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THE NEW-BORN BABY

**A MANUAL FOR THE USE OF
MIDWIVES AND MATERNITY
NURSES**



ERIC PRITCHARD, M.A., M.D., F.R.C.P.



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THE NEW-BORN BABY

INFANT EDUCATION

By ERIC PRITCHARD

M.A., M.D.(OXON.), F.R.C.P.(LOND.)

*Medical Director, Infants Hospital, London;
Pædiatrician to Queen Charlotte's Maternity
Hospital, etc.*

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ERIC PRITCHARD

M.A., M.D.(Oxon.), F.R.C.P.(Lond.)

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DEPARTMENT OF INFANT CONSULTA-
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PREFACE

THIS little book consists of a series of lectures on the subject of the care of new-born babies, which I have given during the last four years to students, both male and female, taking out courses of training in midwifery at Queen Charlotte's Hospital. Certain of these lectures have already been published in "Mother and Child," but the majority of them are not available to students. Moreover, I find it quite impossible to include all the subjects contained in this book in any series of lectures to any one group of students. For this reason it may prove a convenience if the whole series is published in book form, although I do not claim that these lectures cover all those subjects connected with the care of new-born infants of which a fully qualified midwife is expected to have some knowledge.

The full usefulness of the Welfare Movement has been definitely hindered by want of liaison between midwives and health visitors. If there could be a little more uniformity of practice and of teaching among midwives and welfare workers it would be greatly to the advantage of the movement as a whole. The publication of this little book represents a humble effort to effect these objects, on the part of one who has devoted most of his life to the Welfare Movement, and who has recently come into close association with one of our great midwifery schools.

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THE NEW-BORN BABY

CHAPTER I

THE GENERAL MANAGEMENT OF THE NEW-BORN BABY

IN the management of the new-born baby there are three points of primary importance. Firstly, the feeding ; secondly, the maintenance of bodily temperature ; and thirdly, the prevention of infection.

The first of these will be dealt with in a subsequent chapter—reference to the third of these subjects will be made on several occasions, notably in the chapter which deals with the care of the skin, but the second point will be dealt with fully on the present occasion along with certain other matters of minor importance connected with the management of the respiratory, circulatory and nervous systems to which it is the duty of the midwives to pay special attention.

My views on the subject of the training of the physical functions of the baby are, I believe, well known, as also the importance which I attach to the establishment of good habits in infants at the very beginning of life when they are most amenable to educational discipline. Although the manner in which the various organic functions, such as those connected with temperature maintenance, respiration and circulation, may depend to some extent, or perhaps even to a large

extent, on the actual anatomical structure of the organs themselves, nevertheless, whether these functions are efficiently executed or not is determined by the manner in which the nervous control over them is exercised. For instance, although the strength of the arm and the dexterity of the fingers may depend on the degree or on the kind of development of the various flexor, extensor, pronator, and supinator muscles, which work the brachial, carpal, metacarpal and phalangeal bones, none the less, neither the arm nor the fingers can exercise a single one of their motor functions or acquire any dexterity of movement unless their activities are controlled and co-ordinated by the nerves of the brachial plexus and the nerve cells in the spinal cord and brain with which they are in connection.

When a baby or child learns to control the muscular movements which are concerned in such complicated co-ordinations as walking, drawing, sewing, writing or playing the piano, it is not the muscles which learn and memorise, it is the nerve cells in the brain or spinal cord controlling their actions which are taught, which remember, and which repeat. The more often the nerve cell practises or repeats the message which it conveys to the muscle or organ, the more fixed, automatic, and stereotyped becomes its behaviour, and consequently the more reliable and accurate becomes the response of the muscle or organ which interprets the activity of the nerve cell in the form of action or movement or function. Nerve cells can be trained well or badly according as the kind of education which they receive is good or the reverse. The lessons should be easy and simple at first, though progressively more complicated and difficult, and they should be repeated

over and over again until they are perfected. Nerve cells should be taught, trained and disciplined to act individually or in conjunction with others, just as recruits are drilled to act individually, in platoons, companies, regiments or battalions. This principle applies to all the organic functions, not only to those of the muscles. The glands of the stomach which secrete gastric juice, or the cells of the kidney which excrete urine can no more exercise their normal functions of secretion or excretion when separated from their nervous connections than can the fingers execute the complicated muscular co-ordinations concerned in writing when the fingers are damaged or paralysed or when the brachial plexus is severed or destroyed.

When, therefore, we are dealing with a new-born baby, or indeed with an infant or child of any age, when we are tending it, or feeding it, or nursing it, or helping it in any way, so that it can carry out its organic functions in a required manner, we should always bear in mind that whatever educational influence we bring to bear affects the receptive material of the nerve cells rather than the particular organ which interprets the action. If we feed a baby properly we are educating the functions of digestion—*i.e.*, the nerve cells which control the activities of the stomach and intestines. If we protect it from external heat or cold, or expose it to variations of temperature, we are educating the nerve centres which subserve temperature-regulation. If we teach a baby to breathe through its nose we are educating the nerve cells which control the muscles of respiration—namely, those which expand the chest and keep the mouth closed—and if these lessons are

repeated we reduce the act of respiration to automatism, and induce, it is to be hoped, good habits of breathing. On the other hand, if we allow a baby to breathe through the mouth we connive at the establishment of a bad habit.

With this preamble, I will now give in detail some account of the education of some of the more important organic systems, beginning with the heat-regulating mechanisms.

THE EDUCATION OF THE HEAT-REGULATING CENTRES

We all depend very largely for our comfort and health on the efficient control of our blood temperatures by the heat-regulating nerve centres. When we describe an individual as "hardy," or speak about methods of hardening, what we really mean is that the person referred to has well-trained heat-regulating centres, or that the system of training has reference to the education of these same centres. These nerve centres are situated in the medulla and base of the brain, and they are concerned with the maintenance of normal blood temperature by means of two distinct sets of mechanisms. The first one is connected with the production of heat and, as circumstances require, it can bring about a very rapid combustion or oxidation of fuel in the body with an increased generation of heat, or it can slow down internal combustion and restrict heat production. The second mechanism is concerned with the dissipation of heat, and this process is accomplished by bringing the heated blood to the surface of the body, where it can be cooled down by being brought into contact with the atmospheric air,

which is practically always at a lower temperature than that of the blood, or of cooling it still further by sweat. The irrigation of the skin with perspiration results in the same refrigerating phenomenon that we are familiar with when we apply a wet handkerchief to the fevered brow.

Through the action of these mechanisms, a person with adequately trained heat-regulating centres can remain in a Turkish bath at a temperature sufficiently high to roast a leg of mutton or boil water, or stay in a refrigerating chamber at a temperature low enough to freeze water, without any material variation in the bodily temperature, or indeed without any serious discomfort. The maintenance of the bodily temperature at what is called "normal" level—*i.e.*, 98.6° F.—under all variations of external temperature is of enormous importance to the human organism, for all the organic functions, digestion, respiration, circulation, and especially metabolism, proceed more smoothly and efficiently at this temperature than at any other. If the blood temperature rises much above this normal point the individual becomes what is called feverish, and may be light-headed or delirious. If his temperature falls much below the same point he suffers from what is popularly known as a "chill," his vital processes are lowered, his resistance to infection is reduced, he feels goose-skinny, uncomfortable and possibly ill.

The efficiency with which the heat-regulating centres maintain a normal temperature under all variations of external temperature depends very largely on the manner in which these centres have been trained or educated. During the Great War, it was found that most of the recruits had such badly disciplined centres,

or, in other words, were so "soft," that it would have been constructive murder to send them out to the hardships of the front or to the exposure of the trenches without very careful preliminary re-education. This re-education took the form of a studied submission, first of all, to the relatively mild temperature of rooms without windows, then to tents with mackintosh sheets, then to open air with mackintosh sheets, and finally to the open air without mackintosh sheets. By such means their centres were gradually re-educated and in the end the recruits were able to stand comparatively severe hardships—both cold and damp.

New-born infants are, however, in far worse case than these soft recruits, because their heat-regulating centres have never been trained at all, so that they are completely at the mercy of the surrounding atmosphere. If they are well wrapped up and kept in a warm room their temperature is maintained, but if they are exposed to air of room temperature, or not immediately wrapped up after having a bath, their temperature may fall to as low as 90° F., or even lower, treatment which exposes them to all sorts of risks and renders them more susceptible to infection. Such subsidences of temperature, although they often occur in the case of new-born infants, are seldom registered, for the reason that practically no midwife is equipped with a thermometer which can record such a low reading. The ordinary clinical thermometer can record a temperature perhaps as low as 95° F., but seldom lower. Every midwife or maternity nurse should be provided with a "sub-normal" or "low reading" thermometer, which will register temperatures as low as 88° F., and, further, she should use it

whether she suspects a low temperature or not. Such thermometers cost no more than ordinary ones, so that there is no excuse for not using them. If a new-born infant is properly trained and educated with respect to its heat-regulating centres, it very quickly becomes proficient in controlling its temperature, and the quicker it learns how to do so, and the more expert it becomes in exercising this function, the greater is the vitality of the child and the greater its powers of resistance to cold air, draughts and other forms of chill, and, incidentally, the more resistance it offers to all sources of infection.

It is a little difficult to give exact details of the best methods of training these centres, but one of the first conditions for success is to provide against any serious dislocation of these mechanisms during the early days of life by exposure to low degrees of temperature. The new-born baby cannot be kept too warm during the first few days of life, nor can too much care be taken to prevent undue exposure to the air after the first bath, when there is a great risk of chilling owing to the evaporation of water on the skin. All new-born babies ought to be wrapped up in soft, clinging woollen coverings while waiting for the first bath. To wrap them up in an old or stiff blanket, as is often done, is not sufficient. After the bath they should be dried very quickly with a previously warmed towel and put into their permanent clothing, which should consist of a knitted vest, knitted socks, overall-bootees, and outside all these a soft woollen shawl (see chapter on "Clothing," p. 16). The abdominal binder should be of soft new flannel, which should not be put on too tightly, and the napkin should be adjusted in the ordi-

nary way. It is a great mistake to give the baby a second bath until the cord has come off.

It is obvious that the nerve centres concerned cannot be trained or educated unless they are exposed to varying experiences and temperature changes. Gradually, and day by day, the infant should be exposed to new and greater variations of temperature, first by change of room, then by taking it out of doors, and finally, if thought desirable, by a very gradual reduction in the temperature of the bath, or by sponging with tepid water after the bath. No step should be taken, however, without making sure of the success of the previous one. If this system is conscientiously carried out by the time the infant is a few months old his heat-regulating centres are so well educated and his temperature so stable that there is little or no danger to be feared from unavoidable atmospheric changes. The carefully protected "hothouse" type of baby is always a danger to itself and an anxiety to those who look after it.

THE EDUCATION OF THE RESPIRATORY NERVE CENTRES

An important factor in the maintenance of health is a correct method of breathing. As the child is father to the man, so is the type of breathing assumed by the baby the model on which the future respiratory functions are established. It is therefore of considerable importance to ensure that the new-born infant adopts a correct method of breathing from the first. One essential of correct breathing is that the infant should take air into his lungs through the nose and not through the mouth, for the reason that the nose is

specially provided with the means of purifying, warming and moistening air before it enters the lungs, necessary conditions for the protection of the delicate mucous membrane of the bronchi, and pulmonary alveoli, conditions which are not provided by any mechanisms in the mouth. Under normal circumstances it is easy and natural for the new-born baby to breathe through the nose because the nostrils are open and the mouth closed, but if through structural defects, such as high palate, narrow nose, or congestion of the nasal mucous membranes the air-way through the nose is occluded or obstructed, the infant is compelled to take in air through the only other available aperture. A much larger number of infants than is usually supposed begin life as mouth-breathers for one or other of the above reasons, and thus establish on a permanent basis a very defective method of breathing. A careful watch should therefore be taken to provide against an infant adopting a wrong method from the first, owing to blocking of the nostrils with mucus or for other causes. If an infant is quite unable to breathe through the nose, it must, of course, if it is to live, breathe through the mouth, but in the majority of cases it is possible, though not always easy, for the infant to breathe through the nose, and in such cases a very little encouragement, such as by keeping the mouth closed by propping up the chin or by tying it up with a handkerchief, will induce the baby to breathe *per vias naturales*.

Since congestion or catarrh of the nasal mucous membrane contributes and disposes to obstruction of the nostrils, it is imperative that young infants should be protected from all those causes which conduce to this condition, such as direct infection from contact

with people already suffering from colds, or from the irritating effects of cold, fog, or impure air. It is commonly believed that mouth-breathing is the result of tonsils and adenoids. Although it is quite true that with very large tonsils and a great development of adenoids it is impossible to breathe through the nose, nevertheless, in my experience the chief cause of "tonsils and adenoids" is the habit of mouth-breathing, contracted, perhaps, during the early days of life from one or other of the above stated causes.

As the child grows older he should learn how to increase his "vital capacity," not by the somewhat artificial method of organised breathing exercises, but by the natural means of getting out of breath by running or by the taking of some form of active physical exercise, which makes deep breathing imperative. The "vital capacity" is the amount of air which can be taken into the lungs and expelled from them, and it depends partly on the shape and size of the chest, and partly on the development of the respiratory muscles, especially on that of the diaphragm. The shape of the chest depends very largely on the method of breathing adopted during the early years of life, and also to some extent on the degree of hardness of the ribs. If the ribs are soft as in rickets, they are almost sure to become twisted and distorted by the pull and traction of the muscles. Any deformity arising from such causes is greatly exaggerated by all violent efforts at respiration, such as occur in whooping-cough, asthma, or bronchitis, or by any obstruction to the entry of air, as, for instance, by enlarged tonsils or adenoids, which render adequate respiratory movements still more impossible.

EDUCATION OF THE CIRCULATORY SYSTEM AND
VASO-MOTOR CENTRES

The possession of a good circulation is a great asset in life, and it is mainly dependent on environmental and not on inherent qualities. Circulations, both good and bad, are made, not born, and for the most part they are made at the beginning of life.

The circulation of the blood is very like the circulation of hot water in a central heating system, and it is controlled entirely by vaso-motor centres, in the same way that the circulation in all central heating systems is controlled by the turning on and off of stop-cocks, which are connected with each of the radiators, by the engineer or other person in charge. The particular part of the nervous system which controls the circulation is known as the vaso-motor nervous system—the system which controls the size of the blood vessels supplying an area of the body with blood. If any part of the body is functioning, it requires a corresponding amount of blood to do the necessary work, to supply the fuel and sources of energy. If it is at rest, it only requires a very small quantity. Thus, when the brain is active, the cerebral arteries dilate and allow a large quantity of blood to reach the active nerve cells. On the other hand, during sleep, when the nerve cells are quiescent, the blood supply is cut off by the contraction of the same arteries. During a meal, when the stomach is actively engaged in the processes of digestion, the gastric arteries dilate and allow of the access of much blood. Between meals, or during starvation, the same vessels are contracted. When we run, the vessels which supply the muscles of the legs dilate and allow a free

flow of blood to reach the organs of locomotion. When we sit or lie down the blood supply is cut off and the muscles of the legs become anæmic.

By a good circulation we mean that the vaso-motor nerve centres are so well trained or educated that they are capable of distributing blood to the various organs in strict accordance with the amount required. As a rule we recognise a bad circulation by blueness of some particular part, such as the nose or the ears, or by coldness of the hands or feet, under circumstances which do not warrant such results. People who suffer chronically from afflictions of this kind are those in whom the circulatory mechanisms have been improperly trained, or have been dislocated in early infancy by undue exposure to cold. If an infant is allowed to get cold feet or cold hands during the early days of life, more especially during the first day of life, such a misfortune implies that the vaso-motor centres have been actively employed during this period in cutting off the blood supply through the medium of the so-called vaso-constrictor nerves. If these nerve centres are repeatedly exercised in this particular way it is hardly surprising that they should become very expert in vaso-motor contraction, or that a vicious habit of cold feet or cold hands should be induced. Hence the obvious desirability of avoiding, during the period which immediately succeeds birth, all those causes which are liable to set up such unfortunate habits.

