anemia in man, due to untreated tertian malaria, at an erythrocyte level of less than 1,000,000 there is a lively blood regeneration going on, as expressed by the number of reticulocytes reaching 23% of the total number of erythrocytes. The degree of regeneration indicated by this reticulocyte count was needed approximately to keep pace with the destruction. This blood picture closely resembles the one produced in dogs by means of phenyl hydrazine poisoning[1] but is fundamentally different from the one in an untreated case of pernicious anemia. The mere stopping of the malaria by quinine without any treatment of the anemia in this case sufficed to produce recovery, incidentally making the picture fairly identical with the regeneration phase in the phenyl hydrazine experiment referred to and also to the reaction produced by liver extract in pernicious anemia.

Our observations reveal one other interesting feature: the marked eosinophilia which developed in this case as soon as recovery set in or as soon as the treatment of the malaria was begun. Similar eosinophilia was observed in pernicious anemia when treated with liver.

The reason for presenting this observation is the absence of cases like this in most clinics where the anemia problem is being studied at present.

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Deficiency Anemia in Chinese, Responding to Cod Liver Oil.

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In attempting to survey the anemia situation in North China several factors presented themselves to us as significant. (1) Even outside the so-called famine areas food deficiencies are common, particularly qualitative deficiencies. This point is elucidated by the work of Hsien Wu[1] and his collaborators, who showed that the North China diet is low in fat and on the verge of fat soluble vitamin deficiency. (2) Attacks of prolonged diarrhea, due to dysentery or to yet unknown causes, in a population living on such a diet are apt especially to bring out 2 groups of symptoms: of anemia and

[1] Johnson, R., and Berglund, H., PROC. SOC. EXP. BIOL. AND MED., 1928, XXV, 517.

[1] Wu, Hsien, and Wu, D. Y., *Chin. J. Physiol. Report*, Ser. No. 1, 1928 (July), 135.

of hydrops. (3) We were impressed with the fact that severe secondary anemias of unknown origin, when hospitalized, showed a seemingly spontaneous recovery in the course of about 2 months. Such anemias of lesser severity were also seen during pregnancy, on proper diet already showing marked improvement before term. These anemias are hematologically characterized by a color index in the neighborhood of unity, of the absence of anisocytosis or poikilocytosis, of the absence of nucleated red cells and of immature granulocytes and of practically normal white cell formula. There are no hemolytic features. These anemias show free hydrochloric acid in the gastric juice after histamine injection. There are no neurological symptoms. These cases are easily differentiated from cases of the chlorosis type of which we recently observed some instances.

While these factors were becoming clear in our minds, 2 fresh instances of anemia of this type came under observation. The patients were young soldiers, for a long time living under severe deprivation and lately for 2 months suffering from diarrhea of unknown origin. The first patient (Chart 1) was placed on the Hospital's ordinary Chinese diet. This diet is a well balanced diet, meat free and predominantly vegetarian, but decidedly better in quality than the ordinary diet of the poorer classes. After an observation period cod liver oil was given in doses of 15 cc. daily. The dramatic effect on the reticulocytes, in the form of an increase, from about 1% to 30% on the fourth day of the cod liver oil medication is brought out in the chart, as well as the general behavior of the blood during the

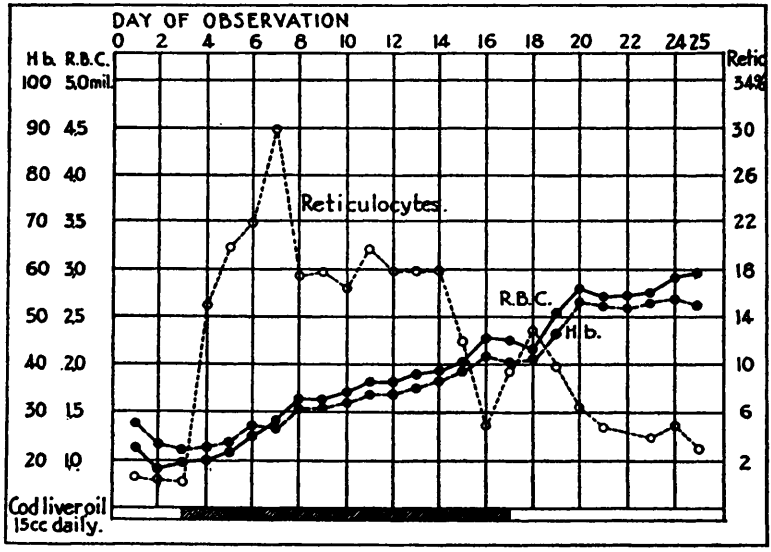

CHART 1.

first 25 days of observation. The blood continued to improve all way back to normal.

The second patient was for 3 days given cod liver oil, which had first been boiled for 10 minutes. Chart 2 shows the reticulocyte response which followed, as well as the general improvement of the blood. On the 19th day ordinary cod liver oil was given and after some delay a second but lower peak occurred on the reticulocyte curve. It will be noticed that the reticulocyte increase associated with the brief administration of the boiled cod liver oil was less marked than in the first case.

