

PROGRESS IN PEDIATRICS

REVIEW OF RECENT LITERATURE ON THE NEW-BORN

N. O. PEARCE, M.D.

Assistant in Pediatrics, University of Minnesota
CHILDREN'S CLINIC OF MINNEAPOLIS

INTRODUCTION

During the last few years the supervision of the new-born child in a number of our best clinics has passed from the hands of the obstetrician into those of the pediatricist, while in private practice the pediatricist is being called on more and more to attend the new-born, one authority stating that after its first breath the little patient belongs to the children's specialist. It is therefore of vast importance that we perfect as best we may our knowledge of the proper means to promote the health and growth of the normal child, and that we be able to recognize at once any unusual condition that may be present, and to institute such treatment as will give these less fortunate children every advantage possible toward proper development.

In order to acquire a comprehensive idea of what has been published during the five years from 1914 to 1918, inclusive, the writer will present a series of papers reviewing the literature, outlining the progress that has been made, and assembling in somewhat concrete form the opinions of our various men on the etiology, pathology and treatment of the diseases of the new-born. Only those diseases or conditions which are recognizable during the first three months of life will be considered, and only that part of any article dealing with the subject of the new-born will be reviewed. The bibliography attached will represent articles which might be of interest to anyone wishing to review the subject more completely.

ANATOMY AND PHYSIOLOGY OF THE NEW-BORN

Blood Analysis.—In examining the literature of the last few years one finds few reports of chemical analysis of the blood in the first days of life. Considerable valuable data have been published on the content of the fetal blood as taken from the cord at birth, it being comparatively easy to obtain in sufficient quantities for chemical analysis. At best, however, this represents more nearly the conditions existing during fetal life than those one might expect to find during the first days after birth. The great difficulty in repeatedly obtaining

blood from the same new-born has greatly curtailed adequate investigation. Since it is possible through the routine puncture of the longitudinal sinus to obtain sufficient quantities of blood for this purpose, and since with the new methods we use very small amounts of blood for the determinations, we may expect more and better work in the future.

Schlutz and Pettibone¹ have determined the nonprotein nitrogen content of the blood in twenty-six newly born infants, and publish a table showing the result of their determinations. The total nonprotein nitrogen of the systemic blood is found to be approximately the same as in the adult, the age and weight of the infant and the period after feeding having no bearing. The percentage of urea nitrogen is uniformly high and averages 50 per cent. of the total nitrogen, and is lowest in the new-born which has not been fed. The amount of ammonia nitrogen is extremely small in every instance and also is not influenced by age or time after feeding. Amino-acids are constantly present even immediately after birth when no feeding has been given.

Slemons and Morriss² in an examination of thirty-five normal obstetric patients found that at the time of birth the average rest-nitrogen in the fetal blood was 24.9 mg. per 100 c.c., while the average of urea nitrogen in fetal blood of sixteen normal patients at birth was 10.4 mg. per 100 c.c. The same concentration of urea in the maternal and fetal circulations would indicate that this substance passes through the placenta by diffusion. Asphyxia dependent on impairment of the fetal heart action is attended with a notable increase in the urea of the fetal blood.

In considering the blood fat of the new-born, Marriott and Sisson³ in a very complete article find that the blood fat is independent of the state of nutrition of the infant. Subcutaneous fat does not necessarily bear any relation to circulating fat. However, the infant who is gaining in weight will have a higher average blood fat than one who is not gaining, and breast fed infants who are gaining in weight have relatively high blood fat percentages.

Huffmann⁴ examined the blood from the umbilical cord and reports an almost constant value for cholesterin of from 0.11 to 0.12 per cent.

1. Schlutz, F. W., and Pettibone, C. J. V.: Quantitative Determination of Nonprotein Nitrogen in Blood of New-Born, *Am. J. Dis. Child.* **10**:206 (Sept.) 1915.

2. Slemons, J. M., and Morriss, W. H.: Nonprotein Nitrogen and Urea in Maternal and Fetal Blood at Time of Birth, *Bull. Johns Hopkins Hosp.* **27**:343, 1916.