If during the first weeks of life an infant's hands and feet are never allowed to become cold, such vaso-constrictor habits cannot possibly become established. On the other hand, permanently rosy cheeks, which represent a persistent habit of vaso-motor dilatation—

usually regarded as symbolic of health—represent the acquisition of an equally undesirable vaso-motor habit, but one of the reverse type, not indeed, as in the case above cited, of vaso-motor contraction, but rather of capillary dilatation. If an infant is allowed to become too hot by reason of over-feeding, over-clothing, or because the room is too hot or stuffy, one of the ways in which it can effect a reduction of temperature is by bringing the blood to an exposed surface of the body where it can be cooled by the air. The cheeks which are usually allowed to remain uncovered are the chief, often the only, part of the body which can provide facilities for this cooling process. Occasional exercise of the vaso-motor functions in this way is quite salutary and physiological, but when too frequently indulged in may lead to over-action and habits which are very liable to become permanent.

The training or education of the vaso-motor centres, which are indeed very closely related to the heat-regulating functions, form an important and integral part of the general physiological education of the child. The discreet and wise use of graduated cold baths is probably the most efficient educational means for securing this end that we possess, although this educational experience should not be resorted to at too early an age. Occasional experiments in variations of heat and cold all have educational value. From what I have said it will be recognised that an efficient circulation means a well-ordered vaso-motor nervous system. Contrary to what is usually believed, the heart is very little concerned in securing a good circulation. With a weak heart or a leaking heart no circulation can be really good, but no matter how strong the heart may be, if

the turn-cock mechanisms of the blood vessels are wrongly managed, the final result, as far as the circulation is concerned, will be bad.

THE EDUCATION OF THE NERVOUS SYSTEM

Although I could devote a whole chapter to the subject of the education of the nervous system, I propose to confine myself to one aspect of it only, namely, that which is concerned in the phenomenon of sleep. It will, of course, be understood from what has preceded that the education of all the organic functions really implies the education of the nerve centres which control these functions. But the training of the nervous system also includes everything connected with education—intellectual, spiritual, moral and psychic.

During sleep the whole of the nervous system, that is to say, all the vast congregation of nerve centres which control the many organic functions, is in a condition of rest, or relative quiescence—never probably in a condition of complete rest—but that part of the brain or central nervous system which is concerned in the most highly organised of all its functions, namely, those connected with consciousness, is during sleep in a condition of complete rest ; practically all the activities concerned in consciousness are suppressed.

Since in the case of the infant there is very little actual consciousness, practically no mental activity, and since very few impressions reach the higher nerve centres by way of the nerves of special sensation, such as those concerned with seeing and hearing, very little nerve activity has to be suppressed in order to induce sleep. Hence the infant very easily goes to sleep, and remains asleep a long time unless the nerve centres

which are concerned in consciousness are racked or troubled by painful sensations carried by the nerves of common sensation. Sleep becomes a matter of habit, just as much as any other bodily function, and since good habits of sleep are very easy to induce during infancy, it is most desirable that every effort should be made to establish them during this period. Babies who learn to sleep well during infancy sleep well during later childhood. Those who sleep badly as infants become disturbed sleepers as they grow older. This is one of the main arguments for abstaining from night feeds. If an infant is accustomed to be fed at night he soon contracts a habit of waking up at the times at which he is accustomed to be fed. On the other hand, if an infant can be induced to sleep the clock round during the night, it is an immense gain from every point of view, for no organ in the body is so dependent for its healthy development on rest as is the central nervous system itself.

CHAPTER II

CLOTHING FOR THE NEW-BORN BABY

MANY successful reforms in the clothing of babies have been introduced during the last twenty-five years, due very largely to the efforts and activities of the Association of Maternity and Child Welfare Centres, with its 2,000 affiliated local centres. During this period long clothing has been completely abolished from all except the most conservative circles ; so, too, has the buckram or flannel binder, and a whole host of other unnecessary and miscellaneous garments formerly included in the wardrobe of young babies.

The main principles aimed at and successfully achieved by the Association have been in the direction of supplying clothing which fulfils the necessary conditions of comfort, warmth, economy, cleanliness, facility for free movement, and skin activity. The number of garments now considered necessary has been reduced to three—namely, long-sleeved vest, overall-leggings, and jersey. In addition to these, a shawl, cap, gloves, some temporary form of abdominal belt, and sanitary squares complete the new-born baby's outfit. The elaborately worked flannels and embroidered linen vestments of the nineteenth century have been superseded by a simple knitted outfit.

Directions for the making of this class of garment are hereto appended, although most of them can be obtained ready made at any good Needlework and

Baby's Outfitting establishment. The majority of the patterns are the same as those used by the Ladies' Needlework Committee of the Infants Hospital (Vincent Square, S.W.1) for making the garments worn by the babies at this institution as well as at its Convalescent Home.

The names of the various firms who either manufacture such garments, or who supply directions or illustrations for making them at home, are given in each case.

Particulars for the clothing of premature babies will be found in Chapter XI, "The Premature Infant," p. 128.

BABY'S VEST—FIRST SIZE

(Double-breasted and Long Sleeves)

2-ply Wool. Needles No. 10

For a slightly larger vest 3-ply wool can be used with same needles

Cast on 56 stitches for back of vest and knit in rib of 2 plain 2 purl for $1\frac{1}{2}$ inches.

Then knit $8\frac{1}{2}$ inches in stocking stitch (making 10 inches in all).

Next row : Knit 15 stitches, cast off loosely 26 stitches for the neck, knit 15 for second shoulder.

On neck end of neck make 33 stitches, which with the 15 stitches already on neck make 48 stitches.

To make the front—knit these 48 stitches in stocking stitch for $8\frac{1}{2}$ inches. Then knit in rib 2 plain 2 purl for $1\frac{1}{2}$ inches to correspond with back. Cast off.

Repeat for the other side of front, knitting the last 8 stitches in every row plain (making garter stitch) to strengthen the edge.

Before sewing up the sides, lay the knitting out flat and pick up 60 stitches. This makes the armpit about 8 inches, and the sleeve should be reduced every few rows till 40 stitches are

left and 5 inches have been knitted, then rib for the cuffs, $1\frac{1}{2}$ inches, 2 plain 2 purl.

Sew up on right side, keeping edge to edge quite flat, and leaving no ridge from lower edge of vest to wrist on either side.

(*This pattern is taken from "Still Simpler Garments for Infants," by Miss M. B. Synge. Obtainable from 8, Holbein Place, Sloane Square, S.W.1, where suitable knitted outfits can be purchased ready-made.*)



FIG. 1.—BABY'S DOUBLE-BREADED VEST.

(Reproduced from "*Still Simpler Garments*," by permission of Miss M. B. Synge.)

BABY'S VEST—FIRST SIZE

(Single-breasted and Long Sleeves)

2-ply Wool. Needles No. 10

For a slightly larger vest 3-ply wool can be used with same needles

Cast on 48 stitches loosely.

Knit rib 2 plain 2 purl for 2 inches.

Knit in stocking stitch for 5 inches.

Cast on 40 stitches for sleeve at the end of row. Knit back to end of next needle and cast on another 40 for second sleeve.

Knit in stocking stitch for $3\frac{1}{2}$ inches.

Knit 49 stitches, loosely cast off the next 30 stitches for neck opening, knit 49 stitches to end of the row.

Turn. Knit 49 stitches, cast on 30 stitches for other side of neck opening, knit 49 stitches to end of row.

Turn. Knit $3\frac{1}{2}$ inches, then cast off 40 stitches at the beginning of the needle, and knit to the end of row.

Turn. Cast off 40 stitches at the beginning of the needle to complete second sleeve, and knit for 5 inches.

Knit a rib of 2 plain 2 purl for 2 inches. Cast off, loosely. Sew up both sides of the vest and sleeves. Crochet all round neck opening and tiny edge to foot of sleeves. Run ribbon or soft crochet chain through neck.

(This pattern is adapted from one used by the Ladies' Needlework Committee at the Infants Hospital. It is intended for a new-born baby.)

BABY'S VEST—FIRST SIZE

(Single-breasted and Short Sleeves)

2-ply Wool. Needles Nos. 10 or 11

For a slightly larger vest 3-ply Wool and Needles
No. 10 can be used

Cast on 48 stitches loosely.

Knit rib 2 plain 2 purl for 2 inches.

Knit in stocking stitch for 5 inches.

Cast on 15 stitches for sleeve at the end of row. Knit back to end of next needle and cast on another 15 stitches for second sleeve.

Knit in stocking stitch for $3\frac{1}{2}$ inches.

Knit 19 stitches, loosely cast off the next 30 stitches for neck opening, knit 19 stitches to the end of the row.

Turn. Knit 19 stitches, cast on 30 stitches for the other side of neck opening, knit 19 stitches to the end of the row.

Turn. Knit $3\frac{1}{2}$ inches, then cast off 15 stitches at the beginning of the needle, and knit to the end of row.

Turn. Cast off 15 stitches at the beginning of the needle to complete second sleeve, and knit for 5 inches.

Knit a rib of 2 plain 2 purl for 2 inches. Cast off loosely. Sew up both sides of vest and sleeves. Crochet all round neck opening, and edge of sleeves. Run ribbon or soft crochet chain through neck.

(This pattern is adapted from one used by the Ladies' Needlework Committee at the Infants Hospital. It is intended for a new-born baby.)

BABY'S OVERALL-LEGGINGS—FIRST SIZE

1-2 ozs. 2-ply Wool. Needles No. 10

This is intended for a new-born baby. For a slightly larger size 3-ply wool and same No. needles can be used.

Cast on 66 stitches.

Rib for $2\frac{1}{2}$ inches, leaving holes for ribbon in the fifth row. To make ribbon holes—knit 3, put wool forward, knit 2 together, knit 3, and so on.

Knit 40 plain rows.

Knit 34 more plain rows, decreasing at the beginning and end of every other row. You should now have 32 stitches left. Knit 8 plain rows for the ankle.

Divide the stitches into 3, and knit the middle 12 into a strip of 32 rows. Pick up 16 stitches on both sides of this strip and the 10 each end that had been left when the stitches were divided into 3 (making 64 on needle) and knit 14 rows for the foot.

Make another piece the same and join to form overall-leggings. These garments are given various names—sometimes called "Overall drawers," "Overall booties," or simply "Overalls."



FIG. 2.—BABY'S OVERALL LEGGINGS.

(By permission of Messrs. Patons and Baldwins, Ltd.)

(The photograph to illustrate this garment has been reproduced from "Woolcraft," by permission of Messrs. Patons & Baldwins, Ltd., but the pattern is adapted from a similar one used by the Ladies' Needlework Committee at the Infants Hospital.)

BABY'S JERSEY OR PULLOVER

About 2 ozs. 2 ply-Wool. Needles No. 10

This is intended for a new-born baby, for a slightly larger size 3 ply-wool with same needles can be used.

Cast on 48 stitches.

Knit 1 plain 1 purl for 2 inches.

Knit in stocking stitch for 5 inches.

Cast on 40 stitches for sleeve at the end of row.

Knit back to end of next needle and cast on another 40 stitches for second sleeve.

Knit in stocking stitch for $3\frac{1}{2}$ inches.

Knit 49 stitches, loosely cast off the next 30 stitches, for neck opening, knit 49 stitches to the end of the row.

Turn. Knit 49 stitches, cast on 30 stitches for the other side of neck opening, knit 49 stitches to end of row.

Turn. Knit $3\frac{1}{2}$ inches, then cast off 40 stitches at the beginning of the needle, and knit to the end of the row.

Turn. Cast off 40 stitches at the beginning of the needle to complete the second sleeve, and knit for 5 inches.

Knit a rib of 1 plain 1 purl for 2 inches. Cast off loosely. Pick up stitches round sleeve and knit $1\frac{1}{2}$ inches, rib 1 plain 1 purl to make cuff. Sew up both sides and sleeves, crochet all round neck opening. Run ribbon through neck.

(This pattern is adapted from one used by the Ladies' Needlework Association at the Infants Hospital.)

INFANT'S SHAWL

For a simple Carrying Shawl $1\frac{1}{4}$ yards square, 10 ozs. 2-ply Wool and Long Needles, No. 5, are required.

Cast on 296 stitches.

Knit in basket pattern—*i.e.*, 4 plain 4 purl for 4 rows, then 4 purl 4 plain for 4 rows. Continue this for 5 inches.

Then knit 32 stitches in basket pattern, 232 stitches in plain garter stitch, 32 stitches in basket pattern. (This completes one row.)

Continue this for 35 inches, not including the 5 inches basket stitch already done.

Knit in basket stitch for 5 inches and cast off.

Crochet a narrow edge all round shawl.

(Reprinted from "*Still Simpler Garments for Infants*," by permission of Miss M. B. Synge.)

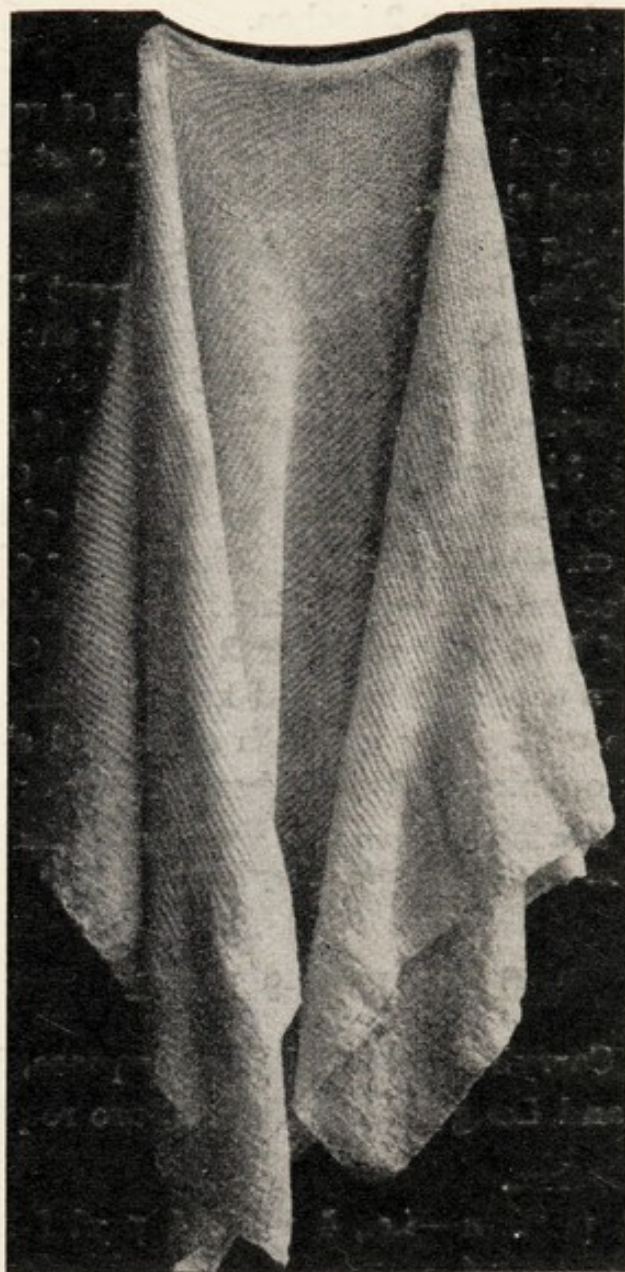


FIG. 3.—INFANT'S CARRYING SHAWL.

(Reproduced from "*Still Simpler Garments*," by permission of Miss M. B. Synge.)

INFANT'S SHAWL—WITH SHETLAND BORDER

Materials required : 1 lb. Greenock Super Fingering, 2-ply, or Sun Wool ; 1 pair of Knitting Pins, size 5, and 1 pair size 6.

Centre : On pins size 6 cast on loosely 128 stitches and knit in plain garter stitch till square.

Border : On pins size 5 cast on 228 stitches and knit 3 plain rows.

4th row : Knit 2, * knit 2 together 4 times (over wool, knit 1, repeat seven times). Knit 2 together four times, purl 1. Repeat from * to end of row, ending with 1 purl, 1 plain. Next 3 rows plain. Repeat these last 4 rows twice.

The shaping for corners is commenced on next row, and the following directions refer to the beginning of first and the end of last pattern only.

4th pattern row : Knit 2 plain, knit 2 together four times, over wool, knit 2 together, over, knit 1 six times, knit 2 together four times, purl 1.

5th pattern row : 2 plain, knit 2 together four times, over wool, knit 1 six times, knit 2 together four times, purl 1.