Chart 3 shows the similar response to cod liver oil in a milder case of anemia associated with pregnancy (I—para, age 22, cod liver oil started 14 days after delivery. This patient had earlier been treated with liver diet with no effect). As usually when the treatment starts at a higher erythrocyte level the reticulocyte response is less marked. The recticulum in each reticulated cell in all our observations has been surprisingly abundant.

Simultaneous with the observations presented in Charts 1-3, controls with cod liver oil were run in other anemias (kala azar, splenomegaly, and splenectomized cases, as well as cases of the chlorosis type) without any effect on the reticulocytes or on the anemia.

The anemias of the chlorosis type recovered on iron medication but without any increase in the reticulocytes.

We interpret the secondary anemia just described as associated with a deficiency in a fat soluble food factor. Extra factors seem necessary to bring the anemia into existence. As such factors we have observed prolonged diarrhea and pregnancy, both factors

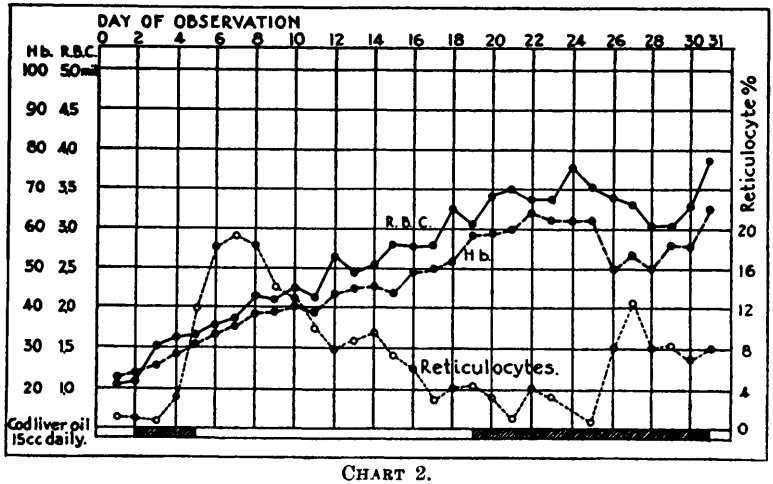

CHART 2.

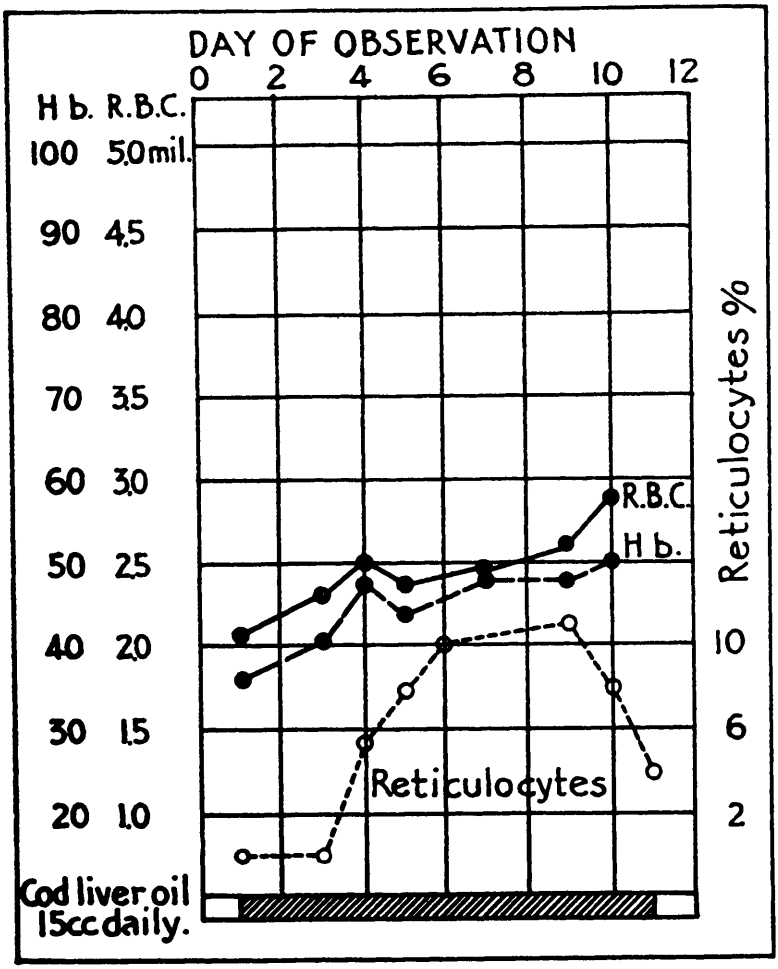

CHART 3.

known to be of importance in the field of hematology. The pronounced reticulocyte feature of this anemia so far seems to distinguish this new form from all other non-hemolytic secondary anemias known to occur in man.