3. Marriott, W. McK., and Sisson, W. R.: Variations in the Lipoid (Fat) Content of the Blood of Infants Under Certain Nutritional Conditions, *Am. J. Dis. Child.* **16**:75 (Aug.) 1918.

4. Huffmann: The Cholesterin Content of the Blood, *Zentralbl. f. Gynäk.* **39**:33 (Jan. 16) 1915.

Slemons and Curtis⁵ examining the maternal and fetal blood, find that the total amount of fat and fat-like bodies vary between 600 mg. and 1,200 mg. per 100 c.c. of the maternal blood. The fetal determinations are within much narrower limits, generally from 500 mg. to 700 mg., with most of the results approaching the lower figure. In the fetal blood the total cholesterol-esters were found in the fetal blood, the cholesterol being exclusively in the free form. The difference between the total cholesterol of maternal and fetal blood in cases in which delivery was effected without anesthetic is accounted for by the quantity of cholesterol-esters in the maternal blood. The quantity of free cholesterol is the same in both circulations. The placenta partition is permeable for free cholesterol and impermeable to cholesterol-esters. The blood cholesterol estimations are of value in the clinical examinations of cases of autointoxication.

Sella⁶ states that the fats of the fetal liver are mixed lipoids, phosphates, cholesterin and neutral fats. In late pregnancy they are principally ethers of cholesterin. They disappear after birth, the liver being free from fat within a few days.

On testing blood for the uric acid content during the first few days of life, Sedgwick and Kingsbury⁷ found in thirty-nine cases, 3 mg. at birth, increasing to 3.9 mg. the third day, falling gradually to 1.6 mg. about the tenth day. They believe there is a parallelism between the high uric acid content of the blood of the new-born and the high excretion of this substance during the first three or four days of life. The human fetal tissue probably possesses no uricolytic power.

Plass⁸ refers to Slemons and Morriss' work with whole blood in which they found the concentrations in maternal and fetal bloods collected at time of delivery to be the same. Losse and Van Slyke show that there is no significant variation in the alkali reserve of maternal and fetal blood. The author in nine cases of fetal plasma examination found the average of preformed creatinin to be 1.07 mg. and the total creatinin averaged 1.93 mg. The plasma of the mother and child contained the same amounts, these values being the same as found in nonpregnant women.

5. Slemons, J. M., and Curtis, Charles S.: Cholesterol in the Blood of Mother and Fetus, *Am. J. Obst.* **75**:569, 1917.

6. Sella: Lipoids of the Liver in Mother and Fetus, *Ann. di ostet. et gin.* **1**:111 (March) 1914.

7. Sedgwick, J. P., and Kingsbury, F. B.: Uric Acid Content of the Blood in the New-Born, *Am. J. Dis. Child.* **14**:98 (Aug.) 1917.

8. Plass, E. D.: Placental Transmission of Creatinin and Creatin in the Whole Blood and Plasma of Mother and Fetus, *Bull. Johns Hopkins Hosp.* **28**:137 (April) 1917.

Morse⁹ in an examination of eighteen normal infants found that the blood at birth contained from 10 mg. to 15.8 mg. of amino-acid nitrogen. The values for whole blood were greater than for plasma, the plasma values being from 9.1 mg. to 11.6 mg. The passage of amino-acid from mother to fetus requires the assumption of absorption properties on part of the placenta. In an additional article under the same title the author gives a differential creatinin content between the whole blood, plasma and corpuscles of the fetal circulation. The whole blood ranged from 3.56 mg. to 6.25 mg. The plasma from 1.15 mg. to 2 mg. The corpuscles from 6.32 mg. to 14.92 mg.

Bang¹⁰ in his research on bile pigment in the blood found that the blood of the umbilical cord always contained a notable amount of bile pigment. He therefore concluded that icterus in the new-born may be considered a physiologic condition. The amount of pigment shows a constant increase in the blood during the first few days, so it is only a question of degree between the new-born with or without clinical icterus.

Lichtenstein¹¹ in his very complete work on the premature infant reports a considerable degree of anemia in a large percentage of his cases. He recommends from 0.25 gm. to 0.5 gm. of ferrous lactate from one to three times a day. His article covers 297 pages, giving a complete history of the literature with details as to care and feeding of ninety-two infants.