6th pattern row : 2 plain, knit 2 together three times, over, knit 2 together, over, knit 1 four times, knit 2 together four times, purl 1.

7th pattern row : 2 plain, knit 2 together twice, over, knit 2 together, over, knit 1 three times, knit 2 together four times, purl 1.

8th pattern row : 2 plain, knit 2 together, over, knit 2 together, over, knit 1 twice, knit 2 together four times, purl 1.

9th pattern row : 2 plain, over, knit 2 together, over, knit 1, knit 2 together four times, purl 1.

10th pattern row : 2 plain, over, knit 2 together, knit 2 together three times, purl 1.

11th pattern row : 2 plain, knit 2 together twice, purl 2 together.

12th pattern row : 2 plain, knit 2 together, purl 1.

13th pattern row : 2 plain, purl 2 together, knit 2 together four times, over wool, knit 1 eight times, knit 2 together four times, purl 1.

14th pattern row : 2 plain, knit 2 together four times, over

wool, knit 2 together, over wool, knit 1 seven times, knit 2 together four times, purl 1.

Repeat from 4th pattern till there are 140 stitches left. Knit the other three sides in same manner. Sew to Centre, then join at Corners.

(Reprinted by permission of the Scotch Wool & Hosiery Stores from their booklet, "What to Knit for Baby," obtainable from all branches.)

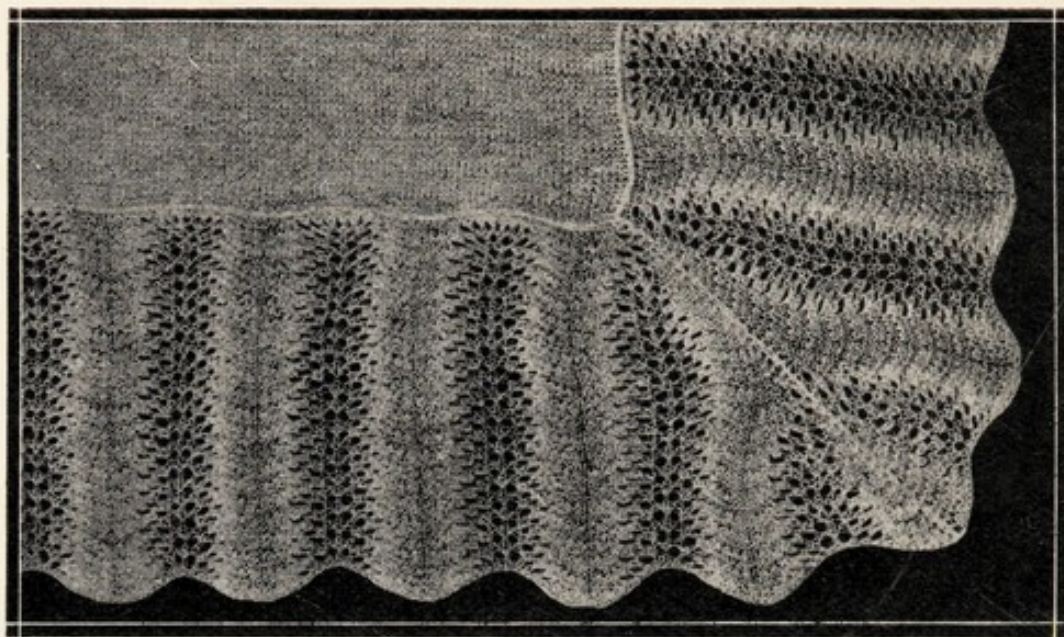


FIG. 4.—INFANT'S SHAWL.

(Reproduced from "What to Knit for Baby," by permission of the Scotch Wool & Hosiery Stores.)

BABY'S BONNET

About 1 oz. 3-ply Wool. Needles No. 8 or 9.

1½ yards Ribbon.

Work to a tension to produce 7 stitches to the inch measured over plain smooth fabric

Cast on 80 stitches.

**** 1st row :** Knit 1, * knit 6, purl 6. Repeat from * to the last seven stitches, knit 7.

2nd row : Knit 1, * purl 6, knit 6. Repeat from * to the last seven stitches, purl 6, knit 1.

Repeat these two rows twice.

7th row : Like the 2nd row.

8th row : Like the 1st row.

Repeat the 7th and 8th rows twice **.

Repeat from ** to ** once.

Then—1st row : Knit 1, purl to last stitch, knit 1.

2nd row : Knit plain.

Repeat these two rows for $4\frac{1}{2}$ inches, ending with a purl row.

Shape for the crown as follows :

1st row : Knit together every seventh and eighth stitch.

2nd and alternate rows : Knit 1, purl to last stitch, knit 1.

3rd row : Knit together every sixth and seventh stitch.

5th row : Knit together every fifth and sixth stitch.

7th row : Knit together every fourth and fifth stitch.

9th row : Knit together every third and fourth stitch.

11th row : Knit together every second and third stitch.

12th row : Knit 1, purl to the last stitch, knit 1.

Break off wool and run through the stitches on the needle.

Draw up and fasten off. With a damp cloth and hot iron press carefully. Sew up seam as far as the shapings. Work 2 rows of d.c. round the edge. Make rosettes with ribbon and attach to each side of bonnet.

(This pattern is reprinted from "Woolcraft," by permission of the publishers, Messrs. Patons & Baldwins, Ltd. It is not intended to fit a new-born baby.)

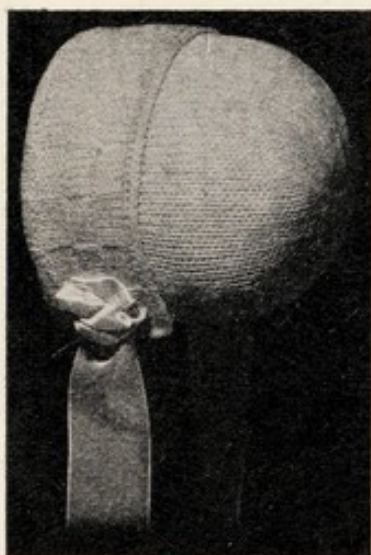


FIG. 5.—BABY'S BONNET.

(Reproduced from "Woolcraft," by permission of Messrs. Patons & Baldwins, Ltd.)

BABY'S GLOVES—FIRST SIZE

(without thumbs)

2- or 3- ply Wool. Needles, Steel, No. 10

Cast on 32 stitches.

Rib, 2 plain, 2 purl, for about 18 rows.

Knit quite plain for 30 rows.

Rib, 1 plain, 1 purl, for 10 rows.

11th row : Knit every two stitches together.

Knit two more rows.

Break off wool, leaving long end.

Thread the wool through the remaining stitches and fasten off firmly, then fold over knitting in half and join top and down side of glove.

Run narrow ribbon through wrist.

(Reprinted by permission of the Scotch Wool & Hosiery Stores from their booklet, "What to Knit for Baby," obtainable from all branches.)



FIG. 6.—BABY'S GLOVE.

(Before sewing up.)



FIG. 7.—BABY'S GLOVE.

(After sewing up.)

(Reproduced from "What to Knit for Baby," by permission of the Scotch Wool & Hosiery Stores.)

BINDER AND ABDOMINAL BELTS

The old idea of the necessity for holding the baby together, pressing it into shape, or preventing its back from breaking, by means of swaddling clothes or stiff binders, has completely given place to the more rational one of allowing full play to the abdominal wall and muscles by the avoidance of all such restraint, except in so far as some sort of bandaging is necessary for keeping the umbilical dressings in position until the cord has fallen off and the wound has become completely healed. Far better than a flannel binder for effecting this latter purpose are a few turns of a 4-inch crêpe bandage. A 6-yard bandage of this type will cut up into four lengths adequate for the purpose. When the umbilical wound is healed there is no further need for any form of binder. If the umbilical opening shows signs of weakness, a short length of adhesive strapping properly applied will prevent this weakness developing into a hernia.

**The Royal Sanitary Institute
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CHAPTER III

THE PRINCIPLES OF PHYSIOLOGICAL FEEDING

THE principles of feeding are the same for all periods of life, so that those I am about to give, although they are specially intended to apply to the young infant, apply also to children of all ages.

Food must be supplied for the following purposes :

1. Heat production.
2. Work.
3. Growth, maintenance, and repair.
4. Manufacture of secretions (mucous, gastric, salivary, etc.).

If enough food is not forthcoming to fulfil these purposes, the reserves of the body will be drawn upon. There will be loss of weight, the output of work will be restricted, growth will be arrested, or the supply of secretions dried up.

Heat production cannot be reduced greatly below the level necessary to maintain the normal temperature of the body without endangering life, and therefore this is the last direction in which an economy will be effected.

A complete diet should contain an adequate amount of fuel foods (proteins, carbohydrates, fats) to fulfil the requirements of heat production and work, but it must supply in addition all the many elements essential for building up the various body tissues, especially in the

case of growing children, for manufacturing the many different kinds of secretions, and for the maintenance of the body as a working machine.

Just as many different materials are required for maintaining a mechanical machine in working order, so are many required for the continuous running of the animal machine.

In any complete food, such as milk, there is combined a very large number of different constituents—something like forty. Some of these are more essential than others, but it is difficult to maintain health for long without most of them. In the complete absence of any one of the more important elements the animal machine will in time break down in function and death will ensue ; with a reduced or restricted allowance, the machine will not work efficiently for long, or for any length of time at its maximum capacity.

Among the more important elements contained in milk besides the fuel foods may be mentioned the following :

Some twelve different mineral materials including calcium (lime), iron, sodium, potassium, phosphorus, chlorine, iodine, etc.

Some of these are required for growth or building purposes, as, for instance, lime and phosphorus ; some for maintenance, such as sodium, iron, etc.

Death will inevitably ensue in the entire absence of any one of these, but ill-health will almost immediately result from any serious restriction in the amount.

There are some six vitamins present in milk and all are necessary for either growth or maintenance. In the absence of any one, or any combination of them, death will ensue sooner or later. When restricted in

quantity, some impairment of nutrition will immediately follow.

Liebig's " Law of the Minimum " explains that the best result you can expect from any particular dietary is limited by the degree of its greatest fault. If, for instance, in an otherwise perfect diet there is one fault only, such as an insufficiency of iron, the net result will be bad for the infant who subsists on it, because he will soon become anæmic.

The amount of fuel foods required will be dependent on the degree of activity of the infant and on the amount of heat necessary to maintain normal temperature—this in turn will be dependent on the size of the child, on its clothing, on climate, season, housing, or other conditions.

Average babies can be fed according to age or according to weight—the most convenient criterion is weight.

Average babies under six months of age require an allowance of fifty units of heat [Calories] per diem for each pound of body weight, with a gradually decreasing Calorie allowance as the child grows older. Thus a baby three months old, and weighing 11 lbs., requires food of the value of :—

$$11 \times 50 = 550 \text{ Calories.}$$

Since the Calorie value for breast milk is 20 Calories per ounce, such a baby will require :—

$$\frac{550}{20} = 27\frac{1}{2} \text{ ozs. of breast milk per diem.}$$

Cow's milk has a value of 20 Calories per ounce, *i.e.*, the same as breast milk.

Dried milk has a value of 150 Calories per ounce.

Condensed milk (sweetened), 100 Calories per ounce.

Condensed milk (unsweetened), 60 Calories per ounce.

Sugar has a value of 116 Calories per ounce.

Fat has a value of 263 Calories per ounce.

Protein has a value of 116 Calories per ounce.

From these figures it is easy to calculate what quantity of any one of these foods or of any combination of them, is required to supply the estimated daily requirements of normal infants. If substitutes for breast milk are made up to breast standard with respect to the fuel elements, the required volume of such combined substitutes will be the same as the estimated requirement for breast milk.

These calculations for fuel requirements only hold good in the case of normal infants. In the case of undersized, oversized, or ill babies, various allowances must be made.

In the case of babies of abnormal weight the actual food requirement will be some quantity intermediate between that which is correct for their actual weight and that which is correct for the average or "expected" weight of a baby of the same age. For instance, a six-months-old baby weighing 10 lbs. would require $10 \times 50 = 500$ Calories if fed by weight, but $15 \times 50 = 750$ Calories if fed according to the weight it ought to be for this age.

The correct amount will be somewhere between 500 and 750 Calories. Whether nearer to 500 or 750 can only be decided by a careful consideration of all the factors concerned.

BALANCE

This term is usually applied to the relative proportions of proteins, carbohydrates, and fats present in any food. The "balance" in breast milk may be assumed to be the best for infants and it is as follows :—

Proteins, 1·5 ; Carbohydrates (sugar), 7·0 ; Fat, 3·5.

The "balance" in cow's milk is approximately :—

Proteins, 4·0 ; Carbohydrates, 4·0 ; Fat, 4·0.

This latter "balance" may be assumed to be correct for the calf, but it does not necessarily correspond with the requirements of the baby.

Nature seems to base the balance in different varieties of milk in accordance with the principle that the more rapid the growth of the young animal, the larger should be the amount of protein material (for protein is available as material for growth as well as for fuel purposes) ; and, secondly, on the principle that the greater the heat requirement the larger should be the proportion of fat. Carbohydrates, which are easily digested, make up the remainder of the total fuel requirements.

The "balance" of many foods which are given to infants does not fulfil these conditions. As far as balance is concerned foods are good or bad in proportion to the degree to which they fulfil or transgress the physiological standard.

ACCESSORY FACTORS

This term is sometimes reserved for vitamins only. It is, however, more convenient to allow it to cover all

the essential food elements with the exception of the three fuel foods.

There is a definite requirement or "balance" for each one of these accessory factors, and correct feeding aims at supplying each of them in the best possible amount. Although health can be preserved within comparatively wide limits as regards the quantity of these elements, there is, as a matter of fact, an "*optimum amount*" for each. There is special danger in a shortage of vitamins and mineral elements, the more conspicuous instances being Vitamins B and C and the mineral element iron.

DIGESTIBILITY

It is essential that the food given to infants should be digestible—that is to say—capable of being rendered soluble and fit for absorption.

At birth the baby's powers of digestion are extremely limited—practically non-existent—but the capacity rapidly improves if the infant's latent powers are elicited by the giving of easy lessons in digestion. The whole mechanism of digestion can easily be upset by over-work, it will remain undeveloped if not given enough work to do.

Nature provides from the very first the right sort of educational experience by the giving of "colostrum" which requires no digestion at all. This precursor of milk is gradually changed at about the third day of life into breast milk, which is easy to digest.

In artificial feeding these principles should be adhered to. It is just as important to develop the powers of digestion as not to over-tax those that already exist.

INTERVALS OF FEEDING

The rate of supply should be co-ordinated to the rate of requirement, or to the rate at which food is used up, taking also into consideration the necessity for rest and recuperation of the organs of digestion.

Three-hourly intervals are on the whole the best, since they give sufficient time for recuperation, and they do not necessitate very large feeds. There should always be one prolonged rest at night. These intervals should be adopted from the first day of life in order that an automatic rhythm may be established in the habits of digestion; they may be prolonged later without seriously disturbing rhythm.

CHAPTER IV

BREAST FEEDING

BREAST milk—perhaps one ought rather to say breast feeding—fulfils in a remarkable degree the physiological requirements of digestion, nutrition, and development, in the human infant. The method is, however, not “fool-proof,” and demands a certain amount of intelligence on the part of the mother and nurse.

COMPOSITION OF BREAST MILK

If the nursing mother is healthy and properly fed, breast milk contains, or should contain, all the many constituents necessary for nutrition. It may, however, lack adequate quantities of vitamins, mineral elements, or other constituents if the food consumed by the mother does not provide all the sources of these accessories. Milk may further contain foreign or toxic substances, derived either from the food or from disturbed conditions of health in the mother. Serious disturbances in the infant, directly referable to bad qualities of the milk, are practically always due to foreign or toxic substances present in the milk, and not to excess or deficiency of the protein, fat or sugar. These toxic substances are difficult to detect by chemical analysis.

In conditions of health the chemical composition of breast milk does not materially alter from the time of

the establishment of lactation to its termination at weaning. The average composition of breast milk throughout the whole period of lactation is :—

Protein 1.5%. Fat 3.5%. Sugar 7%.

