i = .76 + .09 \log \frac{A_o - A_i}{G_o} \text{ for the ``controls,'' and by}$$

$$\log A_i = 1.04 + .55 \log \frac{A_o - A_i}{G_o} \text{ for cancer sera.}$$

It may be anticipated that similar relationships can be established in other conditions where the serum proteins differ from the normal.

**References**

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# *Comments and Communications*

## Further Notes on Discrimination

Lorch *et al.* (Science, 114, 161 [1951]) have brought before the scientific public a subject that is of great importance today. Discrimination in the United States against Negro citizens in all walks of life raises questions concerning our boast of democracy. Especially in science, where we commonly speak with enthusiasm and pride of the contributions of all nations to our disciplines, we should be alarmed at the fact that Negro citizens do not have equality with the rest of us when they desire to better mankind through science.

Ten years ago Lillie (Science, 95, 10 [1941]), in his obituary for his student, Ernest Everett Just, said:

> An element of tragedy ran through all Just's scientific career due to the limitations imposed by being a Negro in America. . . . He felt this as a social stigma, and hence unjust to a scientist of his recognized standing. . . . That a man of his ability, scientific devotion, and of such strong loyalties as he gave and received, should have been warped in the land of his birth must remain a matter for regret.

It would seem desirable for more white American scientists to follow Dr. Lillie's lead in protest against discriminatory policies and practices, inasmuch as these are discouraging participation by Negroes in the fields of scientific research and teaching.

During the December 1950 meetings of the AAAS in Cleveland there was, so far as I am aware, no gross discrimination against Negro participants. There were, however, conspicuously few Negro delegates or speakers. The reasons for this are not far to seek:

1) Negroes who might otherwise develop a keen interest and a great ability in science often lack incentives to undergo expensive training when they realize that, after obtaining their training, they will either be forced into menial employment despite their abilities or will be employed in segregated schools whose limited budgets make for limited salaries, overloaded schedules, and lack of equipment or funds for research.

2) With individual exceptions the grade school and high-school training of Negroes is relatively inferior in most sections of the country, both in segregated schools for Negroes in the South and in unsegregated schools in the Negro districts of our Northern communities. This situation eliminates many Negro students from competition for college and university training at the same time that white students of equal or inferior basic capacity are able to complete their studies.

3) Because of mass discrimination in employment, Negro parents cannot afford to give their children the necessary scientific training.

4) Those Negroes who have succeeded in mastering all the hurdles and who have become science teachers and research workers, by and large are employed in low-paying positions and institutions, and cannot afford travel expenses to national meetings, nor can their institutions afford to pay their expenses.

Commonly we associate discrimination with our Southern states. Paradoxically, however, the majority of our Negro scientists are able to find employment only in the segregated schools of the South, with all that this implies. Such scientists, because of legal and extralegal restrictions, find themselves isolated in large part from social and scientific contact with most of their fellow-scientists. On the other hand, the problem exists also in our Northern states. The chemist Percy Julian found his home bombed in Chicago. Recently, in the same city, Dr. Julian was barred from a luncheon of scientists at the Union League Club. Very few Northern universities and colleges have more than a token representation of Negroes on their faculties. Many schools, including medical schools, discriminate against Negro students through the so-called quota system.

Lorch *et al.* certainly are justified in complaining against discriminatory practices at a Nashville meeting of the southeast section of the Mathematical Association of America. Their suggestion that an antidiscrimination clause should be placed in the bylaws of that organization should be extended to cover all organizations of scientists. Furthermore, it would seem desirable for the AAAS and all its affiliated organizations to make concerted, though belated, efforts to break down some of the gross discriminatory practices that besmudge the training and hiring policies of most of our schools and laboratories, both in the South and in the North. In this manner the AAAS can better fulfill its function of serving scientists, both Negro and white. Perhaps a first step could be taken through the appointment of an interracial committee to make a thorough investigation of discrimination against American scientists. The committee thereupon could make specific proposals for appropriate action by the AAAS and its affiliates.

