luciferase without invoking additional entities, but more experimental data is required to elaborate further on this model.

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Beta Thalassemia Trait: Detection at Birth

Abstract. *The synthesis of alpha, beta, and gamma chains in samples of cord blood was measured by the incorporation of leucine labeled with carbon-14 into these chains. In a newborn affected with beta thalassemia trait, the presence of one beta thalassemia gene was revealed on the 1st day of life by the lower specific radioactivity of the beta chain.*

In beta thalassemia there is a hereditary defect in the synthesis of beta chains (*1*). The disease becomes evident only after the age of 2 to 3 months, when production of gamma chains decreases and total circulating hemoglobin becomes dependent upon adequate production of beta chains (*2*). This report describes a study of hemoglobin synthesis, in a patient with beta thalassemia trait, by means of a method sufficiently sensitive to detect the disorder at birth.

The patient was the third child of parents with beta thalassemia trait. The mother had previously given birth to two children, both of whom were affected with homozygous beta thalassemia (Cooley's anemia). The baby was delivered at the end of the 37th week of pregnancy and weighed 5½ lb (2.5 kg). Routine studies of his blood at birth and thereafter at monthly intervals revealed that the initial hemoglobin concentration was at the lower limit of normal; morphology of the red cells was normal. The percentage of hemoglobin A_2 was less than 1 percent at birth and rose to 2.8 percent at 5 months of age. The clinical diagnosis of beta thalassemia trait could not be established until the child was 4 months old, when hypochromia, microcytosis, and target appearance of the red blood cells became sufficiently pronounced.

The infant's cord blood was incubated with L-leucine uniformly labeled with ^{14}C (specific activity, 200 mc/mmole) for 2 hours. Red blood cells were washed three times with isotonic saline and lysed according to the method of Lingrel and Borsook (*3*). The cord blood of four normal newborns was similarly studied. Globin was prepared from the whole red cell lysate by acid-acetone precipitation. The alpha, beta, and gamma chains were separated on carboxymethyl cellulose column (1 by 20 cm) in the presence of 8*M* urea by the method of Clegg, Naughton, and Weatherall (*4*). The absorbance (expressed as optical density) of each fraction was determined at 280 nm. Samples (1 ml) were counted in a liquid scintillation spectrometer. Figure 1 shows the separation and radioactivity of the alpha, beta, and gamma chains of cord bloods of the affected newborn and of one of four normal newborns. The identity of these chains has been established by Clegg and his co-workers and by Bank and Marks (*2*, *4*). The radioactivity under the peak of the beta chain in the affected newborn is diminished compared with the representative normal newborn, the latter study being similar in all respects to the results obtained in the three other normal newborns.

The specific activity of each chain was expressed as counts per minute divided by optical density, the fractions at and immediately around the peak for

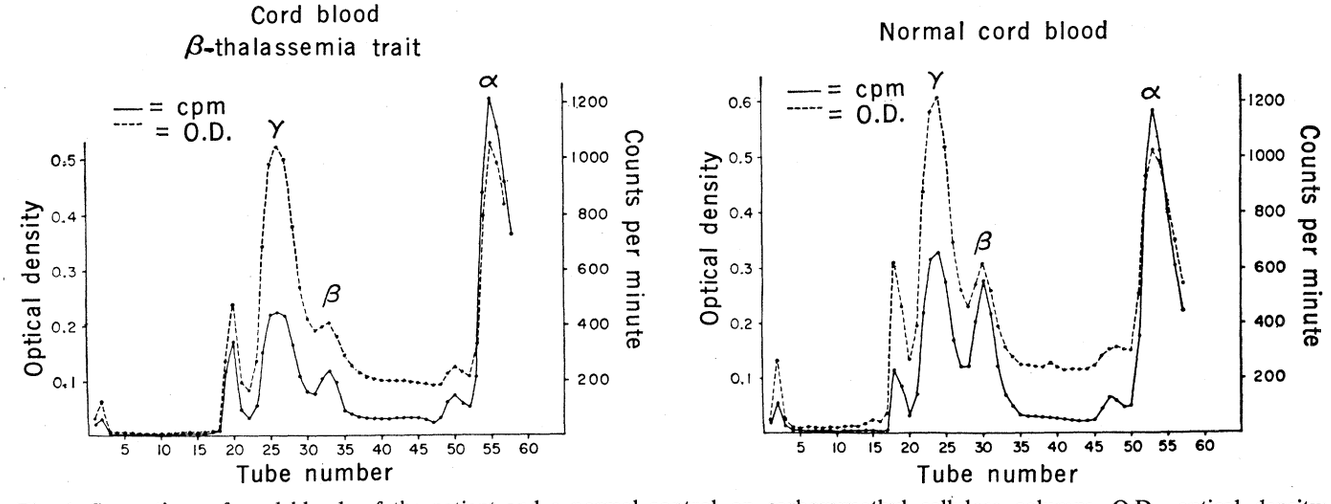

Fig. 1. Separations of cord bloods of the patient and a normal control on carboxymethyl cellulose columns. O.D., optical density; cpm, counts per minute.