This is quite different from the composition of colostrum, which, it must be remembered, is not milk at all, but merely an oozing from the lymphatics, or blood vessels, of the mammary glands. Colostrum is, in fact, very little different from ordinary lymph or blood plasma, and, contrary to what is generally believed, it contains a far higher percentage of protein than does breast milk. The average percentage composition of colostrum on the second day is as follows :—

Protein 7.45%. Fat 2.17%. Sugar 3.5%.

The content of protein may even reach 9 per cent., but these proteins are of the non-coagulable variety and consist mainly of globulins, which do not coagulate in the stomach like caseinogen. In fact, they are practically the same as those which already exist in the blood of the infant, and which have been derived from the blood of the mother. They require no digestion, and can be absorbed into the system without setting up allergic or other disturbing reactions. It is quite possible that the protective bodies which are known to exist in colostrum may be attached in some way to these globulins, and this may help to explain why the latter are present in such large quantities. These protective bodies, which are of the nature of agglutinins and precipitins, are supposed to be of value to the new-born baby in promoting its resisting powers against infection. They may confer what is called a passive immunity, and reinforce the natural immunity of the

child until it can acquire an active immunity of its own—that is to say, the power of manufacturing its protective bodies by its own metabolic processes.

QUANTITY OF BREAST MILK

Before the establishment of lactation—that is to say, during the preliminary colostrum stage—the amount of the mammary secretion is small and variable, depending partly on the energy with which the infant sucks and partly on the frequency with which it is put to the breast.

During the first twenty-four hours the total amount seldom reaches more than $\frac{1}{2}$ oz. On the second day not more than 2 ozs., and on the third day about 5 ozs. After that, with the establishment of lactation proper, the amount of the secretion rapidly increases.

If breast feeding is to be conducted on sound lines the quantity of breast milk obtained by the infant should always be checked by the “Test Feed.” This will prevent not only inequalities in the amount obtained at different feeds, but it will also be a safeguard against starvation or overfeeding. The differential test feed proves that the infant obtains nearly the whole amount that it is likely to extract from the breast during the first five or six minutes of feeding. After that the infant swallows more air than milk. It is, therefore, a great mistake to leave an infant too long at the breast. If the test feed proves that the infant does not obtain from the two breasts a sufficient amount in about twelve minutes, the feed should be made up to the required amount with milk obtained by expression or by exhaustion with the breast pump, or

by supplementary feeds of suitably modified artificial food.

NUMBER OF FEEDS

For the sake of the mother, and in consideration of the exhaustion attendant on parturition, the custom is generally followed of not putting the infant to the breast until eight hours after birth. After that the greatest regularity should be observed in order to induce regular and rhythmical habits of secretion on the part of the mammary glands, and of gastric activity on the part of the infant. Long experience has convinced me that the most suitable interval during the first three months is three hours, the total number of feeds being six, with a long period of rest at night. The best times are :—

6 a.m. 9 a.m. 12 noon. 3 p.m. 6 p.m. 10 p.m.

DIGESTIBILITY

Breast milk is of exactly the right degree of digestibility. It is sufficiently digestible not to overtax the powers of a young infant and sufficiently indigestible to give the gastric functions something to do and to stimulate development. Colostrum practically requires no digestion at all, but can be absorbed almost without change. It is incorrect to regard this substance as an aperient, or that it has value in clearing out the meconium. No fluid could possibly be less stimulating or possess feebler aperient properties.

The transition from colostrum to milk usually begins on the third or fourth day. At this time special care should be taken to provide against overfilling of the stomach.

WEANING

No baby ought to be weaned or relegated to the bottle before the evidence for this necessity has been very carefully weighed from all points of view. If a baby does not obtain enough, or too much, breast milk, or does not suck properly, these are no arguments for weaning. Patience and resourcefulness must be brought to bear to solve these problems as they arise. Under normal circumstances there is no rational reason why the baby should be weaned at eight or nine months. At this time it is true the infant requires other forms of food besides milk, but it also still requires quite a considerable amount of fluid food. If at this time an infant is weaned from the breast the usual practice is to supply it with cow's milk supplemented with various starchy, farinaceous or solid varieties of food in addition. There is no reason why an infant should not have these supplementary additions and still continue at the breast, for breast milk still remains more suitable than cow's milk. In Eastern countries it is a common custom for children to remain at the breast for two years or even longer. I would suggest that with supplementary feeding, breast feeding need not be relinquished entirely before the end of the first year.

After six months it will usually be found as the result of test-feeding that the total yield of breast milk is not sufficient for the child without supplementary additions. It is better to supplement each feed and make it up to the required amount rather than to substitute one or more whole bottle feeds for whole breast feeds. At six months five feeds a day are usually sufficient and at eight months regular meals at 9 a.m., 1 p.m.

and 6 p.m. may be given, with small milk feeds first thing in the morning and last thing at night.

SUPPLEMENTARY FEEDING

If there is not sufficient milk the deficiency should be made up with supplementary feeds at each feed, a deficiency which must, of course, have been checked by a test feed. These feeds may be given at first from the bottle, and after six months or so, with cup and spoon. For the first six months the supplementary food should consist of cow's milk modified to breast standard. If the infant is under three months of age it is safer to peptonise the food at first in order to avoid digestive disturbances, and later on gradually to decrease the degree of artificial pre-digestion.

DEPRESSED, SORE AND CRACKED NIPPLES

With depressed nipples, the breast pump or cupping-glass should be used consistently before the birth of the child. If by these or other means the deformity has not been adequately corrected a nipple shield of suitable type should be used.

Sore and cracked nipples are generally caused by allowing the infant to suck too long or too frequently during the first few days after birth, before the epithelium covering the nipple has become hardened by the friction incidental to sucking. Want of proper washing and drying after a feed is also a contributory factor, as is the dribbling of milk from an inadequately emptied or overfull breast.

Nipples should be prepared before the birth of the child by friction and inunction of some simple oint-

ment, such as lanoline. When actually sore or cracked they are best treated by the application of Compound Tincture of Benzoin (Friars' Balsam).

A good nipple shield is also a great help in such cases. A very ingenious variety of shield is sold by

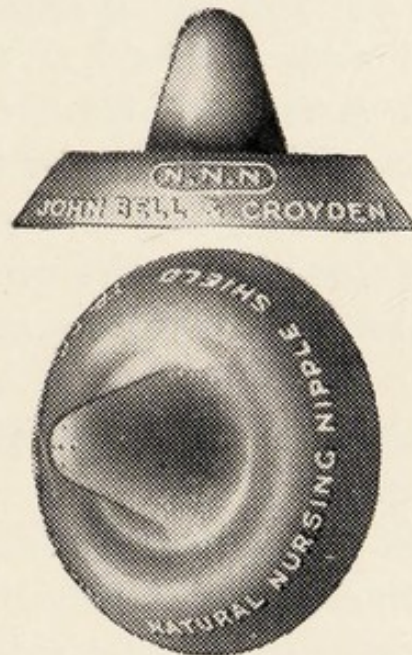


FIG. 8.—NIPPLE SHIELD.
(*John Bell and Croyden.*)

Messrs. John Bell and Croyden, of Wigmore Street, London, W. 1, an illustration of which is here given.

ESTABLISHMENT OF LACTATION

No reliance whatsoever can be imposed on so-called galactogogues. If any of the popular preparations of this kind have any value at all it is by reason of their psychological rather than their physical properties. The establishment of lactation under natural conditions is brought about by the secretion of hormones derived from the uterine tissues, by the stimulation of the nipples by sucking, and by indirect psychological influences.

The secretion of milk is chiefly associated with vascular or circulatory conditions, and cannot be influenced markedly, if at all, by the actual quality of the food, or the amount of fluid which the mother takes. The so-called "draught" so often experienced by women during suckling, is an expression of circulatory change—an inrush of blood to the gland, and is unconnected with a sudden flooding of milk as is popularly supposed. The main conditions essential for satisfactory lactation are :—

- (1) The normal health of the mother, which, of course, is dependent on adequate food and nutrition.
- (2) Adequate stimulation of the nipples by the sucking of the infant.
- (3) A favourable psychological state of mind on the part of the mother.
- (4) Absolute regularity of the times of feeding.

CHAPTER V

THE ARTIFICIAL FEEDING OF INFANTS

It is a mistake to believe, because a certain number of infants can survive for a time and apparently flourish on foods which violate the principles of physiological feeding, that such matters as "balance," digestibility, and quantity, are of little importance. Most young animals, including human babies, can adapt themselves to their surroundings and accommodate themselves to conditions which are quite foreign to their specific organisation and natural make-up, and this is perhaps more true of diet than of any other factor in the environment. All the same, it is better to follow the path of least resistance and supply an environment which is adapted to the conditions rather than attempt to mould the various organs and their functions to shapes or in directions for which they were never designed. Much of my time is occupied in attempting to restore to normal the functions of digestive organs in infants which have been forced out of their natural inclinations by bad feeding. Attempts at adaptation which fail leave an aftermath of pathological results which are often very difficult to cure. The artificial feeding of infants would long ago have arrived at a more satisfactory stage than that which it has at present reached if a danger signal were invariably displayed the moment any unsuitable food was given. Unfortunately, grievous errors may exist in a dietary

without being detected so long as no easily recognisable danger signals are displayed. Everyone can recognise at once that a food is unsuitable if the baby who consumes it is sick, has so-called undigested motions, or has wind or colic. But a baby can take a food which is deficient in vitamin or mineral content for months before any defect in nutrition is recognisable. In fact, the indigestible qualities of a food can usually be recognised immediately, but the nutritional defects are slow to manifest themselves by objective symptoms.

DEFERRED SYMPTOMS OF MALNUTRITION

We know, or at least we ought to know, that if a food is deficient in the anti-scorbutic vitamin symptoms of scurvy will develop in two or three months, but until that time arrives there is no outward or visible evidence of the gathering storm, and the same is true of many other necessary elements in the dietary. For these reasons it is essential that we should be familiar with and observant of the canons of physiological feeding. Without waiting for the development of deferred danger signals, or for the onset of pathological symptoms, we should be able to predict from a careful survey of the dietary itself what must inevitably happen within a prescribed period of time.

Let me give you a few examples of what I mean. Condensed milk is an easily digested food. Infants fed on it grow fat and sleek and apparently thrive well, but, owing to the high sugar content and relative deficiency of fat-soluble and water-soluble vitamins, we know from experience that if infants are fed on this kind of food for any length of time without compensatory additions they will ultimately become scorbutic and

easily fall a prey to infectious diseases. From this I do not wish it to be understood that condensed milk is a bad food for infants. On the contrary it is a very good food under particular conditions, and if certain compensatory additions are made to it. From the point of view of digestibility it has valuable qualities which must appeal to all who employ it, but it has certain defects from the point of view of nutrition which are not readily detected. Another food which may give immediately good, but ultimately bad results, is whole cow's milk. When this food is used the saving clause often is that it is given in relatively small quantities at first. This is fortunate, for otherwise it would almost certainly cause at once severe vomiting and other digestive disturbances. The bad results which escape detection at first are connected with the over-development of the stomach to which this kind of food disposes. It leads to overwork of the liver and finally to liver crises. In addition, it disposes to all those many bad results which are traceable to an excessive protein intake.

Without giving further examples of the deferred results which can accrue from want of observance of the laws of physiological feeding, I would like once again to emphasise the statement that the best results can only be obtained by absolute compliance with all the laws of physiological feeding, and that Liebig's "Law of the Minimum"—namely—that the optimum result of any method of feeding is limited by its greatest defect, still holds good.

I think everybody is agreed that no better method of feeding has yet been devised than good breast feeding. It therefore follows that when we cannot

provide this optimum means of feeding, the next best must be that which most closely approximates to it.

SUITABLE SUBSTITUTES FOR BREAST FEEDING

It is not so many years ago that we discovered all sorts of unsuspected elements in milk ; for instance, some six of those elusive bodies called vitamins, but in addition to these we now know that there are many mineral elements and extractives which we thought of no account, but which we now know play quite important *rôles* in nutrition. Some thirty years ago the late Dr. Oliver Wendell Holmes declared that " A pair of substantial mammary glands have an advantage over two hemispheres of the most learned professor's brain in the art of combining a nutritive fluid for infants." Although this dictum is true to-day, it was still truer thirty years ago. At the present time we probably know nearly every important constituent of milk and approximately its quantitative representation. Further, we are in a position to purchase or prepare each one of these constituents in a relatively pure form, so that we can combine all the required elements in their proper proportions and compound a synthetic substitute for human milk which is almost, although not quite, identical with the natural product. Therefore it is not perhaps altogether beyond the capacity of the human brain to compound a nutritive fluid for infants which fulfils all the requirements.

I sometimes take the opportunity of demonstrating this possibility, when lecturing to students, by actually combining in proper percentage proportions the forty or so elementary constituents which are found in human milk. This necessitates the provision of some sixteen

or so different mineral elements in addition to casein lact-albumen, extractives, fats and sugar. The elements which we cannot provide, and which certainly have some importance, are those protective bodies to which I have already referred as present in the human secretion. All milks contain the same kind of elementary constituents, though they may not be exactly identical and they may not be present in exactly the same quantitative representation. Cow's milk certainly contains practically the same constituents that are present in human milk, and we know from experience that a certain proportion of human infants can be reared on unmodified cow's milk. We know, however, for the reasons already stated, that some fed in this manner fall by the way.

DIFFICULTIES IN SUBSTITUTING COW'S MILK FOR HUMAN MILK

There are two outstanding differences between cow's milk and human milk which make the substitution of the one for the other a dangerous and hazardous proceeding. Firstly, the casein of cow's milk is not only much more indigestible than the casein of human milk, but it is also present in nearly five times the amount. Secondly, the butter-fat of cow's milk differs from the butter-fat of human milk in that it contains quite a large percentage of butyric acid, which human butter-fat does not, and which has an irritant effect on the mucous membrane of the infant's stomach.

Further than this, there are minor differences ; for instance, cow's milk contains far less sugar than human milk and a great deal more calcium—partly in the form of calcium phosphate and partly in combination with

casein. These differences prevent cow's milk from being a perfectly satisfactory substitute for human milk, although, as I have already stated, the digestive organs can after a time adapt themselves to these differences with some considerable degree of success.

MODIFICATION OF COW'S MILK

All sorts of devices or methods of modification have been employed to correct these differences and obviate the objections. The best-known method is to dilute cow's milk with sufficient water to reduce the excess of casein to reasonable proportions. This method, however, has the inherent defect that the water which dilutes the casein dilutes also all the other thirty-nine constituents in the same proportion. If the cow's milk diluted in this way is substituted in corresponding quantities for breast milk, the infant will be starved of thirty-nine of the required elements for the sake of reducing one of these—*i.e.*, casein—to reasonable proportions. This is clearly irrational. It is true that you can compensate for the dilution of certain of the more essential constituents by the independent addition of such of them as are considered of sufficient importance—as for instance, fat, sugar, and vitamins—but even then you do not compensate for the dilution of other elements which may be important. For this reason, I repeat that the modification of cow's milk by dilution with water is not a good method, even if certain of the defaulting elements are made good by independent additions. A better method is to remove from cow's milk its great excess of casein without interfering with any of the other constituents. This can easily be done by straining off all the casein after

throwing it down as an insoluble coagulum by means of rennet—in other words by the making of whey. The whey thus prepared can be brought up to breast standard by restoring a small quantity of the casein removed and by the addition of $2\frac{1}{2}$ per cent. of sugar.

THE PREPARATION OF MODIFIED MILK

The following are the actual details which are to be observed in preparing modified milk of this kind :—

- (1) The milk from which the whey is prepared should not be boiled preparatory to the addition of the rennet. It may, however, be pasteurised for forty-five minutes at a temperature of 145° F. if thought desirable.
- (2) The temperature of the milk should be raised to a little above blood heat before adding the rennet.
- (3) Two teaspoonfuls of rennet, or the equivalent of some other rennet preparations, should then be added to each pint of warm milk.
- (4) After sufficient time has been allowed for the curd to form, the latter should be broken up with a fork and strained through muslin.
- (5) The resulting whey should then be raised to a temperature of between 145° F. and 150° F., in order to destroy the rennet and pasteurise the fluid.

