THE NATURE OF THE PLANTAR REFLEX IN EARLY LIFE AND THE CAUSES OF ITS VARIATIONS *

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INTRODUCTORY AND HISTORICAL

In 1898 Babinski¹ called attention to the plantar reflex as a diagnostic sign in lesions of the pyramidal tracts of the spinal cord. The reflex which he called *le phénomène des orteils* consists, as is now so well known, of the plantar flexion of the big toe consequent on the tickling of the inner border of the sole of the foot. This is the normal response. When the pyramidal tracts are diseased in any part of their course, the same stimulus applied to the sole of the foot results in a dorsiflexion instead of a plantar flexion of the toe. Since then this peculiarity of the toe reflex in organic lesions of the pyramidal tract has become known as Babinski's sign or the Babinski phenomenon, and has been a subject of investigation by many observers all over the world, including Buzzard,² Collier,³ Cohn,⁴ Crocq,⁵ Cestan and Le Sourd,⁶ Van Epps,⁷ Van Gehuchten,⁸ Glorieux,⁹ Guidiceandrea,¹⁰

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1. Babinski, J.: Du phénomène des orteils et de sa valeur semiologique. *Semaine méd.* 321, 1898; Sur la transformation du régime des réflexes cutanés, etc., *Rev. neurol.* 58, 1904.

2. Buzzard, T.: On the differential diagnosis of insular sclerosis from hysteria, *B. M. J.* 1:1077, 1899.

3. Collier, J.: An Investigation of the Plantar Reflex, etc., *Brain* 22:71, 1899.

4. Cohn, M.: Ueber die Bed. der Zehenreflex, *Neurol. Centralbl.* 18:580, 1899.

5. Crocq, J.: Die Reflexe Mit Rücksicht auf die Lebensversicherung, *Wien. med. Wchnschr.* 52: Nos. 17-25, 1902.

6. Cestan and Le Sourd: Contribution a l'étude du phénomène des orteils, *Gaz. d. hôp.* 1249, 1899.

7. Epps, C. Van: The Babinski reflex, *J. Nerv. & Ment. Dis.* 214, 1901.

8. Van Gehuchten: Quoted by Passini.²¹

9. Glorieux: Quoted by Passini.²¹

10. Guidiceandrea: Quoted by Passini.²¹

Kalischer,¹¹ König,¹² Munch-Petersen,¹³ Okada,¹⁴ Schüler,¹⁵ Schneider,¹⁶ Yoshimura¹⁷ and many others. The various findings are not in agreement. Thus, while all French and British observers, as well as most investigators of other countries, confirm Babinski's statement, other neuropathologists (Cohn, Kornilow,¹⁸ Schüler, Tumpowski,¹⁹ and others) either consider the test unreliable, or attach no diagnostic significance to it. Kornilow says:

Although Babinski's sign often occurs in the presence of functional disturbance of the pyramidal tract, there are also cases of disease of the pyramidal tracts without the presence of Babinski's sign. On the other hand, cases have been observed in which there was an undoubted Babinski's sign, and which at the necropsy revealed perfectly normal pyramidal tracts. The differential diagnostic significance of the Babinski phenomenon for the purpose of distinguishing organic from hysterical hemiplegias is not pathognomonic. There are cases of hysteria in which the Babinski sign is present.

Chodz'ko²⁰ criticizes the observations of Babinski's opponents as inexact and as probably due to defective methods of observation.

While, therefore, there is no absolute unanimity on the matter, the balance of evidence is preponderatingly, one might even say, overwhelmingly in favor of the diagnostic significance of the Babinski phenomenon.

Passini²¹ confirms Babinski's statement in the case of children suffering with pyramidal lesions (cerebral diplegia and monoplegia, congenital hydrocephalus with spastic paresis of the lower extremities, spinal diseases, e. g., compression myelitis due to spinal caries).

Babinski having found this peculiarity of the toe reflex in pyramidal disease of the spinal cord, expected a priori to find similar dorsiflexion of the big toe as a physiologic phenomenon in early infancy, at a time

11. Kalischer, O.: Ueber den Normalen und Pathologischen Zehenreflex, Virchows Arch. f. path. Anat. 1899.

12. König, W.: Ueber die bei Reizung der Fusssohle zu beobachtenden Reflexerscheinungen, etc., Berl. klin. Wchnschr. 822, 1899.

13. Munch-Petersen, H.: Die Hautreflexe und ihre Nervenbahnen, Deutsch. Ztschr. f. Nervenhe. 22:1902. Quoted by Yoshimura.¹⁷

14. Okada, E.: Ueber das Babinskische Zehenphänomen, Neurologia 1:13, 1902. Quoted by Yoshimura.¹⁷

15. Schüler, L.: Beobachtungen über Zehenreflexe, Neurol. Centralbl. 19: 585, 1899.

16. Schneider, H.: Ueber das Zehenphänomen Babinski's, Berl. klin. Wchnschr., 1901.

17. Yoshimura, K.: Ueber das Babinskische Phänomen, Mittheilungen aus den Medizinischen Fakultät der Kaiserlichen Universität zu Tokyo 8:213, 1909.

18. Kornilow, A.: Ueber Cerebrale und Spinale Reflexe, Deutsch. Ztschr. f. Nervenhe. 23: 1903.

19. Tumpowski, A.: Ueber den diagnostischen Werth des Babinskischen Phänomens, Neurol. Centralbl. 20:663, 1901; abstr. from Medycyna (Polish).

20. Chodz'ko: Beitrag zur Bed. des Babinskischen phänomens, Abstr. from Gaz. lekarska, 1901, in Neurol. Centralbl. 20:663, 1901.

21. Passini, F.: Ueber den Normalen Grosszehenreflex bei Kindern, Wien. klin. Wchnschr. 952, 1900.

when the pyramidal tracts are not yet fully developed. When he came to test for this phenomenon in new-born infants, he found that his surmise was correct. Indeed, he believes that dorsiflexion of the toe is the normal plantar reflex in all children who have not yet learned to walk, but that when the child is able to walk the character of the reflex changes from dorsiflexion to plantar flexion. Cestan and Le Sourd found in all infants under 1 year old a dorsiflexion, but they failed to find the exact age at which the reflex changes from dorsiflexion to plantar flexion.

Collier found the age of transition in normal healthy children to be between 2 and 3 years. He says:

I have met with the typical adult response in children 2 years old who were particularly forward and "strong on their legs." In weakly and especially in rickety children, the infantile response may be as late as the age of 4 years.

During sleep, Collier finds the flexor response (i. e., plantar flexion) to be the rule even in infants, but in some children, even up to the age of 12 years, who showed plantar flexion when awake, there was dorsiflexion during sleep. Collier, like Babinski, associates this dorsiflexion of the toe in infants with imperfect myelination of the pyramidal system, and calls attention to the fact that in monkeys (in whom the pyramidal tracts are incompletely developed) the plantar reflex is dorsiflexor in type.

Schüler examined 100 children and found the following results:

No reflex response.....	in 40 per cent.
Dorsiflexion	in 30 per cent.
Plantar flexion	in 12 per cent.
Indefinite response.....	in 18 per cent

The 40 per cent. in which there was no response were all young infants. He concludes that in normally developed infants plantar flexion is the prevailing response during the fourth quarter of the first year but that the nature of the response varies with the general development of the infant. Thus an infant aged 14 months whose weight was only that of one aged 5 months, showed dorsiflexion, while a 5 months' old infant which was well developed showed plantar flexion.

Cohn, like Schüler, finds no response at all in about half the cases examined.

Gallewski^{21a} set himself the task of discovering whether the Babinski reflex, whose clinical significance in adults cannot be doubted, is also to be correlated with the degree of development of the pyramidal tracts in infants. Utilizing the Weigert-Pal's method of staining

21a. Gallewski, M.: Histologische und klinische Untersuchungen über die Pyramidenbahn und das Babinskische Phänomen im Säuglings Alter. Dissertation Breslau 1902 (British Museum).

as modified by Kulschitzky, he finds that there is a definite parallelism between myelination and function in the pyramidal system as measured by the presence or absence of Babinski's sign. He examined nine infants between birth and 8 months of age and found that in all of them, except one (case 6) the reflex was dorsiflexor in type and they all showed greater or less poverty in myelin in the pyramidal regions (the degree of myelination varying with the age of the infant).

One child (Case 6) presented an extreme atrophy (only weighing 2,070 gm., i. e., about 4½ pounds), but the reflex was plantar flexor in character. The pyramidal tracts, both crossed and direct, were very poorly myelinated so that microscopically they resembled the picture shown in the case of an infant one month old.

Here, then, is a case which apparently militates against Babinski's theory. In order, however, to bring the case into line with that theory, Gallewski calls to his aid Kalischer's explanation of the Babinski phenomenon. Kalischer believes that those muscles which are less well innervated will respond reflexly in preference to an antagonistic group of muscles whose innervation is better. In infants in whom the foot is still, atavistically, a prehensile rather than a progressional organ, the interossei are a stronger group of muscles than the extensors of the toes, and, therefore, as a result of reflex irritation the extensor hallucis responds. When the foot definitely becomes an organ of locomotion, the relative strength of the antagonistic groups of muscles becomes reversed and dorsiflexion is replaced by plantar flexion. In Case 6, which was one of extreme atrophy, Gallewski makes the unwarranted assumption that the interossei were more atrophied than the extensors, and thus plantar flexion is obtained.

Walton and Paul²² find no characteristic reflex in infants. Morse,²³ in an investigation of 254 infants not suffering from any nervous disease found no plantar reflex at all in ninety (35 per cent.); reflex absent on one side and plantar flexion on the other in eighteen (7 per cent.); reflex absent on one side and dorsiflexion on the other in fifteen (6 per cent.); plantar flexion on both sides in sixty-four (25.5 per cent.); dorsiflexion on both sides in fifty-four (21.5 per cent.); plantar flexion on one side and dorsiflexion on the other in thirteen (5 per cent.).

He found further that during the first nine months bilateral dorsiflexion was more frequent than plantar flexion, while after that age the condition was reserved. His findings are shown in Table 1.

22. Walton and Paul: Contribution to the Study of the Plantar Reflex, etc., *J. Nerv. & Ment. Dis.* **27**:305, 1900.

23. Morse, J. L.: A Study of the Plantar Reflex in Infancy, *Pediatrics* **11**:13, 1901.

Morse concludes that (1) there is no constant plantar reflex in the first year; (2) there is no constant plantar reflex in the second year, although it approximates that of the adult; (3) the normal reflex is not established at 2 years.

Engstler^{23a} examined a large number (eighty-nine) of healthy infants²⁴ in Graz and found (mostly in the sleeping state) that (1) in premature and mature infants at birth, there was a typical dorsiflexion of the big toe in all cases; (2) during the first year 93 per cent. had dorsiflexion and only 7 per cent. plantar flexion, (3) between the second and third years, plantar flexion is 95 per cent.; (4) at the end of the first year, 50 per cent. had dorsiflexion and 50 per cent. had plantar flexion; (5) Babinski's sign becomes an abnormal phenomenon after the second year.

TABLE 1.—MORSE'S FINDINGS AS TO REFLEXES IN NORMAL INFANTS *

	Percentages First Year (200 Cases)	Percentages Second Year (54 Cases)
Plantar flexion on one side and dorsiflexion on the other	5 (8.5)	5.5 (6.5)
Plantar flexion on one side and no reflex on other..	7 (11.8)	7.5 (8.7)
Dorsiflexion on one side and no reflex on other.....	6 (10.2)	5.5 (6.5)
No reflex on either side.....	41	15.0
Plantar flexion on both sides.....	16.5 (28)	57.5 (67.4)
Dorsiflexion on both sides.....	24.5 (41.5)	9 (10.9)

* The percentages in parentheses are those calculated after deducting the eighty-two cases in the first year and the eight cases in the second year which gave no reflex on either side.

Griffith²⁵ accepts Engstler and Leri's²⁶ statement that "the plantar reflex in the new-born is characterized by dorsal flexion of the toes" and that "gradually this condition changes, but it is not till the third year that plantar flexion is the rule."

Barnes²⁷ agrees with Kalischer that the change from dorsiflexion to plantar flexion occurs at the beginning of walking even if the latter is delayed to the age of 4 or 5 years; but he finds that the response in infants is not so strong as in severe spastic states in adults—proving that even at birth the pyramidal system is by no means functionless, although myelination of fibers has not occurred.

Leri finds in 166 infants aged from 1 day to 3 years that (1) at birth dorsiflexion is the practically general rule (in this way agreeing with Muggia's findings but disagreeing with Guidiceandrea). (2)

23a. Engstler, G.: Ueber den Fussohlenreflex, etc., Wien klin. Wchnschr. 18:567, 1905.

24. The total number of cases he examined was 1,000 but 109 gave no response.

25. Griffith, J. P. C.: Diseases of Infants and Children, 1919.

26. Leri, A.: Le reflexe des orteils chez les enfants, Rev. neurol. 689, 1903.

27. Barnes S.: The Diagnostic value of the plantar reflex, Rev. neurol. & psych. 352, 1904.

After 3 years plantar flexion is the rule, although dorsiflexion may occur without any pathologic significance. (3) Between 1 and 3 years dorsiflexion is not met with, as a rule, except (a) in affections of the central nervous system; but in these cases it has not the same significance as in adults because the pyramidal tracts soon after their formation are still more susceptible to every slight irritation especially of a toxic character; (b) in severe disturbances of nutrition which produce a retardation of development of the pyramidal tracts. (4) The change from dorsi flexion to plantar flexion occurs in normal infants at about 5 or 6 months. (5) Plantar flexion is of more diagnostic significance than dorsiflexion since in children in whom walking starts late it remains the only sign that the pyramidal tract is properly developed and that there is no fear in them of Little's disease.