McClanahan and Johnson's¹² article contains a splendid review of the reports on blood examinations of infants since 1910. They report differential leukocyte counts on a large number of children ranging from 3 weeks to 1 year in age; the results of those under 1 month are as follows:

Age	Small Lymph.	Large Lymph.	Polys.	Trans. Eosin.	Eosin.
3 weeks.....	16	26	48	8	2
	21	42	28	9	..
	64	14	16	2	4
1 month.....	19	31	43	7	..
	27	43	26	4	..
	12	32	46	7	3
	25	41	30	4	..
	59	7	29	3	2

9. Morse, A.: Amino-Acid Nitrogen of Blood in Normal and Complicated Pregnancy and in New-Born Infant, *Bull. Johns Hopkins Hosp.* **28**:199 (June) 1917.

10. Bang, F.: Jaundice of the Newly Born, *Hospitalstidende* **8**:637 (June 30) 1915.

11. Lichtenstein, A.: Blood Findings in the Prematurely Born, *Svenska Läk. Sällsk. Handl.* **43**:1533 (Dec. 31) 1917.

12. McClanahan, H. M., and Johnson, A. A.: Brief Report of 68 Blood Examinations of Infancy with a Review of the Recent Literature of the Blood of Infants, *Arch. Pediat.* **33**:756 (Oct.) 1916.

Very little has been published on the coagulation time of the new-born child during the first few days of life. Shaw and Williams¹³ have described several methods for obtaining the coagulation time of human blood. They point out that there are wide variations in results due to different methods and technic. Also there is a wide variation when different operators use the same method and technic, due to personal equation. The variation with different methods on the same blood may be from 2.5 to 34 minutes. The theories of coagulation as set forth by Morawitz, Howell and Berdet and Delange are briefly discussed, and the method for obtaining the coagulation time used by Dale and Laidlaw is described in detail. They tested the coagulation time of 108 healthy infants under 2 years of age by this method, the time ranging from 1 minute and 15 seconds to 1 minute and 48 seconds, the average being 1 minute and 30 seconds. In testing the same children with Brodie's coagulometer the results were, in children under 1 year, an average of 3 minutes and 47 seconds, the longest time being 4 minutes and 42 seconds.

Flusser¹⁴ states that Wright's method of testing the coagulating time is inaccurate. He describes a capillary tube method and reports that the coagulation time by this method in the first two weeks of life is $8\frac{1}{4}$ minutes in a temperature of from 19 to 29 C. The coagulation time is not effected by dyspeptic erythema, eczema, pemphigus neonatorum, rachitis or cephalhematoma. In icterus neonatorum the time is 11 minutes and 40 seconds or even longer. In nine cases of hereditary syphilis, two had increased coagulation time. In latent hereditary syphilis this characteristic may be found before the earliest symptoms. It passes away after antisyphilitic treatment.

Urine.—The examination of the new-born urine has received a great deal of attention in the past, and the various constituents have been well established for some time. There is very little new work reported in the recent literature.

Schloss¹⁵ has described a simple apparatus for the collection of urine from male infants. It consists of a tube with a constriction and bulb at the lower end which forms a reservoir. This has been in use for some time at Bellevue Hospital and has been satisfactory.

Sedgwick¹⁶ examined the urine of a series of new-borns and some older children for oxalic acid content. Part of the results pub-

13. Shaw, H. L. K., and Williams, F. J.: Blood Coagulation in Infancy, Albany M. Ann. **36**:571 (Dec.) 1915.

14. Flusser, Emil: Coagulability of the Blood in the First Weeks of Life, Monatschr. f. Kinderh. **12**:12, 1914.

15. Schloss, Oscar: A Simple Apparatus for the Collection of Urine from Male Infants, J. A. M. A. **70**:223 (Jan. 26) 1918.

16. Sedgwick, J. P.: Oxalic Acid Excretion in the Urine of Children, Am. J. Dis. Child. **10**:414 (Dec.) 1915.

lished were obtained by the Salkowski and part by the Albahary method, the latter giving consistently higher results. All of the new-born urines examined were collected from normal breast-fed infants. By Albahary's method there was an average daily excretion of oxalic acid amounting to 4.78 mg., the highest individual instance being 9.43 mg. He concludes that inasmuch as the infants were breast fed exclusively, the oxalic acid excreted was of endogenous origin. The oxalic excretion in new-borns is relatively higher than in adults.