To bring this whey up to breast standard it is now necessary to add $2\frac{1}{2}$ per cent. sugar, some additional cream (for fat whey contains only 1.3 per cent. fat), and sufficient milk to supply the amount of casein required. The following formula meets the requirements :—

Fat whey as prepared above	.	.	10 ozs.
Milk sugar.	.	.	$\frac{1}{2}$ oz.
Cream.	.	.	$\frac{1}{2}$ oz.
Add sufficient milk to make one pint.			

Such a mixture will actually contain more casein than is present in breast milk and also rather more total proteins. The fat and sugar content is practically correct, and so is that of the vitamins. The mineral content is probably nearly correct with the exception that there is an excess of calcium. Such a mixture will, however, give eminently satisfactory results provided it is not given to new-born or young babies before their digestive functions have been developed up to the degree which is necessary for dealing with a food of this kind which contains coagulable casein. However good a substitute it may be for milk it is not, and cannot be, a satisfactory substitute for colostrum during the first week of life. It can, however, be made suitable by thorough peptonisation. This should be done in the following manner—the milk modification should be raised to a temperature of 117° F. To each pint of it should be added one Fairchild's Peptonising Powder, or 2 drachms of Liquor Pancreaticus. The mixture should be well stirred, and kept at this temperature for the required period. This period will differ according to the stage of development of the infant's digestive functions. At first, in the case of a new-born baby, and especially in the case of a premature baby, the mixture should be very thoroughly peptonised for about three hours, and subsequently peptonised for shorter and shorter periods, remitting about ten minutes every day. In this way it takes about eighteen days to reach the stage at which all peptonisation is omitted.

This may be a somewhat troublesome process, but the results are so eminently satisfactory that the extra trouble need not be grudged.

For those who cannot carry out such elaborate details, the following simplified method can be employed :—

Take milk, 10 ozs. ; sugar, 1 oz. ; cream, 1 oz. ; bone and vegetable broth, 4 ozs. ; water to make 1 pint.

The addition of the bone and vegetable broth is made to compensate for the reduction in the quantity of vitamins, mineral elements, and extractives, brought about by the dilution of the cow's milk with water. Without some such addition there would be a serious shortage of some or all of these constituents. This mixture, like the one mentioned above, must be peptonised before it is given to premature or new-born infants.

The following is the recipe for the making of the bone and vegetable broth :—

BONE AND VEGETABLE BROTH

To make 1 pint—take 1 lb. of bones, any variety will serve, provided they can be broken up with a hammer or by other means. Let them simmer down with 1 pint of water and one tablespoonful of malt vinegar. Do not skim off the fat or allow the water to evaporate by leaving the lid of the saucepan off.

At the end of eight to twenty-four hours add a good handful of mixed vegetables—green vegetables such as spinach, cabbage and brussels sprouts, and root vegetables such as turnips and carrots are the best. Let the broth simmer for half an hour or longer, and then strain, and make up to 1 pint. No salt or other seasoning should be added.

The broth should be kept in a cool place, and should

not be used if it is more than three days old in winter or one day old in summer. When using, be careful to take a fair mixed sample containing both the fat and the marrow layers as well as the jelly.

This soup can be given to the youngest infant, or to children of any age. For a very young baby, start with one teaspoonful in each bottle and continue to increase the amount gradually up to one tablespoonful.

Pieces of chopped liver, kidney, or other butcher's offal, may be added with advantage, and so may Marmite or malt extract—these latter should be added to the broth after straining—one tablespoonful of either will be sufficient.

All good substitutes for breast milk—the whey mixture, as described on page 49, diluted cow's milk mixtures or modified dried milk preparations are practically of the same food value as breast milk, and therefore should be given in quantities which are the same as those advised in the case of breast feeding. Thus will be provided the required number of Calories (see page 30).

FEEDING BOTTLES

The actual form or shape of the feeding bottle is of very little importance. The main desiderata are that it should be capable of being easily cleaned, and that there should be as few complications in the way of valves and screws as possible. There is some advantage in the measurements being marked on the outside of the bottle without any corresponding depressions on the inside, which make it difficult to clean, and which retain *débris* of milk. The ordinary bottle supplied with the Soxhlet apparatus is good and simple, as also are

the bottles supplied by the Association of Maternity and Child Welfare Centres.¹

TEATS

The shape of the artificial teat is of some importance. It should be so formed as to encourage the same sort of jaw-work in the infant as is compulsory in breast-feeding. In the latter case, the infant seizes in its mouth quite a large portion of the areola round the nipple, and compresses it between the tongue and the roof of the mouth, and at the same time exercises a certain amount of traction, in fact, it employs very much the same sort of movements as those on which the milking of a cow depends. These movements are well designed to empty the lacteal ducts in the breasts and simultaneously to exercise the muscles of mastication. The large soft indiarubber teat which is known as the Marylebone Teat,² or the one originally designed by the Association of Maternity and Child Welfare Centres, elicits these kind of movements, whereas the small hard teats which are commonly employed, encourage the infant to obtain its food by the formation of a vacuum in the mouth in the same way that medicine is taken through a glass rod, or cider cup through a straw. The formation of a vacuum in the mouth tends to cause falling in of the cheeks, and in no way helps to develop the jaws.

¹ The price of these bottles is 4*d.* each, or 3*s.* 6*d.* per dozen. They can be obtained by writing to the Secretary of the Association of Maternity and Child Welfare Centres, Carnegie House, 117 Piccadilly, W.1.

² These teats can be obtained from Messrs. John Bell & Croyden, 50 Wigmore Street, London, W.1.

CHAPTER VI

PATENT AND PROPRIETARY FOODS

THE number of patent and proprietary foods which are advertised for infant feeding grows ever larger, and it is impossible to keep pace with all the recent additions. In using them, however, it is very important to know their exact composition, also whether they are intended to be used as exclusive foods or merely as supplementary additions to milk mixtures. Roughly speaking, these foods may be divided into the following classes :—

(A) Those which are intended to be used as substitutes for breast milk, without additions other than water.

(B) Those which are intended to be added to milk mixtures to supplement deficiencies. These include :—

- (1) *Carbohydrate foods.* Sugars and starches.
- (2) *Fats.* These consist for the most part of emulsions of cod-liver oil, butter-fat, nut oil, etc.
- (3) *Protein foods.*
- (4) *Preparations containing the different vitamins,* either singly, or in combination.
- (5) *Preparations consisting of mineral elements.*
- (6) Finally, there are preparations which consist of a combination of several of the above classes.

In the following paragraphs these foods are described in greater detail.

CLASS A

Dried Milks. Dried milks are invaluable substitutes for dairy milk, their chief advantages being that they are clean and relatively free from bacterial contamination. Further, they will keep almost indefinitely, and from this point of view are economical. The prejudice against them, that because they are cooked foods, they have suffered loss as to their nutritive properties, is unjustifiable. It is always desirable that fresh orange juice should be taken in addition to all dried milks, but the same is also true of dairy milk, and even in the case of breast feeding it is well not to omit this precaution.

Quite recently a variety of dried milks has been put upon the market, which, when adequately diluted, is practically of breast standard. This is a very great advance on the old method of using dried milks which have not been modified, or which have been deprived of part of their cream—so-called “half-cream” varieties.

Humanised or modified dried milks can be used with the greatest confidence as substitutes for modified dairy milk, but in the case of delicate or new-born infants they should be used with the precautions mentioned on p. 50, namely, that they should be pre-digested or peptonised before use. Personally, I never in the first instance give either dried milks or dairy milk to infants under one month of age without previous peptonisation. In the table which appears at the end of this chapter there will be found a list of some of the commoner varieties of dried milks. In using dried milks care must be taken to employ the measures

supplied by the manufacturers, or else to weigh the powders carefully on accurate scales. To prepare 1 fluid ounce of mixture of any of these dried milks, 1 drachm (apothecary's measure) by weight must be added to every fluid ounce of water. To measure in a teaspoon is not sufficiently accurate (see p. 244).

Complete Foods. Apart from dried milks there are not many infant foods in common use which can be regarded as complete foods and capable of being substituted for breast milk without additions. One of these is Allenbury No. 1. This is really a humanised dried milk, though not usually so described. It contains rather a low percentage of protein, rather a high percentage of sugar, and a somewhat low percentage of fat. It is an easily digested food, more so than most dried milks, but in my opinion not sufficiently digestible for new-born or premature infants. Its chief defect is that it contains no anti-scorbutic element, so that when it is used great care must be taken to supply in addition a sufficient amount of fresh orange juice. Another complete food is Almata, a very correctly balanced synthetic food containing egg, as well as milk albumens. The great advantage of this food is that the coagulum which is thrown down in the stomach is light and flocculent, corresponding very closely with that of human milk. It is of special use in cases in which the stomach is intolerant of the heavy curd thrown down by cow's milk or ordinary dried milks when they enter the stomach. It is specially useful when there is a tendency to vomiting. Although this food has the above advantages, I do not recommend it as an exclusive food for the entire period of bottle feeding. Its chemical composition is as follows :—

Protein, 12·5 ; *Fat*, 27 ; *Carbohydrate*, 54·6 ; *Calorie value* per ounce, 130.

When diluted with water in the proportion of 1 part Almata to 8 parts water, the percentage composition is :—

Protein, 1·5 per cent. ; *Fat*, 3·4 per cent. ; *Carbohydrate*, 6·7 per cent., *i.e.*, the same as breast milk.

CLASS B

Carbohydrate Foods. Cow's milk may be supplemented with either soluble or insoluble carbohydrates. The soluble carbohydrates include milk sugar, malt sugar, or the ordinary table sugar. For infants during the first month of life, it is better to use nothing else than milk sugar, since this is the sugar the infant would get if it were breast-fed. After the first month, the next sugar to use is ordinary table or cane sugar, and after that, malt sugar. It is in my opinion a mistake to believe that malt sugar is more digestible than milk sugar, or that it is less liable to undergo fermentation in the bowel than other varieties. Malt sugar is, however, a convenient stepping-stone to the insoluble carbohydrates. Malt sugar can be procured in the form of Dextri-Maltose (Meads), or in the form of Mellins' Malted Food. I find it a useful plan to mix the three sugars—milk sugar, cane sugar and malt sugar—in equal proportions after the child is about two months of age, although for the first month I advise strict adherence to milk sugar. When the child is about two months old, it is a good plan to gradually add some insoluble carbohydrate, such as prepared barley to the

milk mixture. Since starches have weight for weight the same food or Calorie values as sugars, when they are introduced into milk mixtures they should replace a corresponding weight of sugar in order that the correct balance may be maintained. In substituting insoluble carbohydrate for the soluble sugars, the first step to take is to prepare the milk mixture with thin barley-water in place of ordinary water, or if whey mixtures are employed, to cook the barley in the milk before adding it to the whey. When the infant has learnt how to digest this simple form of starch, larger quantities may be gradually substituted for the sugar, until, if thought desirable, starch may entirely replace sugar. The percentage composition of certain of the cereal foods (Robinson's Prepared Barley, Ridges' Food, Neave's Food, etc.) will be found in the Table at the end of this chapter.

FATS

Substitutes for Cream. At the present time there are quite a number of good artificial substitutes for cream on the market. I have myself devised formulas for several of them. The best, in my opinion, is undoubtedly Vitoleum Cream, which is made of a mixture of different fats so combined that the resulting emulsion is almost exactly of the same chemical composition as human cream, and like it also with respect to its physical properties.

Another good substitute is Brestol, prepared by the same firm which supplies Cow and Gate foods; its disadvantage is that it is solid, like butter, and will not mix easily with milk mixtures.

Another synthetic cream is that which is known as

Marylebone Cream, which is manufactured by the British Drug Houses and also by Messrs. John Bell & Croyden, and prepared by both in accordance with my own formula. All these creams can be used in preparing milk modifications consisting of cow's milk or dried milks diluted with water, and can be added in the same quantities as dairy cream. It is quite unnecessary to use them when humanised dried milk preparations are employed. The chief advantages of these synthetic creams as compared with dairy cream, are that they will keep almost indefinitely, and are also sterile.

Substitutes for Milk Proteins. It is but seldom that any additional proteins are required when milk preparations or milk modifications are used, for the reason that in using such substitutes for breast milk, the trouble is that there is an excess and not a deficiency of protein. All the same, pure casein may be procured in the form of commercial casein, or in the form of Casumen, a proprietary preparation. Whey proteins are obtainable in the form of Albulactin, a somewhat expensive proprietary preparation. It is a mistake to believe that when Albulactin is added to cow's milk it makes it more digestible. It may, however, be added to weak milk dilutions in order to bring up the percentage of the whey albumens to a higher level.

Secway, which is a variety of dried whey, is a very useful preparation for temporary use in cases of severe vomiting or when the infant's stomach is intolerant of ordinary milk modifications, or as an addition to weak milk dilutions. It is a fat-free variety of whey and contains no vitamins at all. It consists largely of whey albumens, milk sugar, and mineral elements. It may be used in a dilution of 1 in 5. Its percentage

composition may be seen by referring to the Table at the end of this chapter.

VITAMIN PREPARATIONS

There are at the present time an enormous number of preparations of this kind on the market. Further details of the vitamins and the deficiency diseases are given in Chapter VI., pp. 64-75.

Vitamin A. This can be supplied in the form of Carotene (Burroughs & Wellcome, 1 tabloid three times a day); Crookes Vitamin A (Organon, 5 drops twice daily); or in combination with Vitamin D, as in Adexolin, 5 drops three times a day. Since cod-liver oil contains this vitamin in good amount, it is usual to give it in this form. It must be remembered that different samples or brands of cod-liver oil contain very variable amounts of the Vitamins A and D. The following are reliable preparations :—

Kepler's Cod-liver Oil; Kepler's Cod-liver Oil and Malt; and Parke Davis & Co.'s Standardised Cod-liver Oil, and Haliverol (8 drops 3 times a day).

Cod-liver oil should not be given in large amounts to young infants either in the form of an emulsion or combined with malt.

Vitamin B. Can be supplied in many varieties of dried yeast. Yestamin is a useful variety, and can be added to ordinary milk mixtures to the extent of about 15 grains in each bottle. It can also be employed in the form of Bemax or Marmite, the former contains a larger proportion of B₁, while the latter consists mainly of B₂. They can be used in combination.

Vitamin C. Which is generally given in the form of

fresh orange juice, can also be usefully given in the concentrated form of Sunkist orange juice. This is prepared from Californian oranges and is a convenience when fresh oranges cannot be procured, or are not of good quality.

Several preparations, such as Virol, Robolein and Vitmar, contain combinations of various vitamins with mineral elements, and can be given to the extent of about half a teaspoonful three times a day, in addition to the ordinary milk mixture. Bickiepeg Broth, which is made according to my own formula, is a useful addition to milk dilutions, as it contains a good representation of most of the necessary mineral elements, in addition to vitamins and extractives, or the broth may be made at home in accordance with my formula given on p. 51.

EXPEDIENTS AND PREPARATIONS FOR RENDERING COW'S MILK PREPARATIONS MORE DIGESTIBLE

A number of methods are in use for rendering milk more digestible. The most practical method is the pre-digestion of milk by means of pancreatic extracts. One method is described on p. 50, another method is to use Benger's Food. If Benger's Food is added to cow's milk at a temperature of 117° F. and allowed to remain at this temperature for a sufficiently long time, the milk will be well peptonised, and the starch contained in the Benger's Food will be converted into sugar. It is, however, essential that the peptonisation should be continued for a considerable time, much longer than is suggested in the directions supplied by the makers, in fact I strongly advise nurses to dis-

regard the printed directions and adopt those which are here given. For young babies the process of pre-digestion should be allowed to proceed for about two hours or longer. The usual time allowed is not nearly sufficient to carry the pre-digestion of the milk far enough for babies who have undeveloped powers of digestion, while the starch of which the food itself mainly consists is not converted into sugar, and may thus be a source of danger.

Lactic Acid Milk. Lactic acid milk is now becoming very popular. Many babies certainly digest it more easily than ordinary untreated milk mixtures. It is specially useful in those cases in which babies cannot secrete enough acid to activate the pepsin in the stomach. Lactic acid milk is made as follows :—

DIRECTIONS FOR MAKING LACTIC ACID MILK

One pint of cow's milk is raised to the temperature of about 130° F., and 1 drachm of lactic acid (B.P.) is added drop by drop, while the milk is continually stirred with a spoon. Milk thus treated may be given to the baby without further modification, or it may be diluted according to requirements with or without further additions. It is now possible to procure dried milks which have already been treated with lactic acid and simply require dilution with water. There are three varieties of dried lactic acid milk preparations on the market known as "Lacidac." One variety is full-cream, another is half-cream, and another separated or fat-free. The use of these dried milks saves a good deal of trouble in the preparation, but they should only be employed under doctor's orders, and never

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TABLE I
PERCENTAGE COMPOSITION AND CALORIE VALUE OF CERTAIN INFANT FOODS IN COMMON USE.

