condition known as "frenching." This "frenching" in trees is evidently comparable to anemia in animals. Whether "frenching" can be produced by a deficiency in magnesium in the soil comparable to the production of anemia in animals by a deficiency of iron in the diet is not known, so far as I am aware. It is known however that copper sulfate is an effective remedy for "frenching" in citrus fruit trees. When Bordeaux mixture was first used as a spray material it was observed that in addition to its insecticidal property it caused the leaves of the citrus fruit trees to turn green and put on new growth. It was soon found that this beneficial effect was due to the copper in the Bordeaux, so that copper sulfate, or bluestone, has come to be used very extensively by Florida orange growers as a remedy for "frenching."

The object of this investigation was to determine the effect of copper sulfate on the chlorophyl content of "frenched" orange tree leaves, and the following is a description of the method of procedure in carrying out the investigation. Four pounds of commercial copper sulfate, or bluestone, were scattered on the ground in a Florida orange grove around several three-year-old orange trees, whose leaves had lost most of their green color or were "frenched." In the same part of the grove several other trees whose leaves were similarly "frenched" were left untreated for controls. Four months later chlorophyl determinations were made, using the photoelectric method described by Oltman,[1] and it was found that the leaves of the trees treated with the copper sulfate contained 4.6 times more chlorophyl than did the leaves of the control or untreated trees. It should be said in this connection that the copper sulfate greatly improved the general condition of the trees. They put on much new growth and the leaves turned green, while the untreated trees put on very little new growth and the leaves remained spotted yellow or "frenched." It should also be stated that the chlorophyl of the leaves from the treated as well as the untreated trees were analyzed for copper and none was found.

Hart, Steenbock, Waddell and Elvehjem[2] were the first to show that the presence of copper, although in minute quantities, was necessary for the utilization of iron in the formation of the hemoglobin of the red blood cells of the rat, and the experiments reported in this paper would seem to indicate that copper is likewise necessary for the formation of the chlorophyl of the leaves of orange trees, thus indicating a similarity between the animal and plant kingdoms in this respect. It should be mentioned in this connection that cattle grazing on certain types of Florida pasture land develop a nutritional anemia or "salt sickness," just as citrus fruit trees set on certain types of grove land develop "frenching" and this may be cured with the use of iron and copper.

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[1] R. E. Oltman, "A New Method and Instrument for the Quantitative Determination of Chlorophyll," *Plant Physiology*, 8: 2, 321–326, 1933.

[2] E. B. Hart, H. Steenbock, J. Waddell and C. A. Elvehjem, "Iron in Nutrition. VII. Copper as a Supplement of Iron for Hemoglobin Building in the Rat," *Journal of Biological Chemistry*, 77: 797–812, 1928.

THE INCIDENCE OF COLOR-BLINDNESS AMONG THE CHINESE

GARTH'S report in SCIENCE[1] of "The Incidence of Color Blindness among Races" is of considerable interest in showing that unselected white males are afflicted with color-blindness more than any one of the other racial groups reported on, *viz.*, Jews, North American Indians of various tribes, Mexicans and Negroes.

For comparison the following results obtained in an investigation of Chinese students in Chengtu may be of interest. Ishihara's color-blindness tests were used, and each chart was shown to a small group of students at one time. Each student was asked to write down the figure he saw. The students' papers were then collected and compared with the correct answers. In this way in a comparatively short time a large number of students were tested. All were males and ranged in age from students in primary schools to those in university.

Of 1,115 students 67, or 6.3 per cent., were found to be red-green blind, either complete or incomplete.

The only other report on the color-blindness of the Chinese of which we are aware is that of Chang,[2] in which he reports 80 out of 1,164 male students, or 6.9 per cent., to be deficient in color vision (either red-green blind or weak in color discrimination). In addition, he reports that 19 females out of 1,132 examined, or 1.7 per cent., showed either color-blindness or color weakness.

If these two reports are combined we have a color-blindness incidence of 6.5 per cent. for Chinese males, based on the use of the Ishihara test on a total of 2,279 students in the schools of Peiping and Chengtu, and an incidence of 1.7 per cent. for Chinese females, similarly tested on 1,132 girls in the schools of Peiping.

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[1] T. R. Garth, "The Incidence of Color Blindness among Races," SCIENCE, 77: 333, 1933.

[2] S. P. Chang, "Statistics on Color Blindness among Students in Peiping," *National M. J. China*, 18: 806, 1932.