latter results from the operation of sub-optimal or low metabolic levels over some period of time. Conversely, a good or high level would not indicate that deficiency had not operated to produce tissue injury in the past. A more accurate index of the degree of deficiency existing at the time in any given case can be had by serial determinations following administration of known vitamin C supplements. This is apparent in Table II and Fig. 2.

Summary. Experimental data is presented confirming the work of Farmer and Abt that the reduced ascorbic acid content of the blood plasma in the "normal" individual parallels the vitamin C intake. Confirmation of this is presented in a controlled dietary experiment using rhesus monkeys. For satisfactory comparative data, determinations should be made on fasting blood specimens. On the basis of the studies recorded, we believe that fasting plasma ascorbic acid levels below 0.7 mg. % are probably sub-optimal. Levels ranging between 0.7 and 0.9 mg. % would appear adequate. Optimal levels probably lie above this range. Reduced ascorbic acid plasma levels below 0.5 mg. % must be considered low.†

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"Three Dimension" Graphs for Correlating "Age-Weight-Gland" Relationships.

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From the Laboratories of the Philadelphia General Hospital.

In biometric studies of rats, it is desirable at times to compare simultaneously and graphically (1) Various organs by weight with (2) age and (3) body weight of the animal. By ordinary two dimension graphs, relationships between any 2 of these data can be well illustrated, but only by "three dimension" graphs is it possible to illustrate simultaneously the interrelationship of all 3—age, body-weight and weight of any given organ.

The construction of such graphs is simple (Chart 1): Ordinate AB forms with abscissae BC and BD an angle of 120°. AB represents age, the only constant uniform with all rats; BC body-weight and BD gland-weight. The "age-weight" is easily plotted, the line B_1C_1 paralleling BC and forming an angle of 120° (AB_1C_1). Gland-

† We wish to acknowledge our indebtedness to Dr. Nina Simmonds for the dietary surveys made upon the group of medical students.

weight is plotted from B_1 (corresponding to age) on line AB to D_1 (representing gland-weight), which point must be on a line perpendicular to AB projected from C_1 (corresponding to body-weight).

For normal rats all lines representing "age-body-weight" (B_1C_1) will parallel abscissa BC and form angles of 120° with ordinate AB, differing only in length. The lines representing "age-gland-weight" (B_1D_1) will vary in length and will parallel BD only when the increase in weight of the gland, with respect to age is directly proportional to the increase in body weight. If the gland is small for the age, angle D_2B_1A will be greater than 120° and line D_2B_1 short. If the gland is large, then line D_3B_1 will be longer and angle D_3B_1A

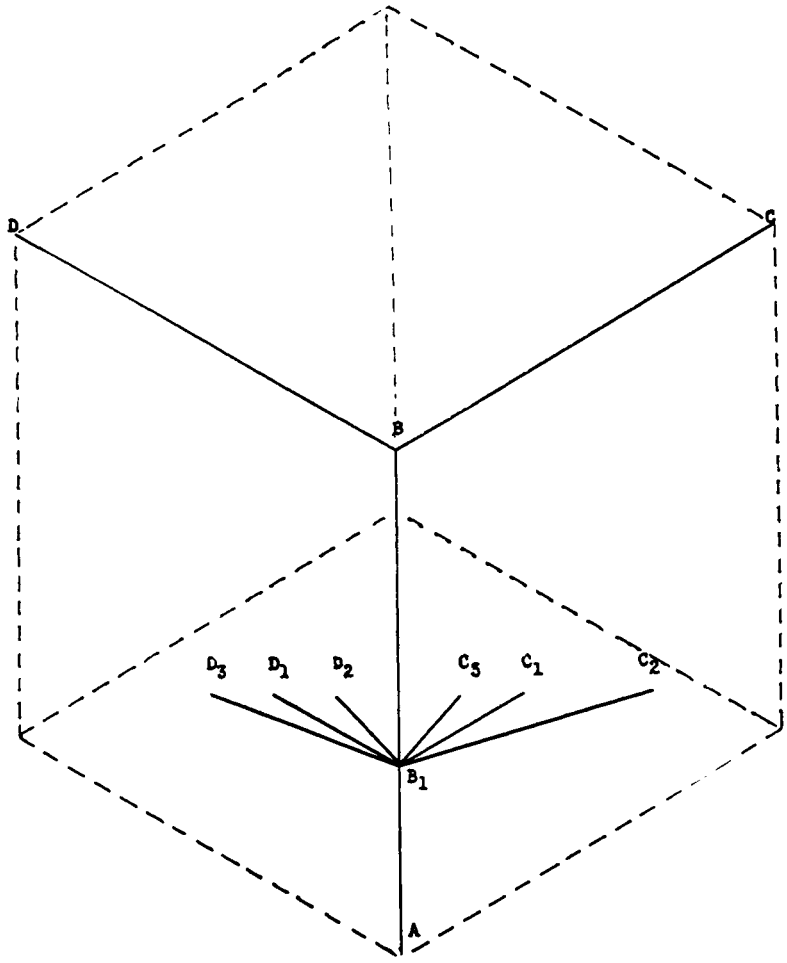

CHART 1.

Illustrates the "three dimensional" quality of the graphs. See text for construction.

more acute. If the body-weight of an animal has been increased over the normal by some experimental procedure then line C_2B_1 will be longer and angle C_2B_1A more acute; if the weight has been decreased, line C_3B_1 will be short and angle C_3B_1A more obtuse. In any case points C_2 and C_3 must always be on the line perpendicular to AB projected through C_1 (the normal body weight).