Moore¹⁷ examined the urine of new-borns for phenol during the first three days of life. The average daily amount excreted in his nineteen cases was 41 c.c.; average total nitrogen 376 mg. He concludes that phenol is quantitatively present in the urine of all new-borns and is partly, at least, of endogenous origin.

Flamini,¹⁸ examining the urine of new-born children, found the acidity in breast fed infants much less than that of those artificially fed. The urine from the breast fed ranged in acidity from 0.1 to 0.6, while in the artificially fed it ranged from 1.25 to 4.0, and in some cases with bowel trouble it ranged from 4.5 to 5.8. The phosphate content was also higher in the bottle fed. Calcium lactate given to bottle fed infants markedly reduced the acidity of the urine, 1.5 gm. being given at each feeding.

Gittings and Mitchell¹⁹ report that the new-born infant eliminates about the same percentage of phenolsulphonephthalein as the adult. In sixteen cases reported the average for the first hour was 47.7 per cent., and at the end of a two-hour period a total elimination of 69.4 per cent. was found. The patients ranged in age from 3 weeks to 3 months. They recommend the injection of 6 mg. of phenolsulphonephthalein in the lumbar region, collecting the specimen by catheterization at the end of two hours.

Mammary Gland.—There are still a few articles appearing in the literature regarding the mammary secretion of the new-born. Arteaga²⁰ discusses the question at great length. He believes that the phenomenon is purely a physiologic process and should be present in all new-borns. He does not believe that there is any relation between mammary secretion and falling off of the cord. In fifty-two infants investigated he found that fluid could be expressed from the gland

17. Moore, C. U.: The Phenol Excretion in the Urine of Infants, Including the New-Borns, *Am. J. Dis. Child.* **13**:15 (Jan.) 1917.

18. Flamini, M.: The Urine Reaction in Infants, *Rivista di clin. pediat.*, Florence **15**:462 (Sept.) 1917.

19. Gittings, J. C., and Mitchell, A. J.: Phenolsulphonephthalein Elimination in Infants and Young Children, *Am. J. Dis. Child.* **14**:174, 1917.

20. Arteaga, J. F.: Mammary Secretion of the New-Born, *Rev. de Med. y Cirug.*, Habana, **23**:321, 1918.

from just after birth up until the twelfth or nineteenth day. In 97 per cent. of cases investigated the findings indicated that the fluid was of the nature of a physiologic secretion, independent of sex or breast feeding. The average duration was forty-three days. The obstetric and pathologic antecedents of the mother seemed to have no bearing.

Apert²¹ observes that the secretion begins on the third or fourth day. It attains its maximum and commences to decrease on the ninth day, but may persist until the twentieth day. In certain cases the tumefaction and secretion of milk are more marked at a later period, the breasts becoming hard, red and painful. As much as 10 c.c. of milk have been expressed in a few minutes. Local infections at times occur, probably due to attempts at expression of the milk. The writer's analysis of such milk showed that the fat, casein and sugar content is about the same as in mother's milk, but the salts were found in greater quantity — P_2O_5 — 0.844; PO_4Na_2H — 1.688; Cl — 0.994; NaCl — 1.638. The microscopic examination showed nothing different from mother's milk. Vaginal bleeding has been noted in connection with tumefaction of the breast and has been considered a prelude to precocious puberty in females. In males enlargement of the breasts has been noted to occur in conjunction with hypertrophy of the genital glands. In certain new-born infants the same anatomic and physiologic modifications manifest themselves as at time of puberty.

Genital Bleeding.—Zacharias²² examined 400 new-born girls and reported genital hemorrhage present in ten. There were no symptoms and the hemorrhage subsided in a day or two. From his review of the literature he believes that mild bleeding may be present from four to eight days. All of the ten children in his series were unusually large and well developed, and he considers this to be one of the factors on which the condition depends. He quotes Halban as attributing the bleeding to a hyperemia of the uterus caused by a hormone developed in the placenta. The hemorrhage usually occurs on the sixth or seventh day, and it may be slight or quite marked and is often accompanied by an additional output of mucus.

