Communications

Big Business Takes Over Research

Recent years have witnessed the establishment of large and powerful institutes, both governmental and private, for the prosecution of research in chemistry and physics. These institutes possess the financial backing, the equipment, the highly trained scientists and the technicians to follow up any new lead in science and to carry this lead rapidly to a successful conclusion. The journals are then flooded with research papers.

On the contrary, the scientific worker who happens to be a teacher in a college or university must prosecute his research with the help of untrained, or partly trained men and often has to put up with unsatisfactory or insufficient equipment. He is obliged also to divide his time between teaching and research. Thus it is patent that the teacher cannot compete successfully with members of research institutes.

It appears to me that college researchers are being forced into the background by this big business of research and that this situation is altogether undesirable. I fully agree with Curt P. Richter [*Science* **118**, 91 (1953)] who states that the man should be supported rather than the design and that we should educate public agencies and legislators to see the importance of backing individuals.

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Intestinal Absorption of Vitamin B_{12} in Man

It is common knowledge that only a small part of vitamin B_{12} ingested is absorbed in the intestine (*1–6*). The underlying principles of intestinal absorption of this vitamin are, however, poorly understood. Recently, we have used surface scintillation measurements of the uptake of radioactive vitamin B_{12} by the liver following parenteral and oral administration of this vitamin for the study of intestinal absorption of vitamin B_{12} in human beings (*7*). We measured the hepatic uptake of radioactivity in normal individuals (*8–10*) following the ingestion of a standard dose of 0.2–0.4 μc (microcuries) of Co^{60}-containing radioactive vitamin B_{12}, to which variable doses of crystalline nonradioactive vitamin B_{12} were added. The mean hepatic counts obtained were then compared with those observed following intramuscular administration of a similar dose of the radioactive vitamin B_{12}. This allowed one to calculate the parenteral equivalent of the oral dose of vitamin B_{12} ingested.

It became evident from these studies that there exists an inverse relationship between the radioactivity counts over the liver and the amounts of crystalline vitamin B_{12} added to the radioactive vitamin B_{12} ingested. In the same individual, the uptake of radioactivity by the liver decreases rapidly on increase of the total dose of vitamin B_{12} taken in, when calculated per 1 μc of radioactive Co^{60}-B_{12} ingested. This indicates an inverse relationship between the amount of vitamin B_{12} ingested and the efficiency of its absorption in the intestine (*11*). The parenteral equivalents of the dose of vitamin B_{12} taken by mouth show a steady decline and follow a hyperbolic regression curve. The oral dose of 0.5 μg B_{12} results in radioactivity counts over the liver equivalent to those observed after injection of 90.5 ± 5.8 percent of this dose; of 1.0 μg, to those observed after injection of 81.5 ± 11.4 percent of this dose; of 2.0 μg, to 40.0 ± 8.1 percent; of 5.0 μg, to 22.0 ± 3.3 percent; of 20 μg, to 6.0 ± 1.5 percent; finally, of 50 μg, to 3.0 ± 0.7 percent of parenteral dose only. The individual differences in absorption, however, may be considerable. The farther extrapolation of the curve shows that the efficiency of absorption of vitamin B_{12} in the intestine would decrease to less than 1 percent if the dose ingested were increased to 1000 μg or more. Because of the decrease in the efficiency of absorption on increase of the intake, the increment in the absolute amount of B_{12} absorbed on increase of the dose ingested from 0.5 to 50.0 μg is strikingly small and amounts only to about 1 μg.

The intestinal absorption of vitamin B_{12} under normal conditions is controlled apparently by the existence of a *partial mucosal block* which shows much similarity to that regulating the absorption of iron in intestine. We believe that it may require for absorption of vitamin B_{12} in addition to Castle's gastric intrinsic factor also an intramural *"intestinal B_{12}-acceptor,"* the role of which in metabolism of B_{12} would be similar to that of apoferritin in iron absorption. With increasing saturation of B_{12}-acceptor in the intestinal wall, the absorption of vitamin B_{12} in the intestine would be braked, and this might explain the regression of efficiency of absorption of vitamin B_{12} on increase of the dose. After B_{12} passes into the blood through the intestinal membrane and before it becomes anchored in the liver and hematopoietic tissues, it circulates in the blood where it probably becomes bound to one of the proteins of the serum (*3, 12*), which by analogy with the serum transferrin we might call *"B_{12}-transferrin."*