	Calorie Value per oz.	Percentage Composition.			Notes.
		Protein.	Fat.	Carbohydrate.	
APPROXIMATE PHYSIOLOGICAL STANDARD REQUIRED FOR DRIED FOODS USED FOR INFANT FEEDING . . .	141	12	26	52	When diluted eight times, gives same percentage composition as breast milk.
Pure Carbohydrate.	116				
Pure Fat	263				
Pure Protein	116				
Albumen water	2	1.8	a trace	a trace	A "placebo."
Allenbury's No. 1	134	9.7	20	60	Extra vitamins essential.
" No. 2	121	9.2	15	69	Extra vitamins essential.
" No. 3	110	9.2	1	82.8	A farinaceous addition to milk.
Almata	130	12.5	27	54.6	A complete food easily digested—useful in vomiting and cases of hypochlorhydria.
Barley water (from Pearl Barley)	2	0.09	0.05	1.43	
Barley water from prepared barley can be made of any strength with corresponding percentage composition.					
Beef tea	2	1	a trace	a trace	A stimulant.
Benger's Food	101	10.2	1.2	79.5	Contains important enzymes. Should not be made at a higher temperature than 117° Fahr.
Bone and vegetable soup	3	—	—	—	Contains vitamins, extractives and salts.
Bread jelly	18	2.7	0.5	15.2	In combination with cream, plus beef juice constitutes Dr. Cheandle's famous mixture.
Cod Liver Oil Emulsion	88	—	33.3	—	Dilute about 1 in 5 or 6. Requires vitamins.
Condensed milk (sweetened), <i>i.e.</i> , Nestlé's	100	9.7	12	32 (12-40)	Requires sugar and vitamins. Can be variously diluted about 1 in 3 or 4.
" " (unsweetened), <i>i.e.</i> , Ideal	60	8.3	12.4	16	Requires modification.
Cow and Gate—Full-cream	140	27	25	37	Requires much modification.
" Half-cream	120	30	16	41	
" Humanised	18.6	13.7	26	55.1	Lactic acid milk (1 in 9).
C. & G. lactic acid milk. Lacidac full-cream	145	25	25.5	35.2	" " "
" " " " Lacidac half-cream	129	28.3	15.5	41	Contains no fat.
" " " " Lacidac separated	104	33	0.7	49	Requires modification.
Cow's milk	20	4	4 (3-4)	4 (4-5)	
Cream—thick (centrifugal)	131	4	50	4	
" thin (hand-skimmed)	52	4	20	4	
Dried milks—Full-cream : average composition	140	25	23	34	
" Humanised	141	12	26	52	
Glaxo—Full-cream	140	22	26	42	
" Half-cream	120	29	14	46	
" Sunshine or Ostermilk (humanised)	137	17.4	19.4	56	Little used, since introduction of Ostermilk.
Hoos Albumen Milk	100	39	32.5	19.5	" " "
" diluted 1 in 13	—	3	2.5	1.5	When diluted 1 in 8 makes a good substitute for breast milk for infants over fourteen days old.
Horlick's Malted Milk	120	13.8	9	70.8	A lactic acid milk for diarrhoea, for temporary use only.
Human milk	20	1.75	3.5	7	Requires vitamins. A good temporary food when there is intolerance of fat.
Lactose	116	—	—	100	
Mead's Protein Milk	100	37	30.9	19.1	For diarrhoea.
Mellin's Food	105	8.9	0.18	82.6	Practically dextrin and maltose.
Neaves'	106	9.2	1	81.2	Practically flour.
Raw meat juice	6	5	a trace	a trace	
Ridge's Food	108	9.2	63	83.14	Practically flour.
Savory and Moore's Food	106	9.6	0.4	81	A carbohydrate addition to milk.
Sister Laura's Food	90	18.9	2.6	60	Practically baked flour; use with caution.
Skim milk	14.15	3.2	1	4.5	
Tru-food—Humanised	151	12	28	52	Contains added iron. Dried by spray process.
Tru-food—Full-cream	147	27	26	39	Dried by spray process.
Vitoleum Cream, 50 per cent.	131	—	30 & 50	—	Closely resembles human cream.
Whey (fat free)	6.10	1	—	0.45	
" (fatty)	13.3	0.95	2	4.7	
" (dry)	100	13.25	0.3	74	

given indiscriminately as substitutes for ordinary milk mixtures.

Citrated Milks. Citrated milks, like lactic acid milks, are useful in special cases, but I cannot recommend them for long continued use. The citration of milk prevents the coagulation of the casein in the stomach, and is thus indicated in cases in which there is considerable gastric intolerance. It is made by adding citrate of soda in varying proportions to the milk before consumption. The amount of citrate of soda to be added varies from 1 to 3 grains per ounce of undiluted milk.

Lime Water. As mentioned on p. 241, ordinary Lime Water is a snare and a delusion, either as an adjunct to digestion, or for the purpose of neutralising the natural acidity of cow's milk. On the other hand, Saccharated Lime Water contains quite a considerable quantity of lime, about fourteen times as much, and may be employed under doctor's orders in these cases in which additional lime is required in the food.

CHAPTER VII

VITAMINS AND DEFICIENCY DISEASES

OWING to recent discoveries it is now well-known that for the maintenance of nutrition and growth a much larger number of food elements is necessary than was previously thought to be the case. Since in the young animal, health and growth can be maintained on a diet of milk alone, it is clear that the latter must contain every essential food factor. On the other hand, it is extremely improbable in view of the conservative methods adopted by Nature that there are in milk any elements which are unnecessary. We now know that there are in milk approximately forty different constituents, including twelve or more mineral elements, and at least half a dozen different vitamins. If any one of these is entirely absent in the food, death will supervene in a comparatively short time, and, further, neither health nor growth can be maintained at a maximum unless all these essential elements are supplied in optimum amount. If either too much or too little is consumed, there will be some corresponding detriment to the well-being of the subject. We have just reached the stage at which we can recognise, by means of the symptoms produced, when certain of the more important elements are deficient in quantity, and, further, we are just beginning to learn how to estimate the dosage which is calculated to produce the best

results. Definite symptoms, for instance, are produced owing to deprivation of certain of the mineral elements, such as iodine, phosphorus, calcium, iron, copper, etc. Although the results of complete deprivation of any of these minerals can be predicted, it is not always easy to recognise the symptoms of partial restriction, or when a combination of symptoms occurs it is not always possible to ascribe any particular results to any one particular deficiency. For instance, in the majority of cases of that deficiency disease known as rickets, although the predominating symptom may be soft bones due to a defective supply of the anti-rachitic Vitamin D, nevertheless, there are often quite a number of additional symptoms due to other defects in the food. If a dietary is sufficiently defective in respect of one constituent to produce definite symptoms, it is almost certain that it will be defective enough to produce other deficiency symptoms.

HISTORY OF THE VITAMINS

The history of the vitamins reads almost like a fairy story, but, however interesting the tale, it is not possible in the following account to give more than the briefest outline.

The first milestone in the history was the discovery of the practical identity of infantile and adult scurvy. It had long been known that lime juice and green vegetables were not only effective in curing, but also in preventing the particular form of scurvy from which sailors and inmates of prisons frequently suffered when condemned to a diet of salted and preserved foods. Towards the end of the last century two distinguished

children's physicians, namely, Sir Thomas Barlow and Dr. W. B. Cheadle, discovered that the same treatment was also a cure for the comparatively common complaint of infancy to which they gave the name of scurvy rickets. This disease had become at that time particularly common owing to the wide use of certain patent and proprietary infant foods, which were often kept in tins or bottles for many months before they were used. These observers believed that some vital or living element in the food was destroyed in the keeping, and that typical symptoms of scurvy rickets were the result. It was this belief that subsequently gave rise to the name vitamins.

The next step in the series of discoveries which finally led to the identification of the various vitamins was the discovery in 1897 that one of the most prevalent diseases in the East, namely, beri-beri, was due to the removal, by milling or polishing, of quite insignificant and imponderable substances in rice which possess an anti-beri-beri influence. It was shown that if the cortical part of rice, which was removed by polishing, was given independently, the symptoms of beri-beri would be cured or prevented. This and similar discoveries led to the suspicion which has been amply confirmed, that there are attached to different varieties of food certain elusive and almost imponderable elements which have an influence on nutrition quite out of proportion to the quantities which are present, and that when food is deprived of these substances which we now call vitamins, certain definite and specific symptoms or combinations of symptoms would arise, to which the term "deficiency" has now been applied.

Each of the different vitamins, which are respectively designated as A, B, C, D and E, plays some definite rôle in nutrition, and when any one of them is absent or present in deficient quantity in any particular dietary it produces its own group of "deficiency" symptoms. It is now known definitely that the vitamins are not what one would call living or vital substances. Two¹ of them at least can be prepared synthetically, and only one of them, namely, Vitamin C, or the anti-scorbutic vitamin, is seriously damaged by cooking or heating. They are, in fact, what is technically known as thermostabile, that is to say, uninfluenced by heat. It is important to remember this because it appears to be a generally held belief that by the heating or cooking of food all the vitamins are destroyed. This is only true of the anti-scorbutic vitamin, otherwise, infants who are fed on different varieties of dried milk, which are, of course, cooked foods, would suffer from all sorts of deficiency diseases, which, as a matter of fact, is not the case.

Another point which should be remembered, and which is often forgotten in connection with the action of the vitamins, is that at no time in life are vitamins more necessary than at the beginning when growth is, or should be, most rapid. I mention this because it is often stated that it is unnecessary to give orange juice or other concentrates of Vitamin C to infants before they are two or three months old. As a matter of fact, Vitamin C should be given from the very commencement of life. With our present knowledge it is impossible to explain exactly the influence which is exercised

¹ Quite recently a third one, *i.e.*, the anti-scorbutic vitamin, has been prepared synthetically, and is probably identical with Hexuronic acid.

on nutrition by the vitamins. Their action may be roughly compared to the influence of the controls in a motor car on the general running of the machine. The controls regulate the direction and the pace at which the car moves, and so do the vitamins control and regulate the rates and directions of the various processes concerned in nutrition. Without vitamins the individual very soon perishes, in the same way that a motor car would rush to its own destruction if undirected by its controls.

Although I feel it necessary to refer briefly to the many possibilities connected with deficiencies of the several food factors, I would like to emphasise the possibility that symptoms can also be produced by excesses ; but for the time being I propose to confine my observations to the effects of deficiencies with respect to the following vitamins :—

Vitamin A. The anti-infective or growth-promoting factor.

Vitamin B₁. The anti-neuritic or anti-beri-beri factor.

Vitamin B₂. The pellagra-preventing factor (P-P).

Vitamin C. The anti-scorbutic factor.

Vitamin D. The rickets-preventing factor.

Each of these vitamins will now be separately described.

VITAMIN A

Properties. The chief function of this vitamin is to promote and maintain growth in young animals. Another function of great importance is its capacity to prevent infection by its action in preserving the

physiological integrity of the epithelial layers of the mucous membranes and thus preventing the penetration of bacteria. Either alone, or possibly in combination with other vitamins, it appears to possess certain prophylactic influences against such infective diseases as ordinary sepsis, puerperal fever, rheumatism and pneumonia.

One of the most interesting results of deprivation of this vitamin is ulceration of the cornea known as xerophthalmia or keratomalacia. Complete blindness may result from serious deprivation, or in lesser degrees of deficiency night-blindness may occur, in which a certain haziness of the cornea makes it impossible to see clearly in twilight or with defective lighting.

This vitamin also seems to have some influence on the development of the blood platelets, and consequently on the rate of coagulation of the blood; hence, it is possible that the frequent hæmorrhages which occur in new-born babies may be dependent to some extent on a deficient intake of this vitamin by the mother, or the new-born infant.

Sources of Vitamin A. This vitamin is found chiefly in animal fats, notably in cod-liver oil, beef suet and butter fat. It is also found in egg yolk, carrots and small-leaf green vegetables. The vegetable precursor of this vitamin appears to be a yellow pigment seen typically in carrots, to which the name carotene has been applied. Carotene can now be prepared in almost pure and crystallised form. It is highly susceptible to oxidation, but is stable at high temperature in the absence of oxygen. When it is consumed, it is converted into Vitamin A, which is colourless, but has practically the same properties. Vitamin A, in the form of carotene,

in combination with Vitamin D, also in nearly pure form, is now added to certain of the better class margarines, which are prepared from vegetable oils, and which would otherwise contain little or none of these highly valuable vitamins.

Vitamin A can be prescribed in the pure form of carotene, or in combination with Vitamin D, as adexolin, Crookes' Organon, or Parke Davis's Haliverol.

VITAMIN B

It has only recently been recognised that the Vitamin B complex consists of at least two separate and independent parts or factors which have somewhat different properties. They are practically always found associated together in natural food products, although the proportions of the two may vary.

Vitamin B₁, or the so-called anti-neuritic factor, protects against the Asiatic disease called beri-beri, and hence sometimes passes under the name of the anti-beri-beri factor. In its fully established form this disease is practically unknown in this country, but minor degrees of deprivation may produce symptoms which become merged in the more obtrusive manifestations of other deprivation diseases, such as rickets. Some of the symptoms which have been ascribed to partial deprivation of this vitamin are atrophy or want of development of the thymus gland, spleen, Peyer's patches, testicle and ovary, as well as a general defect in the development of the digestive tract and lymphatic tissues.

Valuable functions of Vitamin B₁ are to stimulate the appetite, prevent constipation and dilatation of the

stomach and intestines. It is possible that coeliac disease is also connected with want of this vitamin, although other defects in the dietary may be jointly responsible.

Vitamin B₁ is a water-soluble element contained in the germ and outside coverings of seeds. It also occurs in green-leaf vegetables, certain fruits, and in liver and kidneys of animals. It is specially well represented in peas, beans, and seeds generally. During the stage of germination, the amount is increased, as, for instance, when dried peas or beans, after previous soaking in water are allowed to germinate in a dark, warm place.

Vitamin B₁ is also largely represented in yeast, and yeast preparations, as well as in malt. Since this vitamin is contained in the germ or cortical portions of wheat, those who live largely on polished rice, or highly refined white flour, are liable to suffer from various degrees of deprivation, but this result can be compensated for by the independent consumption of yeast preparations, leguminous vegetables, malt preparations, or wheat germ preparations, such as Bemax. Vitamin B₁ is thermo-labile, that is to say, it loses its properties when exposed to heat; the degree of heating must, however, be considerable to destroy them entirely.

VITAMIN B₂

This vitamin, as already mentioned, is usually associated with B₁. It is well represented in yeast preparations, also in Marmite and malt. It is thermo-stabile, that is to say, unaffected by heat. It is sometimes called the P-P (pellagra-preventing factor) vitamin. Although we practically never meet with

fully developed cases of pellagra in this country, there can be very little doubt that we occasionally come across slight dermatological and nervous manifestations which may be due to the same causes which produce pellagra. Personally, I am inclined to think that that interesting disease called "Pink Disease" is in some way connected with want of this vitamin. Cases of it certainly seem to improve when they are given full doses of a yeast preparation. The view generally held now is that pellagra and pellagra-like diseases are due not so much to deprivation of Vitamin B₂ exclusively, as to a combination of deprivation of Vitamin A and Vitamin B₂. At the present day few babies go without either orange juice or cod-liver oil, so that if they suffer at all from vitamin deprivation it is with respect to either B₁ or B₂. To ensure against this, I advise the giving to young babies of a certain quantity of these vitamins, best in the form of Yestamin or Marmite. Since adopting this practice, I have noticed a great improvement in the general condition of the infants, especially with respect to the absence of a tendency to constipation.