Initial Loss of Weight.—There is still some difference of opinion as to the exact cause of the initial loss of weight in the new-born. Benestad²³ believes that it is due to an insufficiency of the metabolism, especially of the hydrogen-containing materials. Infection may play an important rôle. Artificial feeding prolongs and increases the loss

21. Apert, E.: Tumefaction of the Breasts and Secretion of Milk in New-Born Infants, *Le Nourrisson* 2:239 (Sept.) 1914.

22. Zacharias, E.: Genital Hemorrhage in Newly Born Girl Babies, Ten Cases, *Med. Klin.* 10:1643 (Nov. 1) 1914.

23. Benestad, G.: The Cause of Physiological Loss of Weight in the New-Born, *Jahrb. f. Kinderh.* 80:21 (July) 1914.

of weight, as it is more difficult for the infant to become accustomed to this ration than to breast milk.

Borrino²⁴ in his study of 1,110 new-borns finds that the initial loss of weight varies from 100 to 300 gm., reaching a maximum between the second and third days. It does not depend on nursing, but is due to noncompensation for water loss through skin and lungs. The birth weight should be regained from about the eighth day to the end of the second week. Protracted loss or stationary weight would indicate the necessity of medical attention.

Ramsey and Alley²⁵ in their analysis of clinical charts of 300 new-born infants give the average birth weight for boys as 3,391 gm. and for girls 3,276 gm. The initial loss of weight was about 240 gm., the average time the loss continued being three days. Only one-fourth of the infants regained the birth rate by the tenth day. The average daily gain was about 20 gm. All children were nursed at four-hour intervals.

Schick²⁶ reports his experiment in attempting to prevent the initial loss of weight in twelve new-borns. He gave each infant 10 per cent. of its body weight of breast milk during the first twenty-four hours, increasing the amount until 15 per cent. was given at the end of the third twenty-four hours. He used the breast milk of mothers having babies less than a week old. He was able to prevent the initial loss of weight in all cases.

Yerington²⁷ gives the average birth weights estimated from 2,966 weights taken, as 3,500 gm. for males and 3,311.7 gm. for females, the average being 3,432 gm. He states that the initial loss of weight is greater in San Francisco babies by about 38 gm. than the average as given by Holt, but the return to original weight occurs at approximately the same time in infants; that is, ten days. At the end of the first month, Yerington's babies were heavier than those recorded by Newman and Holt. At the end of the first year they are heavier than previously reported from any other locality.

Bailey and Murlin²⁸ in experiments on the loss of weight in the new-born found that the amount of water loss was 28.12 gm. per

24. Borrino, Angelas: Physiologic Loss of Weight in New-Born Infants. *Pediatrics* **25**:413 (July) 1917.

25. Ramsey, W. R., and Alley, A. A.: Observations on the Nutrition and Growth of New-Born Infants; an Analysis of 300 Clinical Charts, *Am. J. Dis. Child.* **15**:408 (June) 1918.

26. Schick, B.: Zur Frage der Physiologischer Körpergewichtsabnahme des Neugeborenen, *Ztschr. f. Kinderh.* **13**:257, 1916.

27. Yerington, H. H.: Clinical Supervision of the Well Baby During the First Year., *J. A. M. A.* **71**:1043 (Sept. 28) 1918.

28. Bailey, H. C., and Murlin, J. R.: Energy Requirements of the New-Born, *Am. J. Obst.* **71**:526, 1915.

kilogram for the first 12 hours, 40.74 gm. during the next 24 hours and 53.6 gm. for the second twenty-four hours. They quote Lust as finding a greater amount of dry substance in the blood during the first week than subsequently, and believe that in the new-born there is a close relationship between the body weight and the concentration of the blood. A part of the water loss is permanent and cannot be made up by administration of water. Reason for this will be readily understood when we remember that the child has passed from a water medium to an atmospheric medium. Immediately after birth the skin is turgid with water absorbed from the amniotic fluid and it is twenty-four hours later before it assumes a normal appearance. In August, 1912, because of the decided loss of weight in a large number of new-borns, fifty infants at Bellevue were allowed to nurse for ten minutes and then given a milk mixture similar to colostrum. Only one case developed any adverse symptoms, and that not serious. The initial loss of weight was lessened by this procedure from 50 to 150 gm. The four hour interval was discontinued in favor of the three hour, because of the great loss in weight.