Finizio²⁸ studied the reflex in 500 new-born infants during the first three days of life. He found no reflex in 5 per cent.; indecisive reflex in 10 per cent.; dorsiflexion in 15 per cent.; plantar flexion in 70 per cent. Finizio also studied the modified plantar reflexes (Schaffer's and Brissaud's reflexes) and found both of them present at birth.

As regards the effect of labor on the character of the reflex, Finizio finds that in difficult forceps cases there is dorsiflexion—possibly because in such cases some meningeal hemorrhage is produced. In true Little's disease, however, he finds plantar flexion. Sometimes in forceps cases he found a brisk knee-jerk with a Babinski phenomenon on one side, and plantar flexion on the other, possibly from inequality of the pressure of forceps on the fetal skull.

Furmann²⁹ who investigated 502 infants and children found the plantar reflex absent only in twenty-four cases. He further found that in infants under 9 months old dorsiflexion of the toe is almost the rule, while the transition from dorsiflexion to plantar flexion occurs between 9 months and 2 years. According to this observer, the occurrence of a Babinski phenomenon after the age of 2 years is indicative of an affection of the pyramidal tracts.

Laurent³⁰ found in 110 children between a few hours and 3 years old a constant Babinski phenomenon during the first six months, and one alternating with a normal plantar reflex between 6 months and 15 months. After that age an extensor (dorsiflexor) response is, according to him, very rare, except pathologically.

28. Finizio, G.: *Le Reflex de la plante du pied chez les Nouveaux*, XIII Cong. Internat. de Med., Compt. Rend. Sect. med. de l'enfance; Paris, 1900, p. 399.

29. Furmann: *Die Reflexe des Säuglings*, Dissertation St. Petersburg, 1903; abstr. by Gundobin in *Die Besonderheiten des Kindesalters*, Berlin, 1912.

30. Laurent, R.: *Evolution des reflexes chez l'enfant*, These de Toulouse, 1905; abstr. in *Brit. J. Child. Dis.* 460, 1906.

OBJECTS OF THE PRESENT INVESTIGATION

As there are wide divergences in the findings of the nature of the plantar reflex in infants and the age at which the reflex becomes definitely of the adult type, I have investigated about 500 children from birth (including premature births) up to the age of 8 years, with the following objects:

1. To test the truth of the generally accepted statements (a) that dorsiflexion is the prevailing phenomenon during infancy; (b) regarding the dependence of the nature of the plantar reflex on the state of the development of the pyramidal tracts as found postmortem.
2. The conformation of the postmortem findings with theoretical expectations.
3. To find the correlation (if any) between the response and various developmental and environmental states.
4. Localization of the reflexogenetic zone in infants.

Nature of the Material.—The material on which this research has been carried out consisted mainly of infants brought to the outpatient department of the Infants Hospital. Some observations, however (especially those at birth), have been made in private cases as well as in a few instances in cases at the Chelsea Infirmary. For the last I am indebted to my cousin, Dr. Victor Feldman, assistant medical officer at that institution, for having kindly allowed me to make the observation.

Method of Investigation.—In all cases, the observations were made when the feet were warm, i. e., after they (as well as the infant) had been well wrapped up in a blanket. The stimulus was applied by means of the thumb nail. In some cases, in order to warm the feet, it was necessary to sponge them with warm water. In a case in which I assisted at the birth of the child, I had the opportunity in a transverse presentation to test the reflex intra-uterinally by enclosing the ankle between ring and middle fingers, stimulating the sole of the foot with the thumb and feeling the direction of the toe with the index finger. In the case of older infants it was often found necessary to pacify them by means of the breast or the bottle before testing for the reflex in order to avoid the error between a true Babinski phenomenon and the movements of the toes and foot which often occur as a defensive mechanism against the irritation and which is not unlike the Babinski reflex. The plantar defense reaction consists in rapid dorsiflexion of the foot with simultaneous withdrawal of the foot from the source of irritation, with or without extension of the big toe. In a true Babinski phenomenon the great toe extends slowly. In some cases the reflex was tested during sleep. It often happened that there was, at first, no response of the toes at all to the plantar stimulus, but frequent repetition of the stimulus very rarely failed, although it did sometimes fail, to elicit some sort of a response.

I have no exact record of the number of cases at every age period which failed to give a response, but as the total number of cases examined was about 500 and of these 426 gave some sort of response, the total percentage of absent reflexes was about 15.

Results.—In the following tables I have classified my results in 426 cases from birth onward in which a response was obtainable. From these it is seen that:

1. During the first year, the proportion between flexor and extensor responses is approximately 4:1 and that in approximately 16 per cent. the reflex is variable, being either different in the two sides or different on each side at different times.

2. During the second year, the proportion between flexor and extensor responses is approximately 3:1 and in about 14 per cent. the reflex is variable.

3. During the third year, in 81 per cent. of cases the response was plantar flexor in type, and in 19 per cent. it was variable. There were no cases with a constant bilateral Babinski phenomenon.

4. During the fourth year the proportion between flexor and extensor responses was 14:1, and in 5 per cent. of cases it was variable.

5. After the fourth year, there was only one case (Case 617) in which there was an extensor response on one side, in all the remaining eleven cases the response was invariably plantar flexor in type on both sides. I have, however, notes of one case, a boy, aged 9 years and 4 months, in which the reflex was the typical Babinski phenomenon (Case 753). This boy was brought to me because he walked on tiptoe. There was no history of obstetric difficulties at birth. He began to walk and talk at the normal periods, but he walked on his toes from the beginning. There is a history of several miscarriages by his mother both before and after the birth of this child, and some time before this child was born the mother passed through a typical spurious pregnancy and labor.

On examining the child I found him to be a bright, intelligent boy. His weight was 6 stone (84 pounds) and his height 4 feet 6 inches. He preferred to walk on his toes, but was also able to walk on the soles of his feet normally. His knee jerks as well as the other reflexes were not increased, and there was no ankle clonus, but the plantar reflex was typically dorsiflexor in type. The flexors of the leg, however, were tense. It is possible, therefore, that this is a mild case of Little's disease, although there is no other evidence to substantiate the diagnosis.

I have summarized the findings of various observers, but it must be noted that the groups of cases are not strictly comparable as regards age.

TABLE 2.—DATA ON FLEXION BY VARIOUS OBSERVERS

	Engstler (891 cases)	Schüler (60 cases)	Morse (194 cases)	Finizio (500 new-born)	Feldman (426 cases)
Plantar flexion.....	26.7%	20%	39%	73%	67.0%
Dorsi flexion.....	73.3%	50%	33%	16%	16.4%
Indefinite.....	.....	30%	28%	11%	16.6%

These figures have been calculated after deducting the numbers of cases, in each series, in which the reflex was absent.

Age at Which the Sign Disappears.—While it would be impossible to say definitely that dorsiflexion never occurs after the sixth year in a child whose pyramidal tracts are not diseased, I have been unable to elicit it in any one of a considerable number of cases in which I have looked for it after that age. Case 777 is the only one among a dozen or more cases of children of that age in which there was dorsiflexion of the toe on one side (right). On the other hand, Case 618 was a normal girl, 4 years old, who had marked dorsiflexion of the toe seven hours after a convulsive seizure.

Correlation Between Response and the State of Development of the Pyramidal Tracts as Found Postmortem.—In two cases in which I had records of the nature of the plantar response I had an opportunity of examining sections of the spinal cord postmortem, after keeping in Müller's fluid for six weeks, and staining sections by Weigert-Pal's method.

CASE 1 (128).—This was a case of congenital deformity. Both tibiae were curved. The fibulae were absent and no definite tarsal bones could be made out radiographically. The feet were practically suspended from the legs in the same straight line. The infant was extremely wasted, having weighed only 5 pounds 3 ounces at one month, and about the same weight at death at the age of 7 weeks. The plantar reflex was absent on the right side and plantar flexor in type on the left side throughout its life. It died at the age of 7 weeks. The cord showed the presence of some myelinated fibers in all the white columns and in each region (cervical, dorsal and lumbar), although myelination was incomplete in the crossed pyramidal tracts in the lower region. There was no noticeable difference in the state of myelination of the two sides of the cord, in spite of the difference in response. As, however, the response was altogether absent on the right side, the fault could not rest in the pyramidal tract but in the lower neuron. Moreover, the anterior horn cells being developed early in the fetus, the fault must have been in the peripheral nerves. The brain was of good size and showed no abnormality. There was only one kidney which was horseshoe shaped, although there were two suprarenals.

CASE 2 (614).—This was a male child whose weight at birth was 8 pounds. The plantar reflex was flexor (i. e., plantar flexion) on both sides at the age of 14 hours, and flexor on one side and extensor (i. e., dorsiflexion) on the other at 28 hours. It died suddenly at the age of 35 hours. Postmortem the thymus was found to be 11.6 gm. in weight (i. e., about normal). The spinal cord showed some myelination of all the white columns although the myelination was more incomplete in the crossed pyramidal tracts. There is no obvious difference in the degree of myelination between the two sides of the cord, in spite of the difference in the character of the response on the two sides.

Fig. 1.—Photomicrograph of section of the dorsal cord region of the spinal cord from Case 614; $\times 14$.

Fig. 2.—Photomicrograph of section of dorsal region of the spinal cord from Case 128; $\times 14$.

Fig. 3.—Photomicrograph of section of lumbar region of spinal cord from Case 614; $\times 14$. The cord was injured during its removal.

Fig. 4.—Photomicrograph of lumbar region of spinal cord from Case 128; $\times 14$.

On comparing the cords of Cases 128 and 614 there is obviously a greater poverty of myelin in Case 128 (the microphotographs do not show it so well as the slides examined by means of a projector), and yet in this case there was no dorsiflexion on either side although in Case 614 there was plantar flexion on the right side.

Hence, it appears that the degree of myelination of the pyramidal tracts in early infancy is not sufficient to explain the nature of the plantar response.

Moreover, the occurrence of a true Babinski phenomenon either on one side or on both sides after the age of 3 years in normally developed children, in whom according to all authorities the pyramidal tracts are fully developed, points to the same conclusion.

The inference that one is led to draw from these facts is that although the pyramidal tracts are not completely developed at birth, there is a sufficiency of myelination in them to give a normal flexor plantar response; but (as I shall show later) that in virtue of the greater susceptibility of children to reflex disturbances in the circulatory system, the pyramidal tracts may be compressed and relaxed alternately as the result of such circulatory disturbances.

What Factors, if Any, Influence the Nature of the Plantar Response in Infants?—Sex: The first factor that would occur to one is the influence of sex. I find that in very early infancy a normal flexor response is slightly more common in girls than in boys, but this may be accounted for by the paucity of numbers. If we take, however, all cases during the first six months, the first year, the first two years, etc., I find that there is an equality of plantar flexor responses in both sexes, although the extensor or dorsiflexor response is at all periods more common in girls than in boys to the extent of about 6 or 8 per cent (see Tables 4, 6, 8).

2. Prematurity (Table 5): The effect of prematurity is shown quite clearly in Table 5.³¹ (a) During the first month no less than six out of eight cases showed a Babinski phenomenon on each side, one only a bilateral plantar flexion, and the other case showed plantar flexion on one side and dorsiflexion on the other. (b) After the fifth week the effect of prematurity begins to pass off, although if the prematurity is very great, its effect is more lasting (Case 738, at the age of 7 months). Throughout the first year thirteen out of thirty-eight infants prematurely born had a positive Babinski phenomenon (34 per cent.). (c) The E:F ratio which is 6:1 during the first month becomes 1:4 during the second month and 1:6 during the third. It still keeps on falling during the second quarter but remains stationary after that.

31. See especially the E:F rates in Table 5, which is very instructive.

TABLE 3.—INCIDENCE OF THE VARIOUS RESPONSES AT DIFFERENT AGES
FROM BIRTH ONWARDS

Age	No. of Cases	F	E	V		No. of Cases	F	E	V
At birth.....	5	3	1	1					
First day....	3	2	1	1					
Second day...	1	..	..	1	First week.....	12	7	3	2
Third day....	1	1	..	..					
Fifth day....	2	1	1	..					
1-2 weeks.....	2	1	1	..	Second week.....	10	5	4	1
2 weeks.....	8	4	3	1					
2-3 weeks.....	4	3	1	..	Second half of month.	22	14	5	3
3 weeks.....	6	3	1	2	First month.....	44	26 (59%)	12 (27.3%)	6 (13.7%)
4 weeks.....	12	8	3	1					
5 weeks.....	14	10	2	2	Second month.....	79	63 (80%)	7 (8.8%)	9 (10.2%)
6 weeks.....	18	15	2	1	Total first 2 mos.	123	89 (72.4%)	19 (15.4%)	15 (12.2%)
7 weeks.....	13	9	..	4					
8 weeks.....	34	29	3	2	Third month.....	72	39 (54.2%)	23 (32%)	10 (14.8%)
9 weeks.....	6	3	1	2	Total first quarter...	195	128 (65.6%)	42 (21.5%)	25 (12.9%)
10 weeks.....	17	10	6	1					
11 weeks.....	7	2	4	1	Second quarter.....	80	55 (68.8%)	9 (11.2%)	16 (20%)
12 weeks.....	42	24	12	6	Total first half year..	275	183 (66.3%)	51 (18.5%)	41 (15%)
14 weeks.....	8	6	..	2					
4 months.....	30	17	8	5	Third quarter.....	38	25 (66%)	5 (13%)	8 (21%)
5 months.....	19	13	1	5	Total first 9 mos.	313	208 (66.4%)	56 (17.9%)	49 (15.7%)
6 months.....	23	19	..	4					
7 months....	16	12	1	3	Last quarter.....	23	16 (70%)	2 (8.7%)	5 (21.3%)
8 months....	13	7	1	5	Total first year.....	336	224 (66.7%)	58 (17.3%)	54 (16%)
9 months....	9	6	3	..					
10 months....	8	8	..	..	First quarter 2d year..	22	12	6	4
11 months....	10	6	1	3					
12 months....	5	2	1	2	Second quarter 2d yr..	12	8	2	2
1 yr. 1 mo. ...	12	4	5	3	Total 1st half 2d year	34	20 (59%)	8 (23.5%)	6 (17.5%)
1 yr. 2 mos. ..	6	4	1	1					
1 yr. 3 mos. ..	4	4	..	..	Third quarter 2d yr. ...	10	8	1	1
1 yr. 4 mos. ..	3	3	..	..					
1 yr. 5 mos. ..	3	..	1	2	Fourth quarter 2d yr. ...	12	9	2	1
1 yr. 6 mos. ..	6	5	1	..	Total 2d half 2d yr. ...	22	17 (72.7%)	3 (13.2%)	2 (9%)
1 yr. 7 mos. ..	3	2	..	1					
1 yr. 8 mos. ..	3	3	..	..	Total whole of 2d yr.	56	37 (66%)	11 (20%)	8 (14%)
1 yr. 9 mos. ..	4	3	1	..	Total whole of first 2 years.....	392	261 (66%)	69 (17%)	62 (16%)
1 yr. 10 mos.	3	1	2	..					
1 yr. 11 mos.	8	2	..	1	Third year.....	16	13 (81%)	..	2 (19%)
2 years.....	6	6	..	..	Fourth year.....	5	3	1	1
2-2½ years...	7	6	..	1	Total first 4 yrs.	413	277 (67%)	70 (17%)	65 (16%)
2½-3 years...	9	8	..	1	.....	13	11	..	2
3-4 years.....	5	3	1	1	Total first 9 yrs.	426	288 (67.6%)	70 (16.4%)	67 (16%)
4-9 years.....	13	11	0	2					