CHARLES C. DAVIS
*Department of Biology, Western Reserve University*

## Limiting Factors

WHEN considering the principle of limiting factors, plant scientists still lean heavily on Blackman's concept (*Ann. Botany,* **19**, 281 [1905]), which implies that, in a process influenced by several factors, only one (the one having the "slowest pace") can limit the process under a given set of conditions. The recent excellent textbook of Curtis and Clark (*Introduction to Plant Physiology.* New York: McGraw-Hill [1950]) presents two figures showing that increased photosynthetic yields can be obtained by increasing either $CO_2$ or light intensity within certain parts of their range, but when interpreting these data they say that the more obvious and more important reason for this phenomenon is that different parts of the test plants are under different environmental conditions. The implication is that Blackman's concept is correct, but that the failure of experimental conditions to insure uniform environment for all plant parts is responsible for the apparent discrepancy between experimental results and Blackman's diagram.

The fact is, however, that Blackman's diagram is oversimplified. This can be demonstrated by discussing the utilization of relatively "slow factors" in a process such as photosynthesis. Let us assume that all the

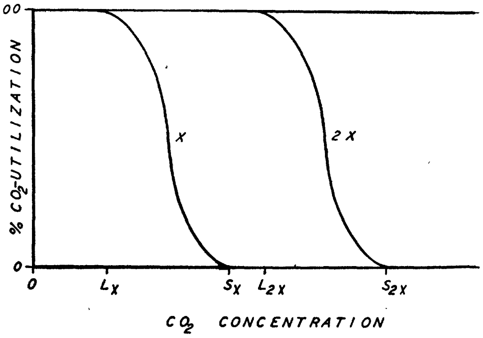


FIG. 1. Diagram of the relationship between $CO_2$-utilization and $CO_2$ concentration in photosynthesis, when light is held constant at a relatively low level.

factors in the photosynthetic process are relatively abundant, except $CO_2$ and light supplies. Let us give light the value $x$ and allow $CO_2$ to vary between 0 and $\infty$; then give light the value $2x$ and again let $CO_2$ vary between 0 and $\infty$. A diagram of $CO_2$-utilization graphed against $CO_2$ concentration would then appear as shown in Fig. 1. Note that for any given light supply there are three ranges of $CO_2$ concentration: the range $O$–$L$, in which $CO_2$-utilization approaches 100%; the range $L$–$S$, in which $CO_2$-utilization decreases from near 100% to near 0%; and the range $S$–$\infty$ in which $CO_2$-utilization approaches 0% asymptotically. In the range $O$–$L$ utilization is so near complete that increased light supply does not increase yield detectably. In this range yield is linearly proportional to $CO_2$ supply. In the range $S$–$\infty$ $CO_2$-utilization represents such a small fraction of the available supply that variation of the $CO_2$ supply has no detectable influence on yield. This is the "saturation" range. These two parts of the range were understood by Blackman, but he ignored the $L$–$S$ range. Therein lay his oversimplification. In the $L$–$S$ range $CO_2$-utilization is detectably less than 100%, and increase of other factors may provide higher efficiency of $CO_2$-utilization and higher yields; but $CO_2$-utilization in this range is detectably more than 0%, and so an additional $CO_2$ supply improves the availability detectably, and higher yields result. The relationship between $CO_2$ supply and yield, however, is not linear in this range.

Fig. 1 also illustrates the meaning of relative scarcity and relative abundance. With a light supply of $x$ the $CO_2$ supply $S_x$ represents approximate saturation. When light supply is $2x$, the $CO_2$ concentration $L_{2x}$ represents relative scarcity, although the absolute value of $L_{2x}$ is greater than $S_x$. It is obviously possible for several factors in a process such as photosynthesis to lie in an $L$–$S$ range simultaneously. Under such conditions an increase in any one of these factors will provide detectable yield increases. The postulation of nonuniform environmental conditions is not needed to explain such a phenomenon.

JACOB VERDUIN
*The Franz Theodore Stone Institute of Hydrobiology*
*The Ohio State University, Put-In-Bay*