Metabolism.—Chapin²⁹ has tried out the various formulas for the determination of surface area of infants both by actual measurement and comparison and believes that the formula: $y = mx + b$ of Howland and Dana, is accurate for all classes of children. In this formula

$$\begin{aligned} y &= \text{surface area of child in sq. cm.} \\ x &= \text{weight of child in gm.} \\ m &= 0.483 \\ b &= 750 \end{aligned}$$

Bailey and Murlin³⁰ found that not infrequently women have milk in their breasts on the first day of the puerperium, but the majority have only colostrum, estimated at 20 c.c. on the first day, increasing in amount on the second and third days, with the milk secretion appearing on the fourth day. In an analysis of colostrum the average for five samples was: Protein, 2.3; fat, 2.9; carbohydrate, 7.1; bomb calories, 67.7; physiologic heat values, calories, 65.3 in 100 c.c. The utilizable heat value of colostrum places it high as a food and possibly higher than breast milk when secretion is fully established. It is the ideal food for the new-born, the only trouble being there is too little of it. It is usually not until the fifth day that an energy supply of breast milk of 200 calories can be counted on. In only five instances out of twenty-eight different test periods were the respiratory quotients

29. Chapin, H. D.: Formula for the Determination of the Surface Area of Infants, *Arch. Pediat.* **31**:624 (Aug.) 1914.

30. Murlin, J. R.: Metabolism of the Mother and Offspring Before and After Parturition, *Am. J. Obst.* **75**:913, 1917.

of new-borns six hours of age above 0.90. Assuming that the oxygen absorption is normal at this early age, that is, is just rapid enough to meet the requirements of combustion, such a quotient would indicate the combustion of a considerable amount of glycogen. We know that the child born at term has in its liver a considerable store of this substance. The respiratory quotients obtained on the second day after birth indicate clearly that this reserve of glycogen is not sufficient to meet the needs of the patient for more than one day. In dry air the quotient was noticeably higher than in moist air. At the end of the first week the quotient has returned to the expected level for whole milk diet, indicating that the various constituents are now present in sufficient amount to play their normal rôle in nutrition. The average heat production per hour for four babies who slept during the period of experiment is 6.73 calories, an average of 1.87 calory per kilogram of net body weight. The influence of crying on energy metabolism is shown by a child, 10 days old, when sleeping through observation period produced 8.14 calories per hour and while crying most of the time produced 10.73 calories, an increase of 31 per cent. Artificial food to supplement the scanty supply for newly born should contain 50 calories per kilogram for the first day, to be reduced as the natural supply comes forward.

Murlin³⁰ in his review of the literature on the metabolism of mother and offspring emphasized the independent behavior of the metabolism of the offspring from that of the mother. The low rate of metabolism immediately after birth is probably due to the fact that the heat regulating mechanism is not yet complete and the higher rate after the second or third month is doubtless related to the more active growth. An excellent bibliography is attached.

Talbot³¹ says that the total calories of the basal metabolism of the new-born infant may be calculated as follows: The total calories equal the length of the infant times $12.65 \times$ the body surface. The energy requirement for the new-born infant is smaller per unit of body weight than for older infants. The respiratory quotient of the new-born infant indicates that the supply of glycogen in the body is quickly used up and that the energy is obtained in large part from body fat until breast milk is available. Chilling from exposure or a water bath depressed the metabolism; therefore the new-born infant should not be bathed in water and great care should be taken that it is not chilled. Weak or premature infants should be fed shortly after birth with milk of another mother when possible; when not, use a 5 per cent. solution of some sugar such as lactose as a temporary expedient.

31. Talbot, F. B.: *Physiology of the New-Born Infant*, Am. J. Dis. **13**:495 (June) 1917.

Talbot³² also reports the metabolism studies on a child having complete absence of the hemispheres of the brain. He was large for his age, being 8 months old. There was a large amount of subcutaneous fat, with muscles relatively undeveloped. The child would remain absolutely quiet most of the time. His metabolism was very low.