TABLE 4.—INFLUENCE OF SEX ON THE NATURE OF THE PLANTAR REFLEX

Age	Males				Females			
	No. of Cases	F	E	V	No. of Cases	F	E	V
0.....	2	1	..	1	3	2	1	..
First day.....	2	1	1	..	1	1	..	..
Second day.....	1	..	..	1	0	..	..	..
Third day.....	0	..	..	..	1	1	..	..
5 days.....	2	1	1	..	0	..	..	..
First week.....	7	3	2	2	5	4	1	..
1-2 weeks.....	0	..	..	..	2	1	1	..
2 weeks.....	2	..	2	..	6	4	1	1
Second week.....	2	..	2	..	8	5	2	1
2-3 weeks.....	4	3	1	..	0	..	..	..
3 weeks.....	6	3	1	2	0	..	..	..
Third week.....	10	6	2	2	0	..	..	..
4 weeks.....	9	7	1	1	2	1	1	..
First month.....	28	16 (57%)	7 (25%)	5 (18%)	15	10 (67%)	4 (27%)	1 (6%)
5 weeks.....	8	6	..	2	6	4	2	..
6 weeks.....	6	5	..	1	10	8	2	..
7 weeks.....	7	4	..	3	6	5	..	1
8 weeks.....	16	13	1	2	18	16	2	..
Second month.....	37	28 (75.7%)	1 (2.6%)	8 (21.7%)	40	33 (82.5%)	6 (15%)	1 (2.5%)
9 weeks.....	2	1	..	1	3	2	1	..
10 weeks.....	9	5	3	1	8	5	3	..
11 weeks.....	6	2	3	1	1	..	1	..
12 weeks.....	27	16	7	4	15	8	5	2
Third month.....	44	24 (54.5%)	13 (30%)	7 (15.9%)	27	15 (55.5%)	10 (37%)	2 (7.5%)
Total first 3 months....	109	68 (62.5%)	21 (19.2%)	20 (18.3%)	82	58 (70.7%)	20 (24.4%)	4 (4.9%)
14 weeks.....	6	5	..	1	2	1	..	1
4 months.....	17	11	3	3	13	6	5	2
5 months.....	8	5	..	3	10	7	2	1
6 months.....	15	13	..	2	7	5	..	2
Second quarter.....	46	34 (74%)	3 (6.5%)	9 (19.5%)	32	19 (60%)	7 (22%)	6 (18%)
Total first half year....	155	102 (65.8%)	24 (15.5%)	29 (18.7%)	114	77 (67.6%)	27 (23.7%)	10 (8.7%)
7 months.....	11	8	1	2	5	4	..	1
8 months.....	6	3	..	3	7	4	1	2
9 months.....	8	5	3	..	1	1	..	..
Third quarter.....	25	16 (64%)	4 (16%)	5 (20%)	13	9 (70%)	1 (7.7%)	3 (22.3%)
10 months.....	2	2	..	..	6	6	..	..
11 months.....	6	3	1	2	3	2	..	1
12 months.....	1	1	..	..	1	1	..	..
Fourth quarter.....	9	6 (66.6%)	1 (1.1%)	2 (2.2%)	10	9 (90%)	..	1 (10%)
Total second half of first year.....	34	22 (64.7%)	5 (14.7%)	7 (20.6%)	23	13 (78.3%)	1 (4.4%)	4 (17.3%)
Total whole of first year.....	189	124 (65.6%)	29 (15.4%)	36 (19%)	137	95 (70%)	28 (20%)	14 (10%)
Second year.....	26	20 (77%)	2 (7.7%)	4 (15.3%)	28	16 (57%)	9 (32.2%)	3 (10.8%)
Total first 2 years.....	215	144 (67%)	31 (14.4%)	40 (18.6%)	165	111 (67.3%)	37 (22.4%)	17 (11.3%)
Third and fourth years	11	9	..	2	9	5	1	3
Total first 4 years.....	226	153 (67.6%)	31 (13.7%)	42 (18.7%)	174	116 (66.6%)	38 (21.8%)	20 (11.6%)
Cases over 4 years.....	8	5	1	2	6	6	..	..
Total.....	234	153 (65.5%)	32 (13.5%)	44 (19%)	180	122 (67.8%)	38 (21.5%)	20 (11.1%)

3. Degree of Development of the Infant as Determined by Length and Weight (Tables 6 and 7): It has been stated by a number of observers, e. g. Leri, Schüler and others that the Babinski phenomenon is more common in poorly developed than in well developed infants. I have therefore analyzed my cases according to their weights as well as according to their lengths.

TABLE 5.—EFFECT OF PREMATURITY

Age	No. of Cases	F	E	V	E:F Ratio
First week.....	3	1	2	..	
2 weeks.....	2	..	1	1	
3 weeks.....	1	..	1	..	
4 weeks.....	2	..	2	..	
First month.....	8	1 (12.5%)	6 (75%)	1 (12.5%)	6:1
5 weeks.....	1	..	1	1	
6 weeks.....	1	1	..	..	
8 weeks.....	3	3	..	..	
Second month.....	5	4 (80%)	1 (20%)	..	1:4
9 weeks.....	1	..	..	1	
10 weeks.....	2	2	..	..	
11 weeks.....	2	..	1	1	
12 weeks.....	4	4	..	..	
Third month.....	9	6 (66.6%)	1 (11.1%)	2 (22.2%)	1:6
First 3 months.....	22	11 (50%)	8 (36.3%)	3 (13.7%)	7:10
4 months.....	3	1	2	..	
5 months.....	1	1	..	..	
6 months.....	3	3	..	..	
Second quarter.....	7	5 (71%)	2 (29%)	..	4:10
Total first 6 months.....	29	16 (55.3%)	10 (34.5%)	3 (10%)	
7 months.....	3	1	1	1	
8 months.....	1	1	..	..	
9 months.....	3	1	2	..	
10 months.....	2	2	..	..	
11 and 12 months.....	..	..	..	..	
Total second 6 months...	9	5 (55.5%)	3 (33.3%)	1 (11.1%)	6:10
Total first year.....	38	21 (55.2%)	13 (34.2%)	4 (10.5%)	6:10

Weight: It is difficult to say exactly what weight at any particular age can be considered abnormally low, but I think it will be agreed that infants under 5 pounds during the first week, under 6 pounds at a month old, under $7\frac{1}{4}$ pounds at 2 months, under $8\frac{1}{2}$ pounds at 3 months, under 11 pounds at 6 months and under 16 pounds at 1 year are considerably under weight. In the tables I have classified the infants according to these arbitrary standards, and I have also indicated what I considered below normal at intermediate ages. The detailed results are shown in the tables (Table 6), but dividing the cases into three monthly periods we obtain the following figures:

(a) During the first three months, there was a total of 133 cases of more or less normal development out of which ninety (67.7 per cent.) showed a normal (i. e., plantar flexion) reflex; twenty-five (18.8 per

TABLE 6.—INFLUENCE OF STATE OF DEVELOPMENT OF INFANT AS JUDGED FROM ITS WEIGHT

Age	Well Developed				Under Normal Development				Pounds
	No. of Cases	F	E	V	No. of Cases	F	E	V	
0.....	4	3	0	1	1	0	1	..	
First day.....	3	2	1	..	..	..	..	..	
Second day.....	1	..	..	1	..	..	..	..	
3 days.....	1	1	..	..	..	..	..	..	
5 days.....	..	..	..	..	2	1	1	0	
First week.....	9	6	1	2	3	1	2	0	Under 5
Second week.....	1	1	..	..	1	..	1	..	
2 weeks.....	5	4	1	..	3	1	2	1	Under 5½
3 weeks.....	4	2	0	2	2	1	1	..	Under 5¼
4 weeks.....	9	7	2	0	3	1	1	1	Under 6
Total first month...	28	20	4	4	12	4	7	2	
5 weeks.....	10	7	1	2	4	3	1	..	Under 6½
6 weeks.....	13	10	2	1	2	2	..	..	Under 6¼
7 weeks.....	10	6	..	4	3	2	..	1	Under 7
8 weeks.....	28	23	3	2	6	..	..	..	Under 7¼
Total first 2 mos.	89	66	10	13	27	17	9	3	
9 weeks.....	3	1	1	1	3	2	..	1	Under 7½
10 weeks.....	10	4	5	1	7	6	1	..	Under 8
11 weeks.....	2	..	2	..	5	2	2	1	Under 8¼
12 weeks.....	25	16	6	3	15	8	4	3	Under 8½
Total first 3 mos.	129	87 (67.4%)	24 (18.5%)	18 (14.1%)	57	35 (60%)	15 (26%)	8 (14%)	
3½ months.....	5	4	..	1	3	2	..	1	Under 8¾
4 months.....	22	14	5	3	7	3	2	2	Under 9
5 months.....	13	11	1	1	6	2	1	3	Under 10
6 months.....	13	10	..	3	8	7	..	1	Under 11
Total second 3 mos.	53	39 (73.6%)	6 (11.3%)	8 (15.1%)	24	14 (58.3%)	3 (12.5%)	7 (29.2%)	
Total first 6 mos.	182	126 (69.2%)	30 (16.1%)	26 (14.7%)	81	49 (70%)	18 (22%)	15 (18%)	
7 months.....	10	9	1	..	6	3	..	3	Under 12
8 months.....	7	5	..	2	5	2	..	3	Under 13
9 months.....	2	1	1	..	7	5	2	..	Under 14
10 months.....	3	3	..	..	4	4	..	..	Under 14½
11 months.....	8	4	1	3	2	2	..	..	Under 15
12 months.....	4	1	1	2	1	1	..	..	Under 16
Total second 6 mos.	34	23 (67.6%)	4 (11.7%)	7 (20.6%)	25	17 (68%)	2 (8%)	6 (24%)	
Total first year.....	216	149 (70%)	34 (16%)	33 (14%)	106	64 (61.3%)	20 (18.8%)	21 (19.8%)	
First half 2d year.....	12	6	4	2	21	4	3	..	Under 17½ at 18 mo. under 20 at 18 mo.
Second half of 2d year	7	5	1	1	9	9	..	..	Under 21 at 19 mo. under 23 at 2 yr.
Total second year...	19	11 (58%)	5 (26%)	3 (16%)	30	23 (76.6%)	4 (30.3%)	3 (10%)	

cent.) showed a Babinski phenomenon and the remaining eighteen (13.5 per cent.) had a reflex of a variable character. Of the fifty-seven cases definitely under standard weight, thirty-four (60 per cent)

showed a plantar reflex of the normal adult type, fifteen (26 per cent.) presented a Babinski sign, and eight (14 per cent.) had a variable reflex.

(b) During the first six months there is again a greater percentage of Babinski phenomena in poorly nourished than in well nourished infants (22.2 per cent. against 16.6 per cent.).

(c) During the first year there is still a preponderance of Babinski signs in favor of badly nourished infants, but this preponderance is not so great as during the earlier periods (19 per cent. as against 16 per cent.).

TABLE 7.—INFLUENCE OF STATE OF DEVELOPMENT AS JUDGED FROM LENGTH

Age	Well Developed				Under Normal Development				Inches
	No. of Cases	F	E	V	No. of Cases	F	E	V	
0-4 weeks.....	13	10	2	1	7	4	2	1	Under 19
1-2 months.....	58	44	6	8	16	14	1	1	Under 20
2-3 months.....	52	29	16	7	17	9	5	3	Under 20½
Total first 3 mo.	123	83 (67.4%)	24 (19.5%)	16 (13%)	40	27 (67.5%)	8 (20%)	5 (12.5%)	
3-4 months.....	29	19	6	4	6	2	1	3	Under 20½
5 months.....	16	12	..	4	2	1	1	..	Under 21
6 months.....	17	13	..	4	4	4	..	..	Under 22
Second quarter.....	62	44 (71%)	6 (9.6%)	12 (19.2%)	12	7 (58.3%)	2 (16.6%)	3 (25%)	
Total first half year	185	127 (68%)	30 (16%)	28 (15%)	52	34 (65%)	10 (19%)	8 (15.5%)	
7 months.....	10	9	1	..	5	2	..	3	Under 23
8 months.....	11	6	5	..	1	1	..	..	Under 23½
9 months.....	6	4	2	..	3	2	1	..	Under 24
Third quarter.....	27	19	8	..	9	5	1	3	
10 months.....	5	5	..	..	1	1	..	..	Under 24
11 months.....	9	5	1	3	..	..	..	..	Under 24½
12 months.....	3	2	1	..	..	..	..	..	Under 25
Last quarter.....	17	12	1	4	1	1	..	..	
Total second 6 mos.	44	31 (70%)	9 (20%)	4 (10%)	10	6 (60%)	1 (10%)	3 (30%)	
Total first year.....	229	158 (69%)	39 (17%)	32 (14%)	62	40 (64.5%)	11 (17.7%)	11 (17.7%)	

From these facts it would seem, therefore, that malnutrition is a factor which operates against the production of a normal plantar flexor response. On analyzing the cases further, however, it is seen that such a conclusion is erroneous. We find that:

(d) During the period from 4 to 6 months there is a practically equal percentage of Babinski signs in the two groups of cases (12.5 per cent. in underdeveloped and 11.3 per cent. in well developed infants), while during the second semester there is actually a greater percentage of Babinski phenomena in normally developed infants than in infants below the standard (11.7 and 8 per cent, respectively).