Such graphs have a "standard pattern" for any given organ at any given age-weight. In addition they have the advantage of demonstrating graphically whether the deviation from normal is in the body-weight or gland-weight.

Chart 2 shows the effect of daily injections of pregnancy urine on the ovary of immature rats for 10 and 20 days. It indicates a negligible change in body weight with a 100% increase in the weight of the ovaries of the treated rats after 20 days.

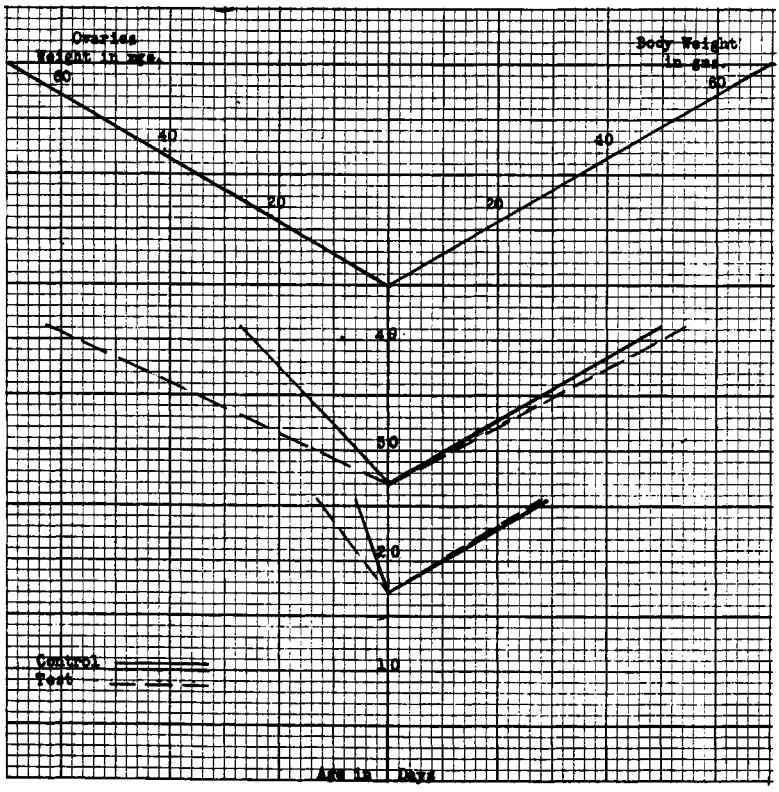

CHART 2.

Illustrates well the lack of effect on body weight of injections of pregnancy urine compared with the effect on ovarian weight. Note that the control "body-weight" graph parallels the "body-weight" abscissa, indicating that it has been the ovaries which have been disturbed experimentally.

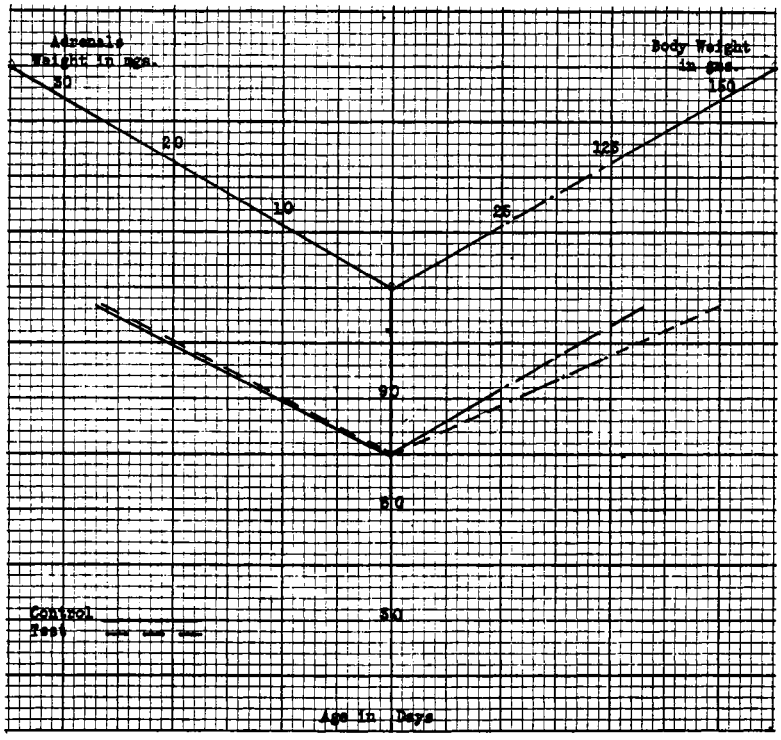

CHART 3.

Growth hormone does not disturb the weight of the adrenal but does increase body weight; ∴ graph of body weight of test rat is not parallel to the abscissa, is longer than control and the angle formed with the ordinate is more acute (see text). The break in continuity of the "body-weight" abscissa has been made to keep the chart small.

Chart 3 shows the absence of effect on the adrenal of injections of growth hormone, which has increased body weight almost 15% over the control rat.

These "three-dimension" graphs are reported with the hope that they may be of value to others interested in disturbed "age-weight-gland" relationships in demonstrating graphically the deviation from the normal in the proper direction, either body weight or gland weight.