The metabolism of the new-born infant, that is the energy transformed in a condition of repose and when the absorption of food from the digestive tract is not going on, does not exceed 48 calories per kilogram of body weight per day.³³ Lusk believes that Huebner's figure of 100 calories per kilogram of body weight during the first month of infant nutrition is in excess of requirement; 80 calories is sufficient.

Careful examination of the saliva of the very young has shown that amylase is by no means always absent, but even if it were the possibilities of digestive utilization of starch are not limited to the efficiency of the saliva. Besides the salivary glands other structures, notably the pancreas, are sources of starch digesting ferments that need to be considered.³⁴

Taylor³⁵ has described a cleverly contrived apparatus for the continuous and separate collection of saliva and gastric juice. He used this to obtain specimens of gastric juice from new-borns. As a result of his experiments he believes with Riche that there is no duodenal reflux into the infant's stomach. He was able to obtain gastric juice from starving infants in amounts that would indicate the possibility of a secretion of 200 c.c. daily. This juice is highly acid, containing both free and combined hydrochloric acid and pepsin. The acidity is often as high as in the secretions of the adult's stomachs. He administered various kinds of food into the mouth, no part of which, because of the previously mentioned apparatus, could reach the stomach, and there was no appetite or psychic secretion of gastric juice as a result.

Hess,³⁶ in his study of the gastric secretion in fifty-five infants from one-half to 18 hours old, found that they regularly secrete a considerable amount of hydrochloric acid before they are given food.

32. Talbot, F. B., Energy Metabolism of Infant with Congenital Absence of Cerebral Hemispheres, *Arch. Pediat.* **32**:452 (June) 1915.

33. Editorial: Food Requirement in Infancy, *J. A. M. A.* **69**:1175 (Oct. 6) 1917.

34. Editorial: Starch Digestion in Early Life, *J. A. M. A.* **70**:1299 (May 4) 1918.

35. Taylor, Rood: Hunger and Appetite Secretion of Gastric Juice in Infants' Stomachs, *Am. J. Dis. Child.* **14**:258 (Oct.) 1917.

36. Hess, A. F.: Gastric Secretion of Infants at Birth, *Am. J. Dis. Child.* **6**:264, 1913.

The amount varies greatly. Renin, pepsin, and lipase are also found to be present. He observes that it is hard to account for the gastric secretion immediately after birth without stimulation and believes it may be prenatal. He suggests that the high acidity may at times be related to the presence of pylorospasm or to duodenal ulcer met with in infancy. Duodenal and pancreatic secretion is very slight in the newly born.

Taylor³⁷ reports the results of an extensive study of what he terms "hunger contractions" in five premature and forty full-term newborn infants. Work on several older children is also included in his report. The hunger contractions of the new-born child prove to be greater than in older ones and are not inhibited by introducing food into the mouth. Reflex inhibition from the presence of food in the stomach is present in infants of all ages. Hunger is not believed to be an ordinary cause of crying in the normally developing breast fed baby. Time of development of hunger after feeding in healthy infants gaining in weight and receiving a sufficient amount of food is as follows: for premature infants under 1 month, 1 hour and 40 minutes, in full term infants under 2 weeks, 2 hours and 50 minutes, in infants from 2 weeks to 4 months, 3 hours and 40 minutes. Time required for development of hunger in infants with chronic nourishment disturbance or those receiving poorly tolerated food is shorter than in normal infants, occurring many times while the food from the previous meal is still in the stomach.

Copeland³⁸ believes the deficiency in development of the new-born anatomically and physiologically is often responsible for otherwise unexplained rises in temperature, the instability of the nervous system being demonstrated in the abnormal responses of the heat regulating mechanism. His article covers a variety of other causes of fever in older children, and he observes that otitis media is present in many cases in the very young and may be one obscure cause of these early fevers.

37. Taylor, Rood: Hunger in the Infant, *Am. J. Dis. Child.* **14**:233 (Oct.) 1917.

38. Copeland, E. P.: Fever of Obscure Causation in Infancy and Early Childhood, *J. A. M. A.* **67**:1346 (Nov. 4) 1916.