(e) The same is the case during the period from 1 to 2 years (the percentage of Babinski phenomena in the normal and below normal groups of cases being 26 and 13.5 per cent., respectively).

It is, therefore, clear that malnutrition per se has no influence on the nature of the plantar response, but that inasmuch as during the early months prematurity and malnutrition go hand in hand, it is probably the prematurity and not the malnutrition that is responsible for the greater presence of Babinski phenomena in the undernourished infants. Indeed, if we subtract from the fifty-seven infants under normal weight during the first three months the seventeen which owed their defective weight to prematurity, and out of which seven had a plantar flexor response, seven a true Babinski sign and three a variable response, we obtain the following figures:

Total number of under weight cases, forty; normal adult type of response, twenty-seven (67.5 per cent.); Babinski sign in eight (20 per cent.); variable reflex in five (12.5 per cent.), which are almost identically the same percentages as those prevailing amongst the normally developed infants.

Length: It is generally recognized that the length of an infant is a far better criterion of growth than is weight.³² I have, therefore, arranged my cases at each age period in two groups, viz., one in which the infants are approximately of the average length at that age and another in which the infants are considerably shorter than the average (Table 7). I have indicated in the tables the lengths which I consider to be definitely below the normal. We there see that

(a) During the first month, 77 per cent. of the normal cases (i. e., ten out of thirteen) had a normal plantar reflex, 15 per cent. (i. e., two out of thirteen) had a Babinski and 7½ per cent. gave a variable response, while of the seven cases under normal length at the same period 57 per cent. had a normal plantar reflex, 28.5 per cent. gave a Babinski phenomenon and 14.25 per cent. gave a variable response.

(b) During the first three months, out of 123 normal cases and forty cases below the normal length, the percentages of cases of normal, Babinski and variable reflexes were respectively identical in the two groups, viz., 67.5, 20 and 13 per cent.

(c) During the second quarter, there was a great percentage preponderance of Babinski phenomena in the case of infants below the standard length, but this may be accounted for by the paucity of the number of cases in the abnormal group.

(d) For the period from birth (0) to 6 months, the preponderance in the abnormal group was very small (19 as against 16 per cent.).

(e) During the third quarter there was a percentage preponderance of Babinski phenomena in favor of the normal group of cases but this again may be accounted for by the very small number of cases in the abnormal group.

32. Feldman, W. M.: *The Principles of Antenatal and Postnatal Child Physiology* Pure and Applied, London, 1920.

(f) For the period from birth (0) to 12 months, the respective percentages in the two groups were practically identical.

It is, therefore, reasonable to infer that just as in the case of weight, length in itself has no influence on the nature of the plantar reflex, and that the preponderance of Babinski phenomena during the first month was due to the prematurity which was the cause of deficient length.

Cephalic Index (i. e. $\frac{\text{Width of head}}{\text{Length of head}} \times 100$) (Tables 8 and 9).

A head which has an index of less than 79 is dolichocephalic or long-headed. An index of between 79 and 81 makes the head mesocephalic and one of over 81 makes it brachycephalic. In spite of the plasticity of the infant's head, it has been asserted by Boas³³ and Ripley³⁴ (and my own observations tend to confirm it) that after the neonatal period, when the effects of the obstetric molding on the infant's head has passed off, although the cephalic index slightly decreases with increasing age, yet the type of the head remains the same, i. e., a brachycephalic head will always remain brachycephalic, and so forth. Now, contrary to the opinion held by most anthropologists that the cephalic index is a racial character determined by heredity, Boas believes that the shape of the head is a character which is affected by environment—including intellectual activity, brachycephaly being the accompaniment of marked activity of the brain. Therefore, I thought it would be of some academic interest to investigate the influence of the cephalic index on the plantar reflex because if Boas' contention is true, and if further it is true, as it almost certainly is, that the cephalic index is unaffected by growth, then one ought to find that in cases of brachycephaly the plantar reflex should be more commonly of the normal adult type, while the Babinski phenomenon should be more frequently associated with a dolichocephalic head. In the statistics presented (Tables 8 and 9), I have, in order to avoid error, excluded all cases of infants under 6 weeks old in whom the shape of the head might still be undergoing change.

The following are the results:

1. During the first quarter, the incidences of the different responses for the three different shapes of head are almost respectively identical.
2. During the first half year the percentages of normal responses for the three different varieties of head are practically identical, and while the incidence of the Babinski phenomenon is practically the same for dolichocephalic and mesocephalic heads, that in the case of brachycephalic heads is perceptibly less than in the other two (viz., 10.5 per cent. as compared with about 17 per cent.).

33. Boas, F.: *The Form of the Head as Influenced by Growth*, Am. Science, n.s. 50; *Changes in Bodily Forms of Descendants of Immigrants*, Washington, 1910.

34. Ripley, W. Z.: *American Science*, n. s. 111:888, 889.

TABLE 8.—INFLUENCE OF SHAPE OF HEAD ON THE NATURE OF THE PLANTAR REFLEX

Age	Dolichocephaly				Mesocephaly				Brachycephaly			
	No. of Cases	F	E	V	No. of Cases	F	E	V	No. of Cases	F	E	V
7 weeks.....	5	3	..	2	2	2	0	..	2	2	..	..
8 weeks.....	12	12	..	..	11	10	1	..	4	2	..	2
Second month.....	17	15	..	2	13	12	1	..	6	4	..	2
9 weeks.....	5	3	1	1	1	1	..	1	..	..	1	..
10 weeks.....	8	4	4	..	3	..	2	..	8	2	1	..
11 weeks.....	4	2	2	..	..	..	..	..	..	..	2	..
12 weeks.....	22	15	4	3	7	4	2	1	7	3	2	2
Third month.....	39	24	11	4	11	5	4	2	10	5	3	2
Total first quarter.....	56	39 (70%)	11 (20%)	6 (10%)	24	17 (71%)	5 (21%)	2 (8%)	16	9 (58%)	3 (19%)	4 (25%)
14 weeks.....	4	4	..	..	..	5	..	..	1	1	1	..
4 months.....	8	4	2	2	9	5	2	2	6	4	1	1
Fifth month.....	12	8	2	2	9	5	2	2	7	5	1	1
5 months.....	8	6	1	1	3	1	..	2	6	4	..	2
6 months.....	5	4	..	1	5	4	..	1	9	7	..	2
Second quarter.....	25	18 (72%)	3 (12%)	4 (16%)	17	10 (58.8%)	2 (11.7%)	5 (29.5%)	22	16 (72.7%)	1 (4.6%)	5 (22.7%)
Total first 6 months.....	81	57 (70%)	14 (17.3%)	10 (12.6%)	41	27 (66%)	7 (17%)	7 (17%)	38	25 (66%)	4 (10.5%)	9 (23.5%)
Third quarter.....	11	10	..	1	4	3	..	1	18	8	5	5
Fourth quarter.....	2	2	..	..	5	3	1	1	9	6	..	3
Total second 6 months.....	13	12	..	1	9	6	1	2	27	14	5	8
Total first year.....	94	69 (73.4%)	14 (14.8%)	11 (11.7%)	50	33 (66%)	8 (16%)	9 (18%)	65	39 (60%)	9 (13.8%)	17 (27%)
First half second year.....	6	5	1	..	8	6	1	1	14	9	1	4
Second half second year.....	5	5	..	..	4	3	1	..	9	7	..	2
Total second year.....	11	10	1	..	12	9	2	1	23	16	1	6
Total first 2 years.....	105	79	15	11	62	42	7	10	88	55	10	23
2-3 years.....	4	4	..	..	5	3	..	2	..	..	..	..
Total first 3 years.....	109	83 (76%)	15 (14%)	11 (10%)	67	45 (67.5%)	10 (18%)	12	88	55 (62.5%)	10 (11.5%)	23 (26.2%)

3. During the whole of the first year the percentages of normal and Babinski phenomena are again practically the same for the three different varieties of heads, although a Babinski phenomenon is somewhat less common among the brachycephalic group.

4. During the second year, the numbers are too few to make any comparison.

5. For the whole period of the first two years, we have the following figures:

Dolichocephaly: 105 cases. Out of these

79, or 75.2 per cent. had a normal reflex.

15, or 14.3 per cent. had a Babinski phenomenon.

11, or 10.5 per cent. had a variable reflex.

TABLE 9.—DOLICHO AND MESOCEPHALY; BRACHYCEPHALY

Age	Dolicho and Mesocephaly				Brachycephaly			
	No. of Cases	F	E	V	No. of Cases	F	E	V
First quarter.....	80	56	16	8	16	9	3	4
Second quarter.....	42	28	5	9	22	16	1	5
First 6 months.....	122	84 (69%)	21 (17%)	17 (14%)	38	25 (70%)	4 (10.5%)	9 (23.7%)
Third quarter.....	15	13	..	2	18	8	4	5
Fourth quarter.....	7	5	1	1	9	6	..	3
Second 6 months.....	22	18	1	3	27	14	5	8
Total first year.....	144	102 (70.8%)	22 (15.2%)	20 (14%)	65	39 (60%)	9 (30.8%)	17 (14%)
Second year.....	23	19	3	1	23	16	1	6
Total first 2 years.....	167	121 (71.8%)	25 (15%)	21 (12.5%)	88	55 (62.5%)	10 (11.3%)	23 (26.2%)
Third year.....	9	7	..	2	..	..	..	..
Total first 3 years.....	176	128 (72.7%)	25 (14.2%)	23 (13%)	88	55 (62.5%)	10 (11.3%)	23 (26.2%)

Mesocephaly: 62 cases. Out of these

42, or 67.7 per cent. had a normal reflex.

10, or 16.1 per cent. had a Babinski phenomenon.

10, or 16.1 per cent. had a variable reflex.

Brachycephaly: 88 cases. Out of these

55, or 62.5 per cent. had a normal reflex.

10, or 11.3 per cent. had a Babinski phenomenon.

23, or 26.2 per cent. had a variable reflex.

In other words, the incidence of a Babinski phenomenon is slightly less among the brachycephalic group than among the other two groups, suggesting that cerebral inhibition may be greater in that group of cases. The fact that no difference is shown during the first three months may possibly be accounted for on the supposition that the head has as yet not completely recovered from the effects of obstetric molding.

6. For all cases throughout the first three years the percentages are practically the same as for the first two years.³⁵

Influence of the Nature of the Infant's Food on the Nature of the Plantar Reflex.—(Table 10) It has been alleged that the reason why human milk contains more lecithin and lactose than that of the cow is because more lecithin and lipin derivatives of lactose are required by the quickly growing infant's brain and nervous tissues with their myelin sheaths than is required by the more slowly growing nervous

TABLE 10.—INFLUENCE OF NATURE OF FOOD UPON THE NATURE OF THE PLANTAR REFLEX

Age	Breast				Bottle			
	No. of Cases	F	E	V	No. of Cases	F	E	V
First month.....	12	7 (58.3%)	3 (25%)	2 (16.7%)	9	4 (44.4%)	4 (44.4%)	1 (11.2%)
Second month.....	16	6	6	4	7	5	..	2
Third month.....	13	3	8	2	11	4	5	2
First quarter.....	41	16 (39%)	17 (41%)	8 (20%)	27	13 (48.1%)	9 (33.3%)	5 (19.9%)
Fourth month.....	8	5	2	1	6	4	2	..
Fifth month.....	1	..	..	1	2	..	1	1
Sixth month.....	2	1	..	1	3	1	..	2
Second quarter.....	11	6 (54.5%)	2 (18.2%)	3 (27.3%)	11	5 (45.5%)	3 (37.3%)	3 (27.2%)
Total first 6 months...	52	32 (42.3%)	19 (36.5%)	11 (21.2%)	38	18 (46.3%)	12 (31.6%)	8 (21%)
Seventh month.....	5	4	..	1	2	..	..	2
Eighth month.....	3	2	..	1	1	1	..	..
Ninth month.....	2	..	2	..	..	..	..	..
Third quarter.....	10	6	2	2	3	3	..	..
Fourth quarter.....	3	2	..	1	9	6	1	2
Total second half year	13	8 (61.5%)	2 (15.4%)	3 (23.1%)	12	7 (58.3%)	1 (8.4%)	4 (33.2%)
Total first year.....	65	30 (46.1%)	21 (32.3%)	14 (21.6%)	50	25 (50%)	13 (26%)	12 (24%)
Second year.....	9	2	3	4	3	1	2	..
Total first 2 years.....	74	32 (43.2%)	24 (32.4%)	18 (24.4%)	53	26 (50%)	15 (28.3%)	12 (22.7%)

system of the calf.³² If that is true, and if it is also true, as it practically certainly is, that to a certain extent the nature of the plantar reflex depends on the degree of myelination of the pyramidal tracts, then we would expect that in infants artificially fed there should be a larger percentage of dorsiflexor responses than in those fed on the breast. This is not found to be the case.