VITAMIN C

This vitamin, which has anti-scorbutic properties, is one of the most interesting of all the accessory factors. Although it has been known for more than 200 years that fresh fruit juices, such as those of the orange, lemon and lime, all have the power of preventing scurvy in adults, it is only comparatively recently that it has been recognised that the same is true of infants. With the introduction of patent and proprietary foods about fifty years ago, a large

number of typical cases of infantile scurvy came to the notice of pædiatricians in this country. With the recognition of its identity with adult scurvy, the therapeutic properties of orange and other fresh fruit juices were utilised for treatment. Now that practically every infant, whether breast-fed or artificially fed, receives a small quantum of orange juice, scorbutic symptoms are very much less common. The symptoms are general tenderness which makes the infant strongly resent being handled, bleeding gums, blood in the urine, and subperiosteal hæmorrhages. Although these hæmorrhagic symptoms usually come on with startling rapidity in infants who otherwise appear in a condition of excellent nutrition, nevertheless, they are sometimes preceded by a period of unexplained listlessness and loss of weight. It is often found associated with rickets, and in the old days used to pass under the name of scurvy-rickets, although the two diseases are quite distinct and can occur independently. All babies, whether breast-fed or artificially fed, should receive a daily ration of some anti-scorbutic. I have found concentrated Californian orange juice, sold under the name of "Sun-kist," a most convenient form for either institutional or home use.

VITAMIN D

This vitamin is generally known as the anti-rachitic or rickets-preventing vitamin, and as it happens it is the vitamin about which most is known. It can be prepared synthetically in a practically pure form from certain species of fungi—ergot and yeast being the usual sources. As derived from these vegetable origins the

vitamin is practically inert, but by irradiation it can be converted into the active form. When prepared from fungi the vitamin is generally known as ergosterol—one of many forms of sterol. In the irradiated form the dosage is fairly accurately known—2 mg. given daily are sufficient to exercise a very powerful anti-rachitic influence in infants to whom it is given. Vitamin D in its active form is widely distributed in Nature, and is present in such foods as eggs, milk, liver, and in many animal fats. It is present in a particularly concentrated form in the oil which can be expressed from the livers of cod fish and halibut, also from other marine fish. Until it was discovered that this vitamin could be prepared in pure form synthetically, it was customary to supply it in the concentrated form in which it occurs in cod-liver oil. At the present time there seems to be a tendency to return to this practice, for some claim that better clinical results are obtained by giving this vitamin in conjunction with Vitamin A in the concentrated form of cod-liver oil or the oil from the halibut's liver, than by giving the synthetic preparations carotene and irradiated ergosterol in combination.

The exact way in which Vitamin D acts as a cure or preventive of rickets is not known, but in some way it controls the utilisation of calcium and phosphorus in the making of bone. Bones, of course, cannot be made without calcium and phosphorus, but they cannot be made from these minerals without the co-operation of Vitamin D, and it follows that the same is true of the development of the teeth, for teeth are only modified varieties of bone. It is possible that Vitamin D acts in some way as a carrier of calcium through the bowel into the blood stream, but whether this is so or not, this

vitamin does not appear to have the same anti-rachitic influence when it is injected into the blood as when it is given by the mouth.

Although good samples of cod-liver oil and halibut-liver oil contain very considerable quantities of Vitamin D, it is not always wise to rely upon these oils as exclusive sources of the vitamin, for very considerable quantities have to be given in order that a sufficiency of the vitamin may be supplied, and this is more particularly true of those samples of cod-liver oil which do not contain a large amount of the vitamin. On the other hand, by giving one of the many preparations of irradiated Ergosterol it is quite easy to give the full amount without upsetting the digestion. It must, however, be remembered that it is possible to give too much of this vitamin, with results very undesirable. Irradiated Ergosterol may be given in the form of Ostelin, or Ostelin Emulsion, or in tabloid form supplied by Burroughs, Wellcome & Co., or Crookes' Vitamin D (Organon), or in the natural form of Parke, Davis & Co.'s Standardised Cod-liver Oil. There are also several reliable preparations of halibut-liver oil now on the market, either alone or in combination with vitamin concentrate—for instance, Savory & Moore's Halibut Liver Oil with Vitamin Malt Extract; Parke, Davis & Co.'s Haliverol; and Crookes' Collosol Brand Halibut Liver Oil.

CHAPTER VIII

MILK : ITS GRADING AND STERILISATION

It has long been recognised that dirty milk is a prolific source of danger to infants, and there can be no question that the enormous drop in the infant mortality rate which has occurred during the last twenty-five years in this country is to quite a considerable extent due to improvements in the standard of the cleanliness of milk sold, whether raw, pasteurised or dried. It is equally certain that the more prevalent practice of feeding infants by the natural method is a further factor in this improvement. It is perhaps unnecessary to point out that the presence of dirt is not the only danger connected with the use of cow's milk. When unsuitably modified, or when given in inappropriate quantities, the danger to the baby is almost as great as when the milk contains a considerable quantity of dirt. Dirty milk is a danger, not because the foreign matter which it may contain—such as hair or dung from the cow, straw, hay, seeds, pollen, dust or soot from the air, or a thousand-and-one other varieties of “matter out of place”—produces symptoms of indigestion in the infant who consumes it, or because it is seriously harmful in any other respect, but because all such foreign matter is necessarily contaminated with micro-organisms of one sort or another, some of which may be pathogenic. A single hair may introduce hundreds of bacteria into milk, and the smallest particle of cow

dung may contain thousands of living organisms. Some of the bacteria which may be thus accidentally introduced into milk may be capable of producing definite diseases, such as tuberculosis, diphtheria, scarlet fever, blood poisoning or undulant fever. Others may be only capable of turning the milk sour, or of leading to its decomposition, but all milk that is dirty in the sense that it contains foreign matter, must, unless it is sterilised, also contain living bacteria, which will either spoil the milk as a food or injure in some way the person who consumes it.

Owing to the rapidity with which germs multiply in such a favourable medium as milk, even the cleanest and best varieties will soon be swarming with bacteria unless means are taken to check their multiplication. The most favourable temperature for bacteria to develop is between 50° F. and 110° F. At a lower temperature the rate of multiplication progressively decreases until at freezing point it practically ceases, and at temperatures much over 140° F. it not only stops, but in the majority of instances the bacteria are actually killed.

DESTRUCTION OF BACTERIA IN MILK

Sterilisation of milk, surgical dressings, instruments, etc., is dependent on the principle that practically all living organisms are killed on exposure to high degrees of temperature. The term "sterilisation" means to render a living organism sterile or incapable of propagating itself, and, in a bacteriological sense, it means to kill all living germs which are contained in any substance. As a matter of fact, it is difficult to render anything completely free of living germs, although it

is comparatively easy to render it relatively sterile, for there are certain forms of bacteria, namely, those which develop spores *i.e.*, “resistant forms,” which are exceedingly difficult to kill, even at high temperatures. Milk, for instance, which has been raised to a temperature sufficiently high to kill all the ordinary forms of bacteria, may subsequently become swarming with bacteria which have developed under favourable conditions of temperature and food supply out of these hibernating or “resistant forms” which have survived exposure to heat. To render milk definitely sterile it is necessary to repeat the process of cooking two or three times, allowing sufficient intervals between the heatings for the spores to develop out into ordinary forms of bacteria, which can be killed at the next heating. This method is known as “fractional” sterilisation, but it is a tedious and unpractical system of rendering milk safe. A better method is to submit the milk once, and once only, to a very high temperature, which will kill even the “spore-forming” varieties of bacteria. This can be done by heating milk in a closed vessel, or autoclave, to a much higher temperature than that at which it boils under ordinary conditions—*i.e.*, 217° F. If the milk is heated by such means to a temperature between 250° F. and 300° F. for a quarter of an hour or so, it will be rendered not only relatively, but absolutely, sterile.

PASTEURISATION

Practically all disease-producing bacteria are killed at a relatively low temperature, as will be seen by examining the following table of lethal temperatures:—

TABLE II

LETHAL TEMPERATURES FOR PATHOGENIC BACTERIA

Diphtheria.	.	.	136° F.	Heated for 10 minutes.
Typhoid	.	.	136° F.	
Pneumococci	.	.	125° F.	
Coli	.	.	140° F.	
Staphylococci	.	.	144° F.	
Tuberculosis	.	.	170° F.	
Streptococci	.	.	140° F.	

To secure safety for infants, it is quite sufficient either to scald the milk—that is to say, just bring it to boiling point, *i.e.*, 217° F.—or to heat it to a temperature of 145° F. for forty minutes. This latter method is what is known as pasteurisation. At the present time practically all the milk sold in London and in certain other large centres of population is pasteurised by this scientific method before it is delivered to the customers.

EFFECTS OF HEAT UPON MILK

It is often stated that the pasteurisation, sterilisation or boiling of milk, deprives it of its nutritive qualities. A great deal has also been written and spoken about the “vital” properties of milk, as if such properties were of the greatest importance from the point of view of nutrition. This is one of the old popular fallacies which die hard. As a matter of fact, the nutritive qualities of milk depend on something like forty different constituents, each of which plays some part in metabolism. The nutritive values of these forty constituents are not to any appreciable extent interfered with by heating or cooking, with one notable

exception, and that exception is in connection with one of the vitamins, namely, the anti-scorbutic vitamin, Vitamin C. This, however, is of very little practical importance in connection with the feeding of infants, for whether the latter consume raw or cooked milk, it is nowadays an invariable custom to provide a supplementary supply of this vitamin in the form of orange juice, or some other fruit or vegetable juice which contains this accessory factor in concentrated form.

Raw-milk faddists appear to forget that when milk enters the stomach of an infant it is submitted to disintegrating forces which are far more catastrophic than any which can be produced by mere heat. The function of gastric juice is to break up the chemical affinities which exist in milk and other foods and reduce the component constituents to the very simplest forms, which can then be assimilated. If milk has any "vital" properties deserving of such a name before it enters the stomach, it certainly has not many after it has remained there for a few minutes.

Although heat does not interfere to any appreciable extent with the nutritive properties of milk, both prolonged cooking or prolonged exposure to high temperatures affects its taste owing to the caramelisation or slight burning of the sugar. This, as we all know, occurs in the case of condensed, roller-dried, and boiled milks, each of which has its own peculiar taste. On the other hand, pasteurised milk has no adventitious taste, and for that reason is more popular for domestic use. An objection to the commercial pasteurisation of milk is that it is easy for contamination to take place between the time of heating and the time of con-

sumption. As far as infants are concerned, the only safe method is to heat the milk immediately before consumption, either by boiling or by sterilisation by some means or other, as, for instance, in a Soxhlet apparatus.

“ SAFE ” MILK

Some people attach great importance to the use of Grade A milk in infant feeding, in the belief that it is perfectly safe. In the nature of things, it is quite impossible for any milk, however carefully handled, to be bacteria-free, and consequently free from all dangers. The conditions under which milk can be sold as Grade A are, that at the time of sale it must not contain more than 200,000 bacteria per cubic centimetre, and no coliform bacteria in 1/10th c.c. A still higher grade is that which is called Grade A (T.T.). Such milk must be derived from cattle which have been regularly tuberculin-tested. The highest grade of all is certified milk. This milk must not contain more than 30,000 bacteria per cubic centimetre, must contain no coliform organisms in 1/10th c.c., and must also be tuberculin-tested. Milks of these high grades command an enhanced price, and are a guarantee of cleanly methods both in the dairies and in the distributing centres, and further, they must be sold in sealed bottles. It is also guaranteed that such milk must have been cooled down rapidly after milking, and kept at a low temperature. At favourable temperatures—that is to say, any temperature between 50° F. and 120° F., bacteria multiply at an enormously rapid rate, so that milk which at one moment can be sold as certified milk, but which for some time subsequently has been

kept in a warm place, cannot be sold a few hours later as Grade A.

The general conclusion to be drawn from this is that the only form of dirt in milk that is really dangerous to infants is that which contains pathogenic bacteria. These are most conveniently destroyed and rendered harmless by "scalding" or boiling immediately before use. No raw milk can be safe for infant consumption.

CHAPTER IX

COMPARATIVE DIGESTIBILITY OF DIFFERENT FOODS

DIGESTION consists in the resolution of solid and non-diffusible varieties of food into forms which are both liquid and capable of assimilation. These changes are effected partly by mastication, partly by shaking up within the stomach and intestines, and partly by exposure to the action of powerful solvents both in the stomach and in the intestines.

The stomach has a remarkable capacity of discriminating between foods which are capable of being digested and those which are not. Within somewhat wide limits, it rejects by vomiting those which it cannot digest itself, as well as those which are incapable of being digested further down the digestive tract.

Some of the foods we eat can be digested, that is to say, rendered liquid and assimilable by the solvents present in the stomach—*i.e.*, gastric juice—but others can only be digested by the combined action of pancreatic, intestinal, and biliary secretions. Some substances are soluble in water, others in acid or alkaline media, others must be exposed to the solvent action of such powerful agents as the enzymes or ferments which are secreted by the various digestive glands which pour their products into the alimentary tract. Pepsin, in combination with hydrochloric or other acids, has a very powerful solvent action on nitrogenous or protein foods, such for instance as the caseinogen of milk, white

of egg, meat, fish, etc., but it does not promote the digestion of carbohydrates (starches or sugars), or of fats. The various enzymes contained in the pancreatic secretion are capable of digesting all varieties of food—*i.e.*, proteins, carbohydrates, and fats—but they must act in combination with alkalies which render these enzymes “active,” in the same way that pepsin itself is “activated” in the stomach by acids.

Active pepsin converts all kinds of proteins, whether initially liquid or not, into peptones, which, owing to their comparatively small molecular size, can diffuse through the intestinal walls and thus enter the bloodstream. As a rule, only the early stages of the conversion of proteins into assimilable forms take place in the stomach, the process is completed in the intestines by the activated pancreatic enzyme, trypsin.

The digestion of carbohydrates depends on their conversion into the simplest forms of sugar—*i.e.*, dextrose or levulose, sugars which are of sufficiently small molecular size to diffuse through the intestinal wall into the blood. Starches, which are quite insoluble and incapable of passage through the intestinal wall, must first be converted into maltose, by the so-called diastatic enzymes contributed partly by the salivary glands and partly by the pancreas. Maltose itself is subsequently converted by other enzymes into dextrose. Even cane sugar, though readily soluble, is not available for assimilation and purposes of nutrition ; it must be converted into still simpler forms of sugar, *i.e.*, dextrose and levulose, by what are called “inverting” enzymes or invertases. Fats are digested by the so-called fat-splitting ferments—the lipases, mainly contributed by the pancreas (steapsin), and partly by the *succus*

entericus. These lipases convert ordinary neutral fat such as butter fat or olive oil into glycerine and fatty acids (palmitic, stearic and oleic), that is to say, into forms which can be easily assimilated and utilised.

Ordinary foods usually consist of combinations of proteins, carbohydrates and fats. They very rarely consist of one single variety. Milk, for instance, has representatives of all the above varieties, and consequently, if it is to be digested completely, must be successively submitted to the solvent action of gastric, intestinal and pancreatic secretions. If the combined action of these solvents is unable to complete digestion, a state of indigestion will be established, with symptoms which will vary according to the time and place at which the failure occurs. Gastric indigestion is usually signalled by vomiting, while intestinal indigestion reveals itself by diarrhoea, colic, wind, as well as by the presence of abnormal substances in the stools.

From the foregoing statements it will be readily concluded that it must be very difficult or impossible to classify foods in order of digestibility. With a weak gastric digestion, one kind of food may prove very indigestible in the stomach, whereas with a weak pancreatic digestion and a good gastric digestion, another kind of food may prove indigestible in the intestines. At the best we can only make very general statements with regard to the relative digestibility of different foods. It is obvious that foods which require no digestion at all, and are ready without any further change for immediate absorption, are those which must head the list, thus peptones, glucose and plain water must obviously occupy foremost places, so also must pre-digested and peptonised foods, provided that the pre-

digestion or peptonising has been carried far enough. Colostrum also, since it can be absorbed and utilised without any digestive changes at all, must occupy the same position, but when we attempt to classify mixed foods, such as milk or milk preparations, in order of digestibility, our real difficulty commences, for one variety may impose no task on gastric digestion, and thus appear highly digestible, while another food may be difficult of gastric digestion and yet be perfectly amenable to pancreatic digestion if once it passes the sentinel barrier of the pylorus.