each chain being used. This value was corrected for the difference in absorption of the three chains. At 280 nm, the absorbances of gamma and beta chains in this system were found to be, respectively, 2 and 1.5 times that of an equal amount of alpha chain. Specific activity of the gamma chain was further corrected for its small difference in the molar content of leucine (γ, 17; α, 18; and β, 18) (*5*). Figure 2 presents the corrected specific activity ratios of the gamma to alpha and beta to alpha chains in the five cord bloods that were examined. The ratios of gamma to alpha chains of the affected newborn and the normal newborns were similar to each other and considerably lower than the ratios of beta to alpha chains of the normal newborns. This indicates that the synthesis of gamma chains in the affected newborn was declining at a rate similar to that in the normal newborns. In the four normal newborns, acceleration of the synthesis of beta chains at birth was indicated by the fact that the ratio of beta to alpha chains was higher than that of gamma to alpha. However, in the newborn affected with beta thalassemia trait, the ratio of beta to alpha chains was approximately one-half that of normal. The reduction of this ratio in the affected newborn was not simply the result of immaturity because no difference was found in the four normal newborns who varied in gestation from 35 to 41 weeks and in birth weight from 4½ to 8 lb.

We conclude from this study that the synthesis of beta chains of this newborn with beta thalassemia trait was decreased by a factor of approximately 2. Therefore, it was possible by this technique to detect the presence of a single beta thalassemia gene at birth, even though routine studies did not suggest the diagnosis. We have not yet had the opportunity to study a newborn affected with homozygous beta thalassemia, but on the basis of this study and of similar examinations performed in older individuals with homozygous beta thalassemia and with beta thalassemia trait (*1*), it is reasonable to assume that detection of such homozygotes would be possible with this method. The homozygous state can also be detected by morphologic methods that are reliable and simple (*6*).

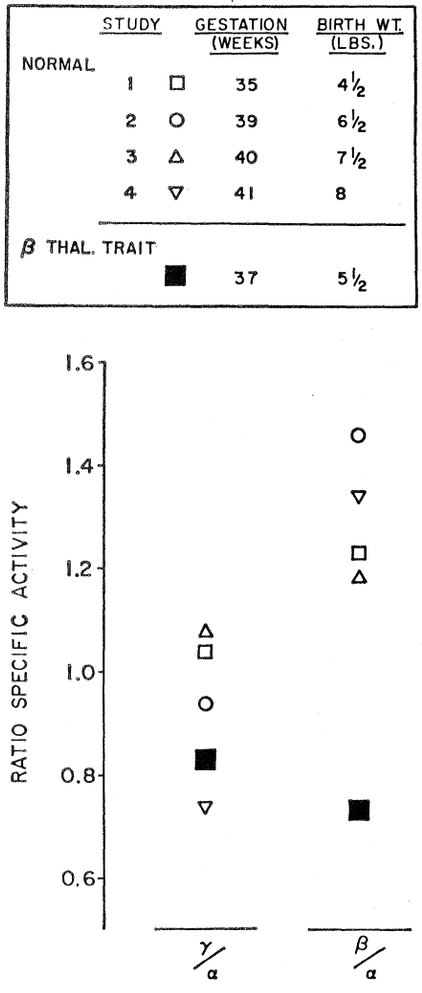

Fig. 2. Ratios of the specific activities of the gamma to alpha and the beta to alpha chains of the patient compared with those of four normal newborns. Gestational periods and birth weights are given in the upper part of the figure.

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Regulation of Segment-Building during the Postembryonic Development of a Common Milliped

Abstract. *Starvation of larvae of the milliped* Narceus annularis *results in the formation of a smaller than normal number of body segments in the early stadia. However, this reduced number is compensated for by subsequent formation of a larger than normal number of body segments in the later stadia, or by the addition of extra segment-building stadia. Apparently there is a mechanism whereby the milliped "keeps count" of the number of body segments produced and can regulate the production of these segments from a proliferative region so that the total number of body segments at sexual maturity is within the normal range for the species.*

A characteristic feature of the postembryonic development of Diplopoda is the addition of new body segments and new limbs during each stadium (*1*). For example, larvae of the common spiroboloid milliped *Narceus annularis* (Raf.) have only seven body segments when they hatch, whereas the adults have 51 to 59 segments (*2*). Most normal individuals pass through nine segment-building stadia plus two maturational stadia, reaching sexual maturity at the eleventh ecdysis. The new segments added at each ecdysis differentiate from a structurally distinct proliferation region located between the penultimate segment and the telson (anal segment) (*3*). The new segments are legless when they first appear; their legs form during the next stadium and are exposed at the next ecdysis, when additional legless segments are also added. This process of segment and limb increase during larval development is basically the same in all orders of Diplopoda studied (*1*, *3*, *4*).

Previous observations (*2*) indicated that young larvae reared under conditions of near starvation add fewer body segments per ecdysis than larvae reared with an optimum food supply. This raised the question of whether semistarved larvae would develop into adults with fewer body segments than normal, or whether the millipeds possess a regulatory system that will alter the later stages of development in a manner that will insure the acquisition of a full complement of body segments before maturity is reached.

Four hundred and fifty larvae hatched from eggs laid by caged females were placed in 15 boxes (30 ani-