The partial mucosal block to intestinal absorption of B_{12} changes to a complete or almost complete block in sprue and in pernicious anemia. This is evidenced by no, or a negligible, hepatic uptake of orally administered vitamin B_{12} in these diseases (*8–10*). In sprue, the block cannot be corrected by the addition of gastric intrinsic factor (*8–10*), because the defect in this disease depends on a generalized and inherent defect in the absorption mechanism of the intestinal wall. In pernicious anemia, the block to absorption of vitamin B_{12} depends largely on the absence of Castle's gastric intrinsic factor and can be converted into a partial block similar to that existing in normals, by addition to vitamin B_{12} of normal human gastric juice (*1, 2, 13*), intrinsic factor concentrate from human or hog stomach (*14, 15*), or by lavishly increasing the intake of vitamin B_{12} (*2, 4*) alone. This, through mass effect, overcomes the block and results in the absorption of some fraction of the dose ingested. However, *the principle of regressing efficiency of B_{12} absorption in the intestine with increase of the intake* will still hold also under these circumstances (*16*).

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Carbon Dioxide Compensation Point in Photosynthesis

Rabinowitch (*1*) has emphasized the scarcity of data concerning the "carbon dioxide compensation point" in photosynthesis (the CO_2 concentration which, with abundant light, yields zero values of apparent photosynthesis because photosynthesis just compensates respiration). He quotes values from three sources: Miller and Burr, for a large variety of potted plants, values of about 0.01 percent; Thomas, Hendricks, and Hill, for beet plants, 0.003 percent; Gabrielsen, for *Sambucus* leaves, 0.009 percent. Some additional values, computed from the literature, are presented here.

Table 4 of Heinicke and Hoffman (*2*) contains data from which the CO_2 compensation point can be estimated. In three experiments reported there (No. 9, 10, and 11) the leaf area per envelope was so large that apparent photosynthesis approached zero. Although they do not report the initial and final CO_2 concentrations of the air drawn through the envelopes, these values can be computed from their data. The computed values are presented in Table 1. Since the error in their CO_2 determinations seldom exceeded 0.005 mg/lit, the low value for CO_2 compensation point in No. 9 is significant, and its association with a low initial CO_2 content of air may be worth noting.

Table 1. CO_2 compensation point values computed from data of Heinicke and Hoffman.

Experiment	Initial CO_2 (mg/lit)	CO_2 compensation point (mg/lit)	(vol. %)
9	0.35	0.08	0.004
10	.59	.14	.007
11	.60	.14	.007

Figure 6 of Decker (*3*), if extrapolated to zero values of apparent photosynthesis, would provide estimates of the average CO_2 compensation points for the pines and hardwoods studied by him, but such extrapolation of Decker's data yields CO_2 compensation points of about 0.3 mg/lit (0.015 percent), which is 50 percent higher than the highest previous estimates. An examination of Decker's computations of mean CO_2 concentration, however, reveals an error. His plant chamber contained a fan that effectively stirred the air within the chamber, and photosynthesis determinations were made after steady-state conditions were obtained with a given rate of air flow. The CO_2 concentration around the plants, under such conditions, would be the same as that of the effluent air,

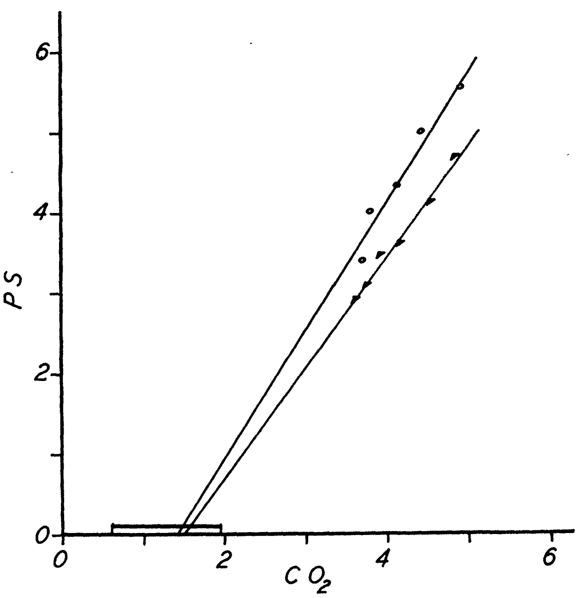

Fig. 1. Photosynthesis (relative values) vs. corrected values of CO_2 concentration (mg/lit, × 10), data of Decker. Each circle is the average of 10 determinations using loblolly pine. Each triangle is the average of 12 determinations combining data from dogwood, and tulip poplar. Extrapolation indicates a CO_2 compensation point of about 0.14 mg/lit (0.007 vol. percent).