The main criteria of digestibility are absence of vomiting, colic, wind, foul-smelling motions and indigestible residues of food in the stools. Judged on this basis, I have arranged the following foods in order of merit, *i.e.*, of digestibility :

1. Colostrum and completely pre-digested foods, glucose, peptones.
2. Partially pre-digested foods, such as Benger's, Horlick's Malted Milk, etc.
3. Unmixed foods, such as sugar, egg albumen, etc.
4. Fat-free whey.
5. Fat whey.
6. Breast milk.
7. Condensed milk.
8. Dried milks (roller process), Glaxo, Cow and Gate, Ambrosia, etc.
9. Dried milks (spray process), Trufood, etc.
10. Cow's milk dilutions, citrated cow's milk, lactic acid milk.
11. Whole milk.

One very definite inference to be drawn from the

order of classification which I here submit is that undiluted cow's milk is of all the foods that are commonly given to infants, the most indigestible—further, that colostrum and completely pre-digested foods are the most digestible, and therefore the safest to give to new-born babies or those suffering from feeble digestions. A study of the order of digestibility given in this list suggests how very illogical it is to change from breast feeding, when it disagrees, to dried milk or ordinary milk modifications. If a food proves on trial to be indigestible it should be relinquished, and a more easily digested one should be substituted for it. Since peptonised milk stands so high in the list this variety of food is more likely than most others to prove successful, and, if successful, the degree of peptonising should be decreased as soon as circumstances allow. In those cases in which it can be clearly established that the incidence of indigestion falls on some particular part of the digestive tract, an attempt should be made to “temper the wind to the shorn lamb,” and provide some food which does not unduly strain the disabled functions. For instance, when the trouble is mainly connected with some disability in the stomach, usually shown by vomiting, this organ should be relieved as far as possible of the task of digesting protein foods, and for this reason a food or milk modification should be chosen which contains as little of the protein element as is possible. Good temporary foods are Horlick's Malted Milk, fat-free whey, or peptonised foods of any kind. If examination of the stools, their irritating effects on the skin, or their frothy condition, suggests that starches or other carbohydrate foods are poorly digested in the bowels, a food should be selected which

has a low carbohydrate content, such as a dried milk without additional sugar, or unsweetened condensed milk.

Incapacity to digest fat is shown by the presence of fat, not soap, in the stools, or by immediate vomiting, especially if there is bile in the vomited material. Food should then be selected which has a low fat content—such, for instance, as Horlick's Malted Food or fat-free whey. Lactic acid milk is specially indicated when the vomit shows a deficiency of hydrochloric acid, or when the stools are particularly foul smelling. On the other hand, citrated milk is indicated when the vomited matter is unduly acid but the stools well digested. Changes should be made in the food only on a considered plan, and never in haphazard manner in the hope that a suitable one will be found.

CHAPTER X

INDIGESTION IN BABIES AND YOUNG CHILDREN

No one, as far as I know, has yet succeeded in making a really satisfactory classification of all the many different forms in which indigestion and dyspepsia present themselves in infants and children. I do not flatter myself that I shall be able to do that which others have failed to do, but I think I can make the subject of indigestion a little easier to understand by explaining what digestion is, for, in the light of such knowledge, it is possible to realise what happens when this process fails or goes wrong ; in other words, what indigestion itself is.

The term indigestion or dyspepsia properly implies that food which is consumed remains undigested, or is improperly digested in the alimentary tract, causing thereby certain symptoms. If, therefore, we thoroughly realise this interpretation of the term we shall be in a better position to understand how it is that there are so many different varieties of indigestion, and also, to some extent, how to treat, and possibly also how most effectually to prevent them.

WHAT DIGESTION REALLY MEANS

When we make use of the term digestion in its literal sense, we mean the resolution of food into soluble or liquid forms, which can pass out of the lumen of the

bowel into the blood or lymphatic vessels in much the same way that water can pass through the pores of a charcoal or porcelain filter. This resolution of solid substances is carried out in different sections of the digestive system by various means, some mechanical or physical, and others chemical.

In the first place, to facilitate the solution of solid food, teeth are provided for the purpose of mastication or for mincing it up into small pieces. After, or in conjunction with this operation, the food is thoroughly mixed with saliva in the mouth and formed into well lubricated boluses, which can easily slip down the gullet or esophagus into the stomach, where each bolus or mouthful as it arrives is shaken up with the gastric secretions. These consist of water, hydrochloric acid and pepsin. Gastric juice is a very powerful solvent of one particular kind of food—namely, protein. Solid pieces of meat, fish, egg, curd of milk, cheese, and all other nitrogenous foods become soluble when in contact with gastric juice, and are converted into liquid peptones, which can filter through the bowel wall into the blood stream. Gastric juice cannot, however, dissolve starchy or farinaceous foods, although solid pieces of such substances which have escaped division by the teeth are rendered soft and creamy when they are thoroughly shaken up in the stomach by the churning or peristaltic movements which help in the resolution of protein substances. After a meal the stomach gradually empties and its semi-digested contents pass into the small intestine by the intermittent opening of the pyloric sphincter, which guards the exit of the stomach. In this way the creamy and fluid contents of the stomach escape into the duodenum or first part of the

small intestine, at a carefully regulated rate. The pylorus stands sentinel, as it were, over the intestine, and only allows fluids or finely divided solids to pass out of the tolerant stomach into the more sensitive and delicate parts of the alimentary tract. In the intestine the partly digested food from the stomach is intimately mixed with other solvents which can render liquid almost every variety of solid food, provided the latter is sufficiently finely divided and is not too much in amount. These solvents are mixed secretions from the pancreas, liver and intestines. We thus see by what a complicated series of events solid forms of foods are rendered soluble and capable of passing through the bowel wall.

PAIN OF INDIGESTION IS A PROTECTIVE REFLEX

If any one link in this chain of independent processes fails to contribute its share in the work food is left undigested, and some form of indigestion results. Indigestion will, therefore, follow through want of mastication, from failure of the stomach to secrete gastric juice in sufficient amount or of adequate potency. It will also result from failure of the liver to supply bile, or of the pancreas to supply pancreatic juice, or of the intestine to elaborate *succus entericus*. Whenever any of these processes fail, the presence of undigested food in some part of the alimentary tract sets up what is called a reflex action, a protective reaction which is primarily designed to acquaint the individual who has consumed such food with the fact that he cannot digest it, and had better desist from taking more of it. Under such conditions the sufferer usually experiences some

pain or discomfort which is the outward expression of the reaction which is taking place in the interior of his digestive tract. Although under normal conditions an infant does not consume solid food, it must be remembered that by the formation of curds part of the milk becomes solid shortly after it enters the stomach.

When the stomach fails to digest or break up solid food there is usually pain referable to the stomach, and often also rejection of the contents of the latter by vomiting. With intestinal indigestion there is usually, in addition to colicky pains, a rapid transport or evacuation of the offending material through the length of the bowel and out at the anus ; in other words, the individual will have diarrhoea. It will thus be noticed that when there is failure to digest solid food, there results not only pain, but a disturbance or perversion of those functions whereby food is conveyed through the length of the alimentary tract. These latter functions are called the motor functions of digestion. They are quite distinct from the solvent functions or digestive functions proper, and are the functions which, when disturbed, give the pain and discomfort usually associated with indigestion.

Under normal conditions we are totally unconscious of the operations of the motor functions, although they practically never cease during waking hours, but the moment they go wrong, when they act too violently or in an irregular manner, or even with insufficient force, we are made conscious of their existence by the development of pain or discomfort. We feel pains in the stomach when the churning or peristaltic movements of this organ are violent, and these pains are often

accompanied by vomiting. We also feel pain when the pyloric sphincter contracts strongly and closes the gateway. We feel gripes or colic when the peristaltic movements whereby food is carried along the length of the intestine are too forcible or irregular, resulting in what is commonly called wind, or diarrhœa. We also feel pain when there is constipation, owing to the ineffectual efforts of the muscular wall to remove the obstruction.

THE PAINS OF INDIGESTION CAN BE CAUSED BY OTHER THINGS BESIDES UNDIGESTED FOOD

It will thus be understood that the pains and discomforts of indigestion are, for the most part, directly due to disturbances of the motor functions, and that the accompanying symptoms are protective in character. But these motor mechanisms can be unduly stimulated so as to cause not only pain, but perverted functions also, by other forms of irritation besides that of undissolved food. I need not emphasise the fact that one can suffer from very sharp colicky pains by the taking of purgative drugs, such as calomel or colocynth, or even Epsom salts, or by drinking strongly acid or irritating fluids, such as vinegar or lemon juice. It will therefore be noticed that liquids can cause symptoms of indigestion just as much as can solid pieces of food, by reason of their stimulating properties. The truth is, the presence in the alimentary tract of any substance which, so to speak, is foreign to it, or even the presence of normal food in abnormally large quantities, may cause symptoms of indigestion by the irritation they set up ; or, as I should prefer to put

it, cause a reflex or protective reminder to the individual that he has consumed some food or substance which is detrimental to his health.

THE PROPER EDUCATION OF THE MOTOR FUNCTIONS IS IMPORTANT

Since, as far as digestion is concerned, our comfort is largely dependent on the way in which the motor functions of the stomach and bowel are carried out, or on the way in which they respond to stimulation, it is of the utmost importance that these essential functions should be established on the soundest possible basis. They should be so organised and educated that the works are not easily upset by small indiscretions, or for insignificant reasons ; but it is equally important that they should be adequately sensitive to gross abuse. This emphasises the importance of the early training or education of these functions. If a baby is correctly and physiologically fed so that for the first year of his life he never has occasion to vomit or to get rid of undigestible intestinal contents by the act of diarrhoea, it is highly probable that in later life he will not be liable to suffer from any of these symptoms unless the dietetic indiscretions are of a very flagrant character. On the other hand, babies who have frequently had attacks of diarrhoea, vomiting, or colic during the early years of life, almost invariably grow into children with very susceptible digestive reflexes. They show some sign or other of indigestion as the result of colds, chills, atmospheric and climatic conditions, or even emotional disturbances. In fact, they become what may be called the subjects of nervous dyspepsia.

I propose now to speak of some of the individual varieties of indigestion which are mainly met with among infants and young children. As I said at the beginning of this lecture, I have never been satisfied with any of the classifications of the different varieties of indigestion which have been offered from time to time, and I do not mean now to attempt to submit one. I propose only to give certain representative and typical forms of indigestion which are commonly met with.

VOMITING

Vomiting, next to crying, is probably the commonest symptom in young infants, and both have this in common, that they are definitely protective reflexes and consequently might be included in the category of physiological functions. Vomiting is a valuable protective reflex, especially in the case of babies, because it enables food to be rejected which might otherwise have still more disastrous or even fatal consequences if retained. The reflex is fully established at birth; indeed, it is frequently called into play before birth owing to the foetus swallowing too much amniotic fluid. It is a very sensitive and delicate reflex which may easily become so over-developed and tyrannical under conditions of abuse, that vomiting may take place almost automatically without provocation, and consequently, its protective significance may become obscured.

MECHANISM OF VOMITING

An understanding of the mechanism of vomiting will help to explain some of the concomitants connected

with it, which without such explanations may be difficult to interpret. For all practical purposes we may distinguish two kinds of vomiting—one in which some of the contents of the stomach are expelled by abnormal and irregular contractions of its muscular walls ; in fact, by a perversion of the normal peristaltic movements. This variety of sickness includes what is commonly described as possetting or overflow. Vomiting in such cases is comparatively gentle, and the stomach contents flow out of the mouth in a slow stream. Vomiting of this kind is quite distinct from that forcible and violent ejection of the whole of the stomach contents which is commonly known as “projectile.” Both varieties can become habitual, but projectile vomiting depends on the spasmodic contractions of the abdominal muscles (recti, transversales, etc.), which forcibly squeeze the stomach against a rigidly fixed diaphragm. Provided the cardiac sphincter at the esophageal end of the stomach is opened at the same moment, nothing can prevent the contents of the stomach being violently discharged into the esophagus and out of the mouth, and the fuller the stomach the more projectile the vomiting. This co-ordinated muscular effort is controlled by a centre—the vomiting centre in the medulla, which is closely associated with the respiratory centre ; indeed, vomiting of this type is, as a matter of fact, a modified and violent expiratory effort, differing little from coughing, except that in the case of the latter the glottis is suddenly relaxed at the acme of the expiratory effort, whereas in vomiting it is kept firmly closed. The vomiting centre can be excited by various forms of stimuli, just in the same way that the respiratory centre can be affected by many different forms of excitation

which induce coughing, sneezing or other expiratory efforts.

The events which evoke action of the vomiting centre are usually reflexes initiated in the stomach. Common varieties are over-filling and delayed emptying, both of which are characteristic elements of the vomiting in cases of so-called pyloric stenosis. Any violent stimulation of the gastric mucous membrane, by undue acidity of the stomach contents, by mustard, or other chemical irritants, can have the same effect, but the vomiting centre can also be directly stimulated into activity by conditions such as high temperatures, toxins circulating in the blood, by emetics such as apomorphin or emetin administered hypodermically, as also by tumours or inflammatory conditions, such as meningitis which mechanically excite the centre. These explanations of the two varieties of vomiting should make it quite easy to understand not only the cause of any particular case of vomiting, but, what is more important, how to cure and prevent it.

As far as infants are concerned, the most usual cause of vomiting is bad feeding, either directly or indirectly. The vast majority of cases which I see are those in which the mistakes in feeding have been made during the first few days in life, and in which the reflex has become firmly established and made very sensitive. This emphasises the importance of preventive measures in breast feeding, such as regulating by the "test feed" the amount of milk consumed; in artificial feeding by the avoidance of foods which can cause violent reactions in the stomach. The mistake which is generally made is to give cow's milk during the so-called colostrum period—that is to say, during the first three or four

days of life. The coagulum of cow's milk is extremely likely to set up spasm of the pyloric sphincter, which is essentially a protective reflex.

A METHOD OF SAFEGUARDING AGAINST VOMITING

If the following plan is adopted in cases in which artificial feeding is used in the case of new-born infants, I can practically guarantee that undesirable reactions or habits of this kind will not be established. The food to be given should always be of such a nature as not to form a coagulum in the stomach. The best variety to use is cow's milk modified to breast standard and very thoroughly pre-digested for two-and-a-half to three hours before being given to the infant. On the first day of life the amount given should only be one measured drachm, on the second day 2 drachms, and on the third day 4 drachms. This rate of increase may be continued until the amount at each feed and for the twenty-four hours fulfils the caloric requirements of the infant as estimated by its weight and age taken in combination. When the full amount, which generally takes five or six days to reach, is attained, the length of time of peptonisation may be decreased by ten minutes less every day. If this plan be pursued, the peptonisation can be omitted at the end of about ten days. The intervals between the feeds are, in my opinion, important, and I greatly deprecate the practice which of recent years has become more and more common—namely, of giving only five feeds during the twenty-four hours at intervals of four hours. It is implicit in this method that the amount of the food the infant has

to take at each feed is greater than if the three-hourly method with six feeds in the twenty-four hours is employed—that is to say, if the total amount in the twenty-four hours is to be sufficient to satisfy the caloric requirements. When the above method is employed, good habits are established from the very first on a sure foundation, and they are not likely to be disturbed subsequently by any ordinary events.

THERAPEUTIC RE-EDUCATION

The cure of vomiting is, as I have indicated, much more difficult than its prevention. In the majority of cases, by the time special treatment is called for the vomiting has become habitual, and the only way to break a habit of this kind is by re-education. There are two methods of carrying out this treatment. The first is as follows: For twenty-four hours the infant should be starved and only allowed a few teaspoonfuls of sterile water. On the second day, for the sterile water may be substituted a solution of Secway (whey powder) in the strength of one in eight, and the amount to be given at three-hourly intervals should not be more than $\frac{1}{2}$ oz. On the following day the amount may be doubled, and if vomiting does not recur, increased on the next day to 2 oz. On the fourth day the amount may be further increased to 3 oz., and from that time forward the mixture may be strengthened and its food value increased by the gradual addition of Vitoleum Cream, and, later, humanised dried milk, such as Sunshine Glaxo may be added. In this way the stomach may be gradually re-educated to tolerate ordinary milk modifications. Another and a very simple way which

can usefully be employed in the case of infants over six weeks of age is to use undiluted condensed milk in very small quantities. If from 1 to 2 drachms by weight of condensed milk are given to a baby of this age, vomiting is practically