35. In view of the fact that owing to the development of the frontal sinuses and the occipital protuberance in later life the cephalic index slightly decreases with age, it is, perhaps, safer to classify both the dolichocephalic and mesocephalic types in our series together as dolichocephalic. This I did in Table 9. The results again show a smaller percentage of Babinski phenomena in the brachycephalic group.

During every age period (except during the first month) breast fed infants show a slightly larger percentage of Babinski phenomena than bottle fed infants, showing that breast feeding per se does certainly not tend to diminish the incidence of the Babinski phenomenon *after* the first month. It is not safe to generalize from the few cases during the first month, but as the percentages of Babinski phenomena during that period are 25 and 44 per cent., respectively, in breast fed and bottle fed babies, it would seem that breast feeding during the first few weeks has a salutary effect on the development of the nervous system.

If, further, we transfer from the thirty-eight bottle fed infants during the first half year (of which eighteen gave a flexor, twelve an extensor and eight a variable response), the fourteen infants (from the second month onward) which were breast fed for a variable period between two weeks and two months after birth (and of which seven gave a flexor, four an extensor and three a variable response), to the fifty-two that were entirely breast fed (up to the time of the examination) during the first half year, we obtain the figures shown in Table 11.

TABLE 11.—INFLUENCE OF NATURE OF FOOD ON PLANTAR REFLEX

	No. of Cases	F	E	V
Bottle fed first 6 months.....	38	18	12	8
Subtract partly breast fed.....	14	7	4	3
Entirely bottle fed.....	24	11 45.6%	8 33.3%	5 21%
Total entirely breast fed first 6 months.....	52	22	19	11
Add partly breast fed.....	14	7	4	3
Total breast fed (entirely or partly)...	66	29 44%	23 34.8%	14 21.2%

In other words, we still arrive at the same result, that whatever influence breast feeding may possibly have on the development of the pyramidal tracts during the first month it has no effect whatever on the subsequent development of these tracts.

Influence of Body Temperature (Table 12).—A consideration of certain facts with regard to the circulation, respiration, and the superficial area of the skin in the infant leads one to expect that changes in the body temperature might have some influence on the nature of the plantar reflex in early life.

I have already shown that at birth the pyramidal tracts of the spinal cord are sufficiently well developed to conduct inhibitory impulses from the brain which would tend to produce a normal plantar reflex, and that the production of a Babinski phenomenon in early life is favored by insufficient cerebral control (? e. g. in dolichocephaly), as well as other factors, such as circulatory disturbances which might cause slight pressure on the incompletely developed tracts.

Now let us consider the following facts: (1) Czerny and Kleinschmidt³⁶ have recently shown radiographically that in severe disturbances of nutrition, which are generally accompanied by a subnormal temperature, and in which the abdominal muscles become relaxed, the heart becomes actually smaller in size on account of the interference with the movements of the diaphragm, which during inspiration helps to drive blood out of the abdomen into the thorax; (2) the relation between the surface and volume (or weight) of the body is greater in the infant than in the adult,³² e. g. at birth the area of the cutaneous surface of the body per kilogram body weight is three times, and at one year twice that in the adult, and hence in cases of subnormal temperatures in which there is anemia of the skin there is a much greater congestion of the internal organs in the infant than there is in the adult.

Consequently, we would expect subnormal temperatures in infancy to bring about great venous congestion of all the internal organs, including the spinal cord, which would tend to produce a Babinski phenomenon. The opposite would be the case in conditions accompanied by pyrexia.

I have, therefore, classified my cases into three groups, viz. (1) those with subnormal temperatures (under 97 F.); (2) those with normal temperatures (between 97 and 99 F.), and (3) those with pyrexia (above 99 F.). The results are very striking (Table 11). They show that: At all periods from birth (0) to 3 months, from birth (0) to 6 months, and from birth (0) to 12 months, the incidence of cases of Babinski phenomena occurs in decreasing percentages in the subnormal, normal and supernormal temperature groups.

Influence of Certain Toxic Agents (see Protocols of Cases).—(1) Syphilis: Of six cases of congenital syphilis, during the first three months, five gave a normal adult type of response and one gave dorsiflexion on one side and plantar flexion on the other. The syphilitic virus, therefore, had no deleterious influence on the pyramidal tracts. Indeed, one would not, a priori, expect it to have. For syphilis among adults, while it may cause degeneration of the posterior columns (as in tabes), hardly ever causes degeneration of the pyramidal tracts, except secondarily to cortical degeneration (as in dementia paralytica). (2) Toxemia from the bowels: This does not seem to have any influence on the nature of the response. (3) Pertussis: It is believed by some that the attacks in whooping cough are due to toxic irritation of the vagus, but out of four cases of pertussis during the first two years, three gave a plantar flexor response and only one a dorsiflexion

36. Czerny and Kleinschmidt: Weiterer Beitrag zur kenntniss der Zirkulationsstörungen bei akuten Ernährungsstörungen der Säuglinge, Jahrb. f. Kinder. 84:441, 1916.

of the toe. The number of cases is too few to generalize but it does not seem as if the pertussis toxin has any influence on the pyramidal tracts.

Other Factors.—(1) Rickets: has been alleged to retard the development of the pyramidal tracts. I do not find it to be the case. (2) Convulsions: Esmenard³⁷ finds that both during an epileptic fit in adults and soon after there is a Babinski phenomenon. In the case of infants suffering from convulsions, in the interval between fits there was a normal plantar reflex in all the four cases that came under my observation during the first two years of life, but in one case of convulsions and pertussis, in a girl, aged 4 years, there was a very marked Babinski phenomenon nine hours after a fit. (3) Sleep: most cases in which the reflex was examined during sleep were of the Babinski character.

DIFFUSION OF THE REFLEXOGENOUS ZONE

Bertolotti,³⁸ in 1904, and Laurent, in 1905, found that the area of skin, stimulation of which will produce a plantar reflex in normal infants, is not confined to the sole of the foot but is very diffuse. Thus in 10 per cent. of cases Bertolotti could elicit a downward movement of the toes on pinching the skin as high up as the abdomen, and in from 30 to 50 per cent. he elicited movement on pinching the skin in various parts of the leg and thigh (compare Oppenheim's, Gordon's and other modifications of the Babinski sign in adults). Laurent found a similarly great extension of the reflexogenous zone, but the abstract of his thesis (which is the only record of his results that has been accessible to me) does not state whether the response he obtained was a plantar flexion or dorsiflexion of the toes. Laurent further found that the extension of the zone tends to disappear after the age of 9 months. Yoshimura¹⁷ confirms the extensive diffusion of the zone in infancy.

I have no statistics to offer on the matter, but I have examined a considerable number of cases and can fully confirm the findings of these observers with regard to the remarkable diffusion of the reflexogenous zone in early life. In quite a large proportion of cases—certainly more than the 10 per cent. found by Bertolotti—I have been able to obtain a plantar reflex on pinching the skin of the abdomen, even at the age of 1 year and 3 months.

In most cases the response was flexor in type (i. e., plantar flexion) but occasionally an extensor response was elicited, even when the

37. Esmenard, J.: Contribution a l'etude du phénomène des orteils dans l'épilepsie, These de Paris, 1902.

38. Bertolotti, M.: Etude sur la diffusion de la zone reflexogene chez les enfants, *Rev. neurol.* 12:1160, 1904.

ordinary response was flexor. It is remarkable, however, that the response was almost in every case much more pronounced than when the stimulus was applied to the sole. After about eighteen months, the reflexogenous zone gradually shrinks. In two cases (Cases 759 and 766), in children between 3 and 4 years of age, in which the zone was localized to the sole of the foot, stimulation of the inner border produced plantar flexion of the big toe, while stimulation of the outer border evoked a dorsiflexion of the toe. This peculiarity was bilateral and constant in each case.

Another interesting fact is that although the reflexogenous zone is extensively diffused in a vertical direction, it is in the large majority of cases lateralized, i.e., pinching of the skin on one side will not, as a rule, produce a plantar response on the other side.

SUMMARY

I have examined the plantar reflex of about 500 subjects from birth up to the age of 7 years, the large majority being under 4 years. I have not recorded the exact number of cases at the various age periods in which no response could be elicited, because absence of a plantar reflex is not peculiar to infancy. In a good many cases in adults I have failed to obtain any plantar response. Moreover, absence of the response is entirely due to an affection or deficient development of the reflex arc and gives no information regarding the upper motor neuron with which alone I was concerned in this investigation. As, however, I was able to obtain a response in 426 cases, I conclude that the total percentage of nonresponses is about 15. In this respect, therefore, my figures are more in agreement with those of Engstler who, in a series of 1,000 cases found the reflex to be absent in 109 (11 per cent.), and of Finizio who among 500 new-born infants failed to elicit it in 5 per cent., than with the 35 per cent. of absent reflexes given by Morse, and 40 per cent. given by Schüler.

As regards the nature of the response, my findings agree very closely with those of Finizio. For while all other observers find the prevailing response to be of the Babinski type, both Finizio and myself find the proportion between plantar flexion and dorsiflexion to be approximately 4:1 (Table 1). I cannot, however, confirm Finizio's statement with respect to the influence of forceps delivery on the nature of the response, for while Finizio finds that in difficult forceps cases there is dorsiflexion of the toe, of the two new-born forceps cases in my series, one of which (Case 602) was a particularly difficult one and gave rise to a good deal of trauma, both gave a normal response (i. e., plantar flexion). But my numbers are too few to draw any conclusions. I give my results as I have found them.

As regards the age at which the plantar reflex definitely becomes plantar flexor in type, I cannot agree with the conclusions of some observers that it depends on the age at which the child begins to walk, since not only do I find plantar flexion to be the prevailing response before the walking age, but I have obtained it in a few cases either unilaterally or bilaterally, long after the child had begun to walk. Moreover, in the same infant you might at different times elicit either plantar flexion or dorsiflexion.

As regards the correlation between the degree of development of the pyramidal tracts and the nature of the response, and the influence of the various developmental and environmental factors on it, see pp. 3 and 4, as well as under "conclusions."

CONCLUSIONS

1. The prevailing plantar response in early life is plantar flexion of the big toe, although when a dorsiflexion of the toe occurs it has not the same significance as a similar response in the adult.

2. The pyramidal tracts are sufficiently developed at birth (in cases of birth at full term) to give a normal adult type of plantar reflex even intra-uterinally, but owing to easily aroused circulatory disturbances in early life, the consequent changes in the circulation in the region of the cord are sufficient to compress the incompletely myelinated pyramidal tracts to evoke a Babinski phenomenon either unilaterally or bilaterally.

3. In premature infants the response is nearly always of the Babinski type, up to 5 or 6 weeks postnatal life, because of the almost total absence of myelination of the pyramidal tracts.

4. Malnutrition, as judged by defective weight and length, is not in itself sufficient to give a Babinski sign, but inasmuch as prematurity and defective weight and length go hand in hand up to about 5 or 6 weeks, the Babinski phenomenon seen in badly developed infants up to that age is due to the prematurity rather than to the malnutrition.

5. Bilateral plantar flexion is at all ages as common in girls as in boys, but bilateral dorsiflexion is at all age periods in infancy more common in girls than in boys.

6. Breast feeding during the first few weeks of life probably tends to diminish the incidence of a bilateral Babinski phenomenon; this may be so owing to the greater percentage of lecithin and lactose in human milk which helps the more rapid myelination of the pyramidal tracts. After the first month or so breast feeding has no advantage in this respect over bottle feeding.

7. Toxic influences, either from the bowel or from other causes, do not affect the conductivity of impulses along the fibers of the pyramidal tracts.

8. Bilateral dorsiflexion of the toes is commoner in cases with a subnormal temperature because, probably, in such cases there is a greater congestion of the spinal cord as the result of: (a) the pallor of the skin, whereby a relatively much larger quantity of blood goes to the internal organs (including the spinal cord) than in adults; (b) the interference with the action of the diaphragm and consequently of the pumping action of the heart in cases of severe disturbances of nutrition—which are frequently the accompaniments of subnormal temperatures.

9. Bilateral dorsiflexion is slightly more common in dolichocephalic than in brachycephalic infants, possibly because inhibitory control is less powerful in the former than in the latter.

10. Rickets does not favor the occurrence of a Babinski phenomenon.

11. The age at which the Babinski sign vanishes has no relation to the age at which the child begins to walk. In the majority of cases of very young infants who cannot even sit up the Babinski sign is absent, and in the cases of a large number of children who can walk and are "strong on their legs" (in some even during the third and fourth years) the Babinski sign is present.

12. As the peripheral nerves are imperfectly myelinated at birth³² a possible explanation of a Babinski phenomenon in certain infants is more imperfect development of the lower motor neuron supplying the flexors of the toes but better development of the neuron supplying the extensors. In such cases, of course, extension is the only possible movement.

13. The inconstant nature of the response in certain infants in whom at the same examination one may obtain on one stimulation a plantar flexion and on another stimulation of either the same or a different cutaneous area a dorsiflexion may be due to the easy fatigability, as well as easy recovery from fatigue of muscle in early life, so that after a certain response has been obtained the muscles producing that response can no longer contract as easily as the opposing groups of muscles and the response is, therefore, produced by the less fatigued group of muscles.

14. The reflexogenous zone is very diffuse in early infancy, and sometimes one is able to elicit a plantar reflex (either flexor or extensor) by stimulating a cutaneous area other than the sole, when stimulation of the sole fails to evoke a response.

PROTOCOLS OF CASES

Age 0 (At Birth) Normal Weight, 7 Pounds				
Case No.	Sex	Weight, Lbs.	Direction of Toe	Remarks
615	M	8	↓ each	Normal birth (Case 616, age 0-24 hours)
715	F	9¼	F	Forceps
716	F	3¾	E	6½ months' fetus
717	F	About normal	F	Reflex tried intra-uterinally and postnatally; transverse presentation; internal version under chloroform; baby born with two lower incisors
718	M	6½	F	Placenta praevia

Forceps, intra-uterine manipulation and placenta praevia did not produce a Babinski phenomenon, but prematurity did.

Age, 0-24 Hours

Case No.	Sex	Weight, Lbs.	Direction of Toe	Remarks
616	M	8	E (at 1 hr.)	Age = 1 hour; same case at birth was V (Case 615)
614	M	8	F (at 14 hrs.)	This infant died suddenly at the age of 25 hours (see notes, postmortem report and microscopic report of cord sections, p. 9)
605	F	6	F (at 22 hrs.)	

Age, 1-2 Days

614 M 8 V Age = 28 hours; see Case 614 under 0-24 hours

Age, 3 Days

602 F 10 F Difficult forceps labor; hematoma of neck and contusion of face; convulsions on second day; mother suffered from dropsy for a few weeks before confinement

Forceps and trauma of birth, as well as convulsions on second day did not produce a Babinski sign.

Age, 5 Days *

Case No.	Sex	Weight, Lbs.	Length, In.	Temperature	Cephalic Index	Direction of Toe	Feeding
729	M	3.15	16½	95.2	87	F	Bottle
730	M	3.11	17	95.2	81	E	Bottle

* These two babies were twins. They were prematurely born at 7½ months. Mother suffered from puerperal sepsis. In spite of the identical sex and prenatal as well as neonatal environments, etc., the plantar reflex was flexor in one and extensor in the other.

Age, 1-2 Weeks

Case No.	Sex	Weight, Lbs.	Direction of Toe	Remarks
606	F	8	F	Age, 11 days
607	F	4	E	Age, 12 days

Explanation of abbreviations and symbols: Under sex, M=male; F=female. Under direction of toe, F=plantar flexion (flexion); E=dorsi-flexion (extension); V=variable (different either on the two sides or on the same side at different times);

↑=dorsiflexion; ↓=plantar flexion; o=no reflex.

↑_R ↓_L=dorsiflexion on right side, plantar flexion on left side.

↑_L ↓_R=dorsiflexion on left side, plantar flexion on right side.

↑_L o_R=absent reflex on right side, dorsiflexion on left side.

o_L ↑_R=absent reflex on left side, dorsiflexion on right side.

o_L ↓_R=absent reflex on right side, plantar flexion on left side.

o_L o_R=absent reflex on left side, plantar flexion on right side.

v ↑ ↓ each=variable on each side.

PROTOCOLS OF CASES

Age, 2 Weeks; Normal Weight, 7½ Pounds, and Length, 20 Inches									
Case	Sex	Complaint	Wt., Lbs.	Length, Inches	Temp.	C. I.	Feeding	Toe	Remarks
4	M	Icterus, neonatorum	6.13	18½	96.4	72.7	?	E	
166	F	Uric acid calculus	6.0	19¾	96	72.2	?	F	
220	F	Tongue tie	6.15	21	98	82.6	?	F	
505	F	Wasting	2.12	17	97	75	?	↑ R ↓ L	Prematurely born at 8 months
683	F	Screaming	7.2	21	96.4	....	Breast	F	
751	M	.....	2.4	....	98	80	Bottle	E	7 months' fetus; weight at birth, 3½ pounds
761a	F	Crying	8	....	....	....	Bottle	F	
35	F	Spina bifida	4.14	16	....	72	Breast	E	Eighth infant, full term
Age, 2-3 Weeks									
285	M	Flatulence	6.15	19	97	75	Breast	F	Age, 16 days
608	M	Nil	6.14	....	98.4	....	Breast	F	Forceps delivery; age, 17 days
609	M	Nil	6.8	....	....	....	Breast	E	Age, 19 days
789	M	Crying	8	....	98.4	....	Bottle	F	Age, 18 days
Age, 3 Weeks									
213	M	Ophthalmia neonatorum	5.1	17¾	97	88	Bottle	F	Mother consump- tive
244	M	Diarrhea	Very tiny infant				Bottle	E	Very feeble, puny infant; col- lapsed; brandy and oxygen given; premature
276	M	"Always hungry"	8	21¼	98.4	80	Breast	F	
655	M	Flatulence	7.12	22	98	....	Breast	V ↑ L ↓ R	
658	M	Swollen feet	9.3	22½	99	68	Breast	V ↑ L ↓ R	? Idiopathic dropsy
481	M	Vomiting	7.14	23¾	100.2	80	Bottle	F	
Age, 4 Weeks; Normal Weight, 7¾ Pounds; Length, 20½ Inches									
128	M	Wasting	5.3	26	98.4	85	Bottle	V ↑ R ↓ L	This was a baby with congenital absence of fibula and tarsal bones; curvature of tibia; see notes roentgen ray re- port, postmor- tem report and notes on sections of card, p. 9
258	?	Wasting	8	19	96.2	76	?	E	7 months' fetus
299	M	Vomiting	7.7	21	97.8	84	?	F	
335	M	Erythema	10.8	22	98.4	77	?	E	
329	M	Right inguinal hernia	4.9	17	96	75	Bottle	E	7½ months' fetus
375	F	Flatulence	6.8	19	98.2	75	?	F	
423	M	Wasting	4.6	16¾	96	79	?	F	Weight at birth, 5 pounds; ? full term
453	M	Phimosi	9.8	21¾	98.2	70	?	F	
470	M	Flatulence	10.8	24½	98	77	?	F	
581	F	Screaming	8.12	21	98	84	Breast	E	
610	M	Nil	7.14	....	....	....	Breast	F	
711	M	Rash on head	8.3	25	98.4	....	Breast	F	
Age, 5 Weeks									
132	F	Wasting, con- genital syphilis	6.1	18¾	98.2	80	.....	F	
148	F	Wasting	7.13	20½	97.6	93	.....	F	
167	M	Diarrhea and vomiting, wasting	7.2	20½	99.6	70	.....	F	
183	F	Rash, (?) toxic	8.11	20½	98.4	79	.....	E	Infant asleep
305	F	Pretful	6.2	18¾	97	75	.....	F	
307	M	Vomiting	6.2	18¾	96	75	.....	F	
449	M	Sore buttocks	9.6	19¾	98.8	76	.....	F	
458	M	Snuffles and nasal obstruction	11.3	22½	98.4	72.7	.....	F	
603	F	Vomiting	7.7	18½	....	....	Bottle	F	Weight at birth, 4 pounds; prema- ture; breast fed only one day

PROTOCOLS OF CASES

Age, 5 Weeks—(Continued)									
Case	Sex	Complaint	Wt., Lbs.	Length, Inches	Temp.	C. I.	Feeding	Toe	Remarks
611	M		10					F	Breast fed first 2 weeks
631	M	Constipation	8.12	23½	99	76	Bottle	V	
703	M	Constipation	9.5	22	97.4		Breast	V	8 months' fetus weaned at one month
704	M	Screaming	11.8	22	97	....	Breast	F	
739	F	Wasting	5.9	18½	96.2	77.7	Breast	E	
Age, 6 Weeks									
12	F	Diarrhea and	8.10	21½	98.6	76		F	One of twins
275	F	Nil	8.8	21	97.4	80	.....	F	
279	M	Wasting	6.15	21	98	80	.....	V ↑ L ↓ R	
282	F	Bronchitis	12.12	23¾	97.4	81.8		F	One of twins
292	F	Flatulence	9.8	20¾	99	77	.....	F	
322	M	Constipation	8.2	22	97	71.4	.....	F	
341	F	Bronchitis	6.11	19½	96	76		F	Congenital syphilis; on breast 2 weeks (?) patent foramen ovale
456	M	Screaming	9.9	20½	97.2	77	.....	F	
461	F	Umbilical hernia	7.4	20	97	80	Bottle	F	
463	M	Systolic bruit all over heart	7.9	20½	98.4	80	Breast	F	Same case as 602 (see under 3 days)
582	F	Vomiting 10 days	8.15	21¼	98	84	Breast	E	
640a	F	Nil	....	....	....	....	Bottle	F	
712	M	Right inguinal hernia	9.11	23½	98.4	72.7	Breast	F	7 months' fetus
713	F	Flatulence	11.4	23½	98.2	81	Breast	E	
666	F	Wasting and vomiting	3.11	17	98.8	77.7	Bottle	F	
678	?							F	See also same case under 1 yr. (681) See also under 1 year = V
681	?	.....	....	....	....	80	.....	F	
752	M	Nil	9	21½	....	....	Breast	F	
Age, 7 Weeks									
242	M	Wasting	8.5	22	96	76		F	Breast 3 weeks
345	M	Rash, (?) toxic	10.12	21	97	77	.....	V ↑ L ↓ R	
375	F	Flatulence	6.8	19	98.2	75	Bottle	F	
425	M	Screaming	7.6	20	97	82.6		F	Breast 3 weeks
445	F	Vomiting	7.5	22	98.4	84	.....	F	
446	F	Constipation	6.12	19¾	96.6	80	.....	F	
482	F	Thrush	12	21	98	77		F	Breast 3 weeks
653	M	Glands in neck (?) C. S.	10.15	23¾	99.2	....	Breast	V ↑ L ↓ R	
662	M	Malnutrition	7.4	23½	98	77	Breast	V ↑ L ↓ R	
706	F	Wasting	5.14	19½	96		Bottle	V ↑ L ↓ R	Breast 3 weeks
707	M	Umbilical hernia	9.4	21½	98.8	....	Breast	F	
733	M	Screaming	10.13	22½	98.2	82	Breast	F	
762	F	Screaming	Well developed				Breast	F	
Age, 2 Months (8 weeks); Normal weight, 9½ Pounds; Length, 21 Inches									
1	M	Wasting and diarrhea	9.6	21½	98.4	73		F	Breast 2 weeks Twelfth infant
13	F	Vomiting	11.2	20¾	99.8	96	Bottle	F	
109	M	Wasting and diarrhea	9.8	21½	98.4	73	.....	F	
129	M	Bronchopneumonia	11.10	23	102	86		F	Breast 2 weeks Twelfth infant
142	M	Wasting and vomiting	7.7	21	97	79	.....	F	
163	F	Wasting and diarrhea	7.0	19½	98	80	.....	F	
170	F	Flatulence	9.6	23	99	79		F	Breast 2 weeks Twelfth infant
172	M	(?) C. S.	8.5	22	97.6	80	.....	F	
334	F	Vomiting	9.10	21½	97.6	77	.....	F	
174	M	Fretful and wasting	7.4	21½	97	76		F	Breast 2 weeks Twelfth infant
194	M	Wasting	7.10	21¼	98	84	Breast	V ↑ L ↓ R	
223	F	Adenoids	9.4	21¾	98	81	.....	F	

PROTOCOLS OF CASES

Age, 2 Months (8 weeks); Normal Weight, 9½ Pounds; Length, 21 Inches—(Continued)									
Case	Sex	Complaint	Wt., Lbs.	Length, Inches	Temp.	C. I.	Feeding	Toe	Remarks
339	M	Icterus neo- natorum	7.5	20	97.2	76	.....	F	7 months' fetus
289	M	.....	16	.....	97.4	84	.....	V ↑ L ↓ R	
388	F	Wasting	6	19½	96	76	.....	F	
417	M	Bronchitis	9.4	22	97	80	.....	F	Father and pater- nal aunt died of consumption, maternal uncle suffering from consumption
428	F	Wasting and vomiting	6.2	20	99.6	79	.....	F	
430	F	Constipation	10.6	22½	97.6	76	.....	F	
436	F	Rash	10.12	21¾	97	73	.....	F	
447	F	Flatulence	9.8	20½	98	81	.....	F	
457	F	(?) C. S.	5.4	20	97.4	79	.....	F	
460	F	Not progressing	7.7	21	97	80	.....	F	
459	F	Constipation	13.1	22½	99.2	81	.....	F	
469	M	Wasting	7.12	19¼	98	76	.....	F	
487	F	Wasting	4.7	17	96.6	79	.....	F	} Premature twins } at 8 months
488	M	Cough	5.5	18	96	75	.....	F	
626	F	Vomiting and crying	7.1	20	98	....	.....	F	
638	F	Snuflles	8.12	20½	97	....	Breast	E	
639	M	Constipation	7.15	21	97.2	....	Breast	E	
677	F	Umbilical hernia	9.13	24	97.4	....	Breast	F	
708	M	Umbilical her- nia and double inguinal hernia	10.8	21½	98	....	Bottle	F	Breast fed 3 weeks
712	M	Inguinal hernia	9.11	23½	98.4	73	.....	F	
740	F	Wasting	7.15	22¾	99	81	Breast	F	
743	M	Wasting and vomiting	8.3	21	98.2	82	Bottle	F	Breast fed 2 weeks
Age, 9 Weeks									
432	?	Wasting, flatulence	7.1	21½	97.2	72.7	.....	V ↑ L ↓ R	Same case as 432a; under 6 mos. = F
318	M	Phimosis	8.13	21½	97.8	77	.....	F	
673	F	Wasting	6.6	19	98	75	.....	F	
593	M	Inguinal hernia	9.0	20	98.4	81	.....	V ↑ L ↓ R	8 months' fetus
477	F	Screaming (?) C. S.	6.10	20½	97	76.2	.....	F	One of twins
737	F	Wasting and vomiting	8.0	22	97.2	76.2	Breast	E	
Age, 10 Weeks									
208	F	(?) Pertussis and wasting	9.14	23½	97.4	80	.....	E	
226	F	Bronchitis	8.4	20½	98	90	.....	F	
312	F	Wasting	7.3	20	96.4	71	.....	F	
431	F	Cough	8.6	20	97	76.2	.....	F	
325	F	Vomiting	10.15	22	98.4	72.7	.....	F	
452	M	Rectal prolapse	11.1	20½	99.6	72.7	.....	F	
600	M	Wasting	4.9	17	97	79	.....	F	} Twins; premature; } fifth pregnancy
601	M	Wasting	5.10	18½	97.8	95	.....	F	
629	M	Constipation	10.8	23½	98.4	82.6	Breast	F	
643	M	Wasting	8	20	98.6	79	Bottle	E	Breast 2 weeks
644	F	.....	11.7	23	98	76	Breast	E	
659	M	Vomiting	11.10	23¾	99	....	Breast	V ↑ L ↓ R	
661	M	Malnutrition	7.8	22½	97.6	....	Breast	F	
684	M	Wasting	6.2	20½	98	79	Breast	E	
637	F	Wasting	5.13	18¾	97	....	Bottle	F	
744	M	Screaming	8.2	24½	98	85	Bottle	E	Breast 2 weeks
761	F	Wasting	7.12	....	....	....	Bottle	F	
Age, 11 Weeks									
151	M	Wasting	7.4	20½	99	72.7	Breast	F	
311	F	Wasting	12.8	23	99	76	.....	E	
455	M	Wasting	6.15	18¾	98	76	.....	F	Father had sple- nectomy 8 mos. previously; pa- ternal uncle had pernicious ane- mia
633	M	Constipation	11.2	23¾	97	....	Breast	E	
650	M	Wasting	6.5	20	97.2	....	Bottle	V ↑ L ↓ R	} Twins; premature
651	M	Wasting	6.11	20	97.6	....	Bottle	E	
768	M	Wasting	8	19½	96	70	Breast	E	

PROTOCOLS OF CASES

Age, 3 Months; Normal Weight, 11 Pounds; Length, 22 Inches									
Case	Sex	Complaint	Wt., Lbs.	Length, Inches	Temp.	C. I.	Feeding	Toe	Remarks
8	M	(?) Toxic poisoning	12.5	25	98.4	78	.....	F	
14	M	Wasting	7.10	21½	97	80	.....	F	
24	F	Anemia and wasting	6.15	20½	97.4	81	.....	F	
26	M	Wasting	8.15	21	98.6	76.2	.....	F	8 months' fetus
57	F	Sore buttocks	10.12	22¾	96	86	.....	E	
68	M	Flatulence	8.13	20	98.4	86	.....	F	
93	F	Constipation	11.7	23½	97	77	.....	F	8 months' fetus
98	M	Losing weight	8.15	22¾	98	82	.....	F	Thirteenth infant; six died of wasting, one died of meningitis
112	F	Anemia	6.15	20½	97	81	.....	F	
119	M	Cough	8.13	22	97	76	.....	F	
136	M	Wasting	7.4	22	97	73	.....	F	
144	M	Rash (?) toxic	12.6	24	98.2	74	.....	V ↓ L ↑ R	
158	M	Wasting	9.4	23¾	103	71	.....	F	
165	M	Wasting	8.7	22½	98.2	81	.....	F	
168	M	Vomiting and screaming	11.5	23	97.2	81	.....	V ↓ L ↑ R	each
178	M	Diarrhea and vomiting	9.13	22½	96.6	74	.....	V ↓ L ↑ R	
186	M	Skin eruption	9.5	22	98.8	86	.....	F	
204	F	Erythema	10.11	21½	97	77	.....	F	
256	M	Constipation, sleeplessness	8.13	21¾	97.6	71	.....	E	
266	M	Wasting	11.1	23	98.4	74	.....	F	
304	M	Constipation	11.14	21¾	98	86	.....	F	
319	M	Diarrhea and vomiting	12.10	25	97.2	77	.....	F	
401	M	Cough	11.4	21¾	100.4	70	.....	F	
419	F	Cough	15.4	21¾	98	73	.....	F	
437	M	Wasting	8.4	20¾	98.4	81	.....	E	
440	F	Wasting	8.13	20¾	97	73	.....	F	
484	F	Wasting	6.0	19	98	70	.....	F	8 months' fetus
493	M	Wasting	6.10	19¼	96.2	76	.....	E	
545	M	Flatulence	8.4	21	97.2	76	Breast	F	
598	F	Malnutrition	7.7	19½	97.2	76	.....	V ↓ L ↑ R	
619	M	Screaming	.....	.....	.....	.....	Bottle	E	"Glaxo" baby
620	F	Nil	9.12	22½	97.4	86	Breast	E	
635	F	Cough	11.7	24	98.8	77	Breast	E	
640	M	Cough	.....	.....	.....	.....	Breast	E	Congenital hydrocephalus
664	F	Wasting	7.4	22¾	98.8	81	Bottle	F	
676	M	Wasting, C. S.	5.5	18¾	96.6	.....	Bottle	F	Premature (9 mos.); breast fed 2 weeks
700	F	Rash on thigh	13.7	24½	99.2	.....	Breast	E	
652	F	Supernumerary thumb	12.2	22¾	98.2	.....	Breast	E	
728	F	Umbilical hernia, wasting	7.10	24	96	84	Bottle	V ↓ L ↑ L ↑ R	
742	M	Wasting	6.15	23	98.4	85	Breast	V ↓ L ↑ L ↑ R	
333	M	Wasting	9.10	21½	100.4	70	.....	F	
670	M	Wasting	7.2	23	97	76	Bottle	E	
Age, 14 Weeks									
130	M	Wasting	7.9	20¼	97.4	76	.....	F	
274	M	Diarrhea and vomiting	14.3	25	98	90	.....	F	
421	M	Wasting	8.13	21½	97	78	Breast	F	
590	M	Umbilical hernia	9.11	22	98.4	76	Bottle	F	
654	F	Screaming	11.13	24	99.6	.....	Breast	V ↓ L ↑ L ↑ R	
667	M	Wasting	11.1	23	98.4	74	Breast	F	
685	F	Constipation	12.2	26	99.2	.....	Breast	F	
624	M	Wasting	7.10	19	96	.....	.....	V ↓ L ↑ L ↑ R	
Age, 4 Months; Normal Weight, 12½ Pounds; Length, 23 Inches									
5	F	Wasting and vomiting	8.9	19	97.2	76	.....	V ↓ L ↑ L ↑ R	
11	F	Diarrhea and vomiting	12.8	24	96.6	79	.....	F	
90	M	Wasting and vomiting	10.4	22¾	97	79	.....	F	

PROTOCOLS OF CASES

Age, 4 Months—Normal Weight, 12½ Pounds; Length, 23 Inches—(Continued)									
Case	Sex	Complaint	Wt., Lbs.	Length, Inches	Temp.	C. I.	Feeding	Toe	Remarks
106	F	Not gaining	8.9	19½	98.2	78	.....	V ↑ L ↓ R	
140	M	Left apical pneumonia with convulsions	9.5	21	103	81	.....	V ↑ L ↓ R	
160	M	Bronchitis	16.13	25½	96.6	82	.....	F	
164	M	Diarrhea and vomiting, wasting	11.15	24½	96	85	.....	V ↑ L ↓ R	
173	F	Malnutrition	8.14	.....	98.6	80	.....	F	
175	F	Intestinal toxemia	9.2	21½	98.4	81	.....	E	8 months' fetus
254	M	Wasting and diarrhea	10.9	22	97.4	86	.....	F	
287	M	Ectopic vesicae	14.8	23	100	79	.....	F	
320	M	Seborrhea capitis, (?) imbecility	10.8	24½	98	73	.....	F	
323	M	Malnutrition	7.1	.....	98.2	73	.....	F	Premature
370	M	Wasting	8.12	24	101.8	83	.....	F	
408	M	Eczema; right inguinal hernia	13.6	23¾	97	79	.....	V ↑ L ↓ R	
473	F	Umbilical hernia, bronchitis	10.3	20½	99	76	.....	F	
604	F	Pertussis	.....	Well developed	.....	.....	Breast	F	
622	M	Vomiting	.....	.....	.....	.....	Breast	E	
672	F	.....	12.10	24½	98.6	81	Breast	E	
674	M	Umbilical hernia	10.7	22	98	.....	Bottle	E	Twins, each breast-fed 1 month 8½ months' fetus Breast fed 2 weeks
675	F	.....	12.2	23¾	98.2	.....	Bottle	E	
684	M	Wasting	10.8	23½	99.2	.....	.....	E	
701	M	Wasting	10.14	23	97	.....	Bottle	F	
422	M	Right inguinal hernia	9.9	21	97.8	73	.....	F	
599	F	Wasting	8.11	20	97.4	77	.....	E	
719	F	Slight hypertrophy of right side of face	16.8	26	98.4	.....	Bottle	F	
265	M	.....	11.7	22	98	83	Breast	F	
306	M	Diarrhea	11.4	23½	99	79	.....	F	
741	F	Constipation	7.13	23½	98	76	Breast	E	
748	F	Screaming	10.4	25¼	97	90	Bottle	E	Breast fed 3 weeks
Age, 5 Months; Normal Weight, 14 Pounds; Length, 23½ Inches									
27	F	(?) Pertussis	11.6	23½	99	70	.....	F	
33	M	Wasting	9.9	22¼	97.2	81	.....	V ↑ L ↓ R	
84	F	Wasting and bronchitis	11.2	26	97	75	.....	F	
105	F	Bronchitis	11.6	23½	99	70	.....	F	3 weeks premature
146	M	Diarrhea and vomiting, wasting	12	24	97.6	82	.....	F	
155	?	Diarrhea	15.6	27	98	86	.....	F	
162	M	Wasting	8.9	21½	96	85	.....	V ↑ L ↓ R	each
235	M	Wasting, pulmonary tuberculosis	8.0	25	97	74	.....	F	
283	F	Restlessness at night	13	24¾	99	83	.....	F	
324	F	Vomiting	7.4	20	96	71	.....	E	
412	F	Slight monogolism	11.2	21½	99	85	.....	F	
315	M	Bronchitis	.....	Well developed	.....	.....	.....	F	
427	M	(?) Defective sight	15.4	27½	98	79	.....	F	
441	F	Digestive trouble	9.3	19¾	98	77	.....	F	
450	F	Wasting	13	23¼	98	76	.....	F	
458	M	Snuffles	11.3	22½	98.4	73	.....	F	
642	M	Cough	15.11	26	98	79	Breast	V ↑ L ↓ R	
732	F	Wasting	9.13	24¼	98.2	82	Bottle	V ↑ L ↓ R	Breast fed 2 mos.
763	F	Nil	17.4	.....	.....	.....	Bottle	E	Same case as 719 under 4 mos. = F
Age, 6 Months: Normal Weight, 15 Pounds; Length, 24 Inches									
2	F	Bronchitis	6.15	25	97	78	.....	F	
15	M	Diarrhea and vomiting, internal strabismus (due to error of refraction)	9.2	22¾	97.6	83	.....	F	

PROTOCOLS OF CASES

Age, 6 Months; Normal Weight, 15 Pounds; Length, 24 Inches—(Continued)									
Case	Sex	Complaint	Wt., Lbs.	Length, Inches	Temp.	C. I.	Feeding	Toe	Remarks
108	F	Bronchitis	16.5	25	97	74	.....	F	
153	M	Wasting, diarrhea and vomiting	10.13	23	97.4	81	.....	F	
176	M	Diarrhea and vomiting	11.12	24	98.4	85	.....	F	Twins, 6 weeks premature
177	M	Diarrhea and vomiting	8	21	98.6	77	.....	F	
201	M	Diarrhea	16.2	21½	99	87	.....	F	
360	M	Vomiting	15.11	27	98.8	80	.....	F	
389	F	Flatulence and cough	16.1	23½	97.8	80	.....	F	
390	M	Restlessness	17.12	25	99	80	.....	V ↑ L ↓ R	
400	M	Diarrhea	14.6	24	99	81	.....	F	7 weeks premature
442	M	Diarrhea and vomiting	14.11	25½	99.2	78	.....	F	
426	M	Diarrhea and vomiting	16.13	26	98.6	83	.....	F	
485	F	Rectal prolapse	.....	.....	.....	.....	.....	F	
397a	F	.....	.....	.....	.....	.....	.....	F	
432a	?	.....	.....	.....	.....	.....	.....	F	Same case as 432 under 9 wks. = V
141	M	(?) Meningitis; fontanel bulging; (?) hydrocephalus	12.1	25	97.6	88	.....	F	
634	M	Wasting	7.6	23½	97.4	....	Breast	F	
665	M	Wasting	14.8	24	99	73	Breast	V ↑ L ↓ R	
594	M	.....	16.0	26	98.8	88	.....	F	
657	F	Diarrhea and vomiting	11.7	22½	97.8	82	Breast	V ↑ L ↓ R	
731	F	Wasting	7.4	22	98	82	Bottle	V ↑ L ↓ R	
735	M	Screaming	9.3	21½	98	85	Bottle	F	
Age, 7 months; Normal Weight, 16 Pounds; Length, 24½ Inches									
82	M	Not thriving	13.8	23	99.6	83	.....	E	6 weeks premature, 4 lbs. at birth
95	M	Impetigo	15.2	25¼	97	87	.....	F	
161	F	Wasting	12.10	24	97.4	77	.....	F	
230	F	Rickets	12.5	24¼	98	78	.....	F	
281a	F	Well developed	.....	.....	.....	.....	.....	F	
338	M	Rickets	18.9	28	98	80	.....	F	
357	M	Convulsions	15.14	28	98.2	83	.....	F	
586	M	Diarrhea and vomiting	15.13	26	98.4	75	Breast	F	8 months' fetus
591	F	Malnutrition	7.3	18¾	99	73	Breast	F	
596	M	.....	19.12	25½	99.2	75	.....	F	
623	M	Convulsions	9.5	.....	97.2	.....	.....	F	
656	M	Seborrhea capitis	17.11	26	98	....	Breast	F	Age, 7½ months
738	M	Wasting and vomiting	10.5	22½	97.8	77	Bottle	V ↑ L ↓ R	
745	F	Wasting and vomiting	8.4	22½	96	83	Breast	V ↑ L ↓ R	6½ months' fetus; breast fed 6 wks. During sleep Twins
746	M	Wasting and vomiting	9.6	21¾	97.4	74	Breast	F	
749	M	Diarrhea	9.3	20½	97.4	87	Bottle	V ↑ L ↓ R	
Age, 8 Months; Normal Weight, 17 Pounds; Length, 25 Inches									
7	M	Diarrhea and vomiting	13.7	26¾	99	79	.....	F	
139	F	Wasting	8.3	22	98.4	83	.....	F	
149	M	Diarrhea and vomiting	8.12	23	97	82	.....	V ↑ L ↓ R	
225	F	Diarrhea	16.4	25½	99.2	85	.....	V ↑	each
234	F	Injury to leg; no fracture	20.2	28½	99	90	.....	F	
255	M	Mongolism; slight macroglossia; nystagmus; adenoids	9.7	26¾	98	83	.....	V	
406	M	Cough	17.5	28	99.6	80	.....	V ↑ L ↓ R	
451	F	Cough	16.12	27	99.4	76	.....	F	
485	M	Diarrhea	18.10	28½	100.6	79	Bottle	F	7 months' fetus; family history of tuberculosis; breast fed 2 wks.
413	F	.....	.....	.....	.....	86	.....	E	
660	F	Malnutrition	11.4	24	98	....	Breast	V ↑ L ↓ R	Age, 8½ months 8 months' fetus
632	M	Wasting	11.0	24	98	90	Breast	F	
747	F	Bronchitis	20.3	31	98.6	73	Breast	F	

PROTOCOLS OF CASES

Age, 9 Months; Normal Weight, 18 Pounds; Length, 25½ Inches									
Case	Sex	Complaint	Wt., Lbs.	Length, Inches	Temp.	C. I.	Feeding	Toe	Remarks
185	M	Diarrhea	20.4	28½	97	84.6	.....	E	
206	M	Restlessness	21.4	32½	101.4	87	.....	F	
211	M	Ileocolitis	11.4	20½	100.2	85.7	.....	F	
259	M	Cough	13.7	24½	99.2	78	.....	F	
294	M	Earache	16.3	29	97.2	80	.....	F	
310	F	Wasting	11.2	27	97	82.6	.....	F	
627	M	Malnutrition	11.9	23½	98.4	91	Breast	E	} 8 months' twins; } age 9½ months 7 months' fetus
628	M		11.13	26	99	82.6	Breast	E	
433	M	Diarrhea and vomiting	10.6	22	97	73.7	.....	F	
Age, 10 Months; Normal Weight, 19 Pounds; Length, 26 Inches									
6	F	Bronchopneumonia	15.13	27	101.2	79	.....	F	
291	F	Diarrhea	17.11	27	97	85	.....	F	8 months' fetus
309	F	Rickets	12.10	25½	98.4	83	Bottle	F	
630	M	Cough	11.2	23¾	98.6	92	Bottle	F	
709	M	Diarrhea and vomiting	14	25	98.2	....	Bottle	F	
436	F	.....	.....	.....	.....	80	.....	F	
314	F	Diarrhea	17.7	27	98	74	.....	F	8 months' fetus; one of twins
476	F	Ileocolitis	10.14	....	98	82	.....	F	
Age, 11 Months; Normal Weight, 20 Pounds; Length, 26½ Inches									
22	M	Rickets	11.7	24¾	....	79	.....	F	
138	F	Convulsions	22.7	29½	96.4	83	.....	F	Strong family history of tuberculosis Breast 3 months
157	M	Bronchopneumonia; (?) tuberculosis	15.2	27	99.2	79	Bottle	F	
263	F	Otorrhea and eczema	21.10	29½	97.2	83	.....	V ↑ R ↓ L	
649	M	Diarrhea and vomiting	20.3	29	97.4	....	Breast	V ↑ R ↓ L	On breast 9 mos.
705	M	Screaming	16.8	26½	99	....	Bottle	E	Breast 3 weeks
23	F	Bronchitis	16.3	27½	97.8	76	.....	F	
688	?	Coryza	9.10	....	96.4	87	Bottle	F	Breast 1 month; age, 11½ months
454	M	Screaming	19.8	27½	96.2	79	.....	F	
758	M	Second degree of scalds of leg and thigh (left)	.....	Well developed	.....	.....	Bottle	V ↑ R ↓ L	
Age, 1 Year; Normal Weight, 21 Pounds; Length, 27 Inches									
199	F	Scabies	17.15	27	97	79	.....	E	
583	?	Wasting	19	28½	99.8	83	Bottle	V ↑ R ↓ L	Breast, 2 months
678	?	.....	15.13	....	98.4	80	Bottle	F	Breast fed 2 weeks (see also under 6 weeks F)
681	?	.....	17.15	....	96	83	Breast	V ↑ each	During sleep (see also under 6 wks. F)
765	M	External strabismus due to myopia	Normal development				Breast	F	
Age, 1 Year 1 Month; Normal Weight, 22 Pounds									
13a	M	Wasting; phimosis	17	29½	98.4	74	.....	F	
16	F	Wasting	15.10	25	103.8	83	.....	F	
232	F	Wasting	14.4	29	98.4	80	.....	F	
368	M	Wasting	14.10	25½	98.8	82	.....	V ↑ R ↓ L	
434	F	Bronchitis	21.4	23¾	97.8	80	.....	F	
502	F	Screaming	?	?	?	?	.....	V ↑ each	Fortnight premature; mother suffered from albuminuria of pregnancy
621	F	Nil	19.12	31	97.2	91	Breast	V ↑ R ↓ L	
637	F	Screaming and wasting	10.13	23½	97.2	....	Bottle	E	Breast fed 5 weeks
646	F	Diarrhea and vomiting	18.6	29½	97.4	....	Breast	E	

PROTOCOLS OF CASES

Age, 1 Year 1 Month; Normal Weight, 22 Pounds—(Continued)									
Case	Sex	Complaint	Wt., Lbs.	Length, Inches	Temp.	O. I.	Feeding	Toe	Remarks
648	F	Diarrhea and vomiting	18.6	29½	97.4	....	.....	E	
652	F	Supernumerary thumb, right hand	12.2	22	98	....	.....	E	
700	F	Umbilical hernia	20.0	30½	99.2	....	Breast	E	During sleep
Age, 1 Year 2 Months; Normal Weight, 22½ Pounds									
336	F	Umbilical hernia	21.8	29	98.4	80	.....	F	
354	M	Wasting	15.8	27	99.6	79	.....	E	
467	?	Rickets	16.9	29½	98.4	83	.....	F	
472	M	Bronchopneumonia	23.10	....	102.2	85	.....	F	
595	M	.....	16.3	26	99.4	70	.....	F	During sleep
714	F	Umbilical hernia; convulsions when 6 weeks old	20	29	98.6	87	Breast	V ↑ L ↓ R	During sleep; breast fed 10 months
Age, 1 Year 3 Months									
137	F	Weakness of neck muscles; (?) slight imbecility	17.4	26	99	77	.....	F	
189	F	Loss of appetite	18.12	....	98.2	77	.....	F	
260	M	Intestinal toxemia	12.2	22½	98	82	.....	F	
504	M	Phimosis; right and left inguinal hernia	21.4	33½	97.6	80	.....	F	
Age, 1 Year 4 Months									
396	M	Bronchitis and wasting	14.8	23½	98.6	80	.....	F	
489	M	(?) tuberculosis peritonitis	16.5	27½	98	87	.....	F	
736	F	Refusing food	20.11	30½	102	83	Bottle	F	Breast fed 6 weeks
Age, 1 Year 5 Months									
381	F	Abscess of buttock	18.12	27	98.8	87	.....	V ↑ L ↓ R	8 months' fetus
587	M	Measles	17.10	23½	99	80	Breast	V ↓ L ↑ R	
589	F	Otorrhea	16.12	28½	99.2	83	Bottle	E	
Age, 1 Year 6 Months									
17	M	Diarrhea and vomiting	14.8	29	100	83	.....	F	
18	M	Diarrhea; adenoids; perforation of right membrana tympani; anemia	18.7	31	98	80	Breast	F	
131	M	Eczema	19.10	31½	98	83	.....	F	
592	F	.....	20.15	29	98.4	77	Breast	E	
597	F	Malnutrition	16.15	27	98.2	70	.....	F	
671	M	Bronchopneumonia	18.5	31	99	87	.....	F	
Age, 1 Year 7 Months									
76	M	Wasting; (?) tuberculosis	18.9	30¾	97	77	.....	F	Family history of tuberculosis
195	M	Wasting; (?) tuberculosis	....	32	98.6	84	.....	V ↑ R ↓ L	
435	M	Scabies	20.1	30	97.4	75	.....	F	Hydrocephalus
Age, 1 Year 8 Months									
313	F	Pertussis	18.4	30	98.8	78	.....	F	
480	M	Pertussis	....	32	99.4	80	.....	F	
420	F	Bronchitis	24.2	28¾	97.8	78	.....	F	
Age, 1 Year 9 Months									
94	F	Not taking well	22.10	32½	99	80	.....	F	
196	F	Well developed	.....	....	....	87	.....	F	
278	M	Slight bronchitis	20.4	31	98	84	.....	F	
625	M	.....	.....	....	....	....	.....	E	

PROTOCOLS OF CASES

Age, 1 year 10 Months									
Case	Sex	Complaint	Wt., Lbs.	Length, Inches	Temp.	C. I.	Feeding	Toe	Remarks
218	M					....	.....	F	
382	F	Congenital im- becility; no his- tory of fits or imbecility in family	15.15	24½	99.2	79	.....	E	Fall on head at 10 months; fam'ly history of tuber- culosis; breast fed 1 yr. 8 mo.
721	F	Bronchopneu- monia; pertussis	Well developed		102.2	....	.....	E	

Age, 1 Year 11 Months								
Case	Sex	Complaint	Wt., Lbs.	Length, Inches	Temp.	C. I.	Toe	Remarks
37	F	Screaming	.....	35½	98	84	F	
135	M	Wasting	13.4	26½	98.6	83	F	
492	M	Otorrhea	?	Well devel- oped		88	V	Breast fed 9 months; pneu- monia at 7 months
Age, 2 Years								
316	M	Malnutrition	18.12	....	98.4	87	F	
317	M	Debility and fretfulness	21.10	32½	97.8	78	F	8 months' tetus
346	M	Weakness of legs and ankles	....	34½	98.4	81	F	
369	F	.....	22.6	....	99.2	86	F	
546	?	Earache and occasional right sided convulsions	23.4	34½	98.4	84	F	
640b	F	Bronchitis	Normal development				F	
Age, 2 Years 2 Months								
443	M	.....	....	31	98	81	F	Ringworm
569	M	.....	....	30	98	77.7	F	
Age, 2 Years 6 Months								
302	M	.....	22.3	30	100	76	F	Pyrexia: child still unable to walk; no signs of ner- vous disease (e.g. paraly- sis, etc.)
402	M	.....	....	37	97	75	F	
702	M	.....	....	36	98.2	....	F	Breast baby
750	F	.....	....	34½	98.2	....	V ↑ R ↓ L	Breast fed
Age, 2 Years 8 Months								
251	M	.....	....	31½	98.6	80	V ↑ R ↓ L	A case of petit mal: family history of fits; all reflexes normal, no Chvostek sign; intelligent infant; walked at 1 yr. 6 mo.; talked at 2 years
764	F	Scabies	....	....	....	....	F	Breast 1 year
Age, 2 Years 9 Months								
285a	M	.....	23.1	30½	99.2	80	F	Left anterior poliomyelitis since 1 year old
640d	M	.....	....	....	....	....	F	
Age, 2 Years 10 Months								
725	F	.....	....	....	101	....	F	
Age, 2 Years 11 Months								
686	F	.....	23.1	34½	98.4	80	V ↑ R ↓ L	Pulmonary tuberculosis; breast fed
241	M	.....	97.6	....	....	77.7	F	Case of acute lymphatic leukemia*

* Differential blood count: polymorphonuclears, 9 per cent.; large lymphocytes, 71 per cent.; small lymphocytes, 7 per cent.; lymphoidocytes, 11 per cent.; myeloblasts, 2 per cent. Although from the point of view of the present investigation it has no special interest, it is a very instructive one from the general medical standpoint. The presence of lymphoidocytes in the blood is believed to point to an early fatal termination and, indeed, this child died suddenly within a couple of days after it was first seen by me.²²

PROTOCOLS OF CASES

Age, 3 Years								
Case	Sex	Complaint	Wt., Lbs.	Length, Inches	Temp.	C. I.	Toe	Remarks
466	?	.....	.....	34	100.2	80	F	Adenoids
640c	M	.....	.....	.....	.....	.....	F	
722	F	.....	.....	.....	98	.....	F	
Age, 3 Years 4 Months								
415	M	Injury left ankle	.....	.....	.....	.....	V ↓ Left	Synovitis, (?) tuberculosis
Age, 3 Years 5 Months								
766	F	Urticaria	Normal development				E outer sole F inner sole	
Age, 3 Years 9 Months								
337	F	General debility	.....	38½	98	80	F	(?) Rheumatic soft systolic bruit at apex
759	F	Pain left knee	.....	.....	.....	.....	E, F	
Age, 4 Years								
618	F	Pertussis	.....	.....	.....	.....	E	Convulsions at 11 a. m.; ob- servation of reflex at 8 p. m.

Cases Over 4 Years

No.	Sex	Toe	Remarks
723	F	F	Age 4½ years; myocarditis after diphtheria
724	F	F	
770	M	F	
764a	F	F	Age 4 years 10 months
602a	M	F	Age 5 years
617	M	V ↑ R ↓ L	Age 5 years 6 months
757a	M	F	Age 5 years 6 months
771	F	F	Age 5 years 6 months
772	M	F	Age 6 years
773	F	F	Age 6½ years
775	F	F	Age 6 years 9 months
774	M	F	Age 7 years 9 months
753	M	E	Very typical Babinski phenomenon; complaint, walking on tip toes from infancy; age 9 years 4 months (see p.)
777	M	V ↑ R ↓ L	Age 6 years (same case as 617)
6 st. 4 ft. 6			
3 st. 2-3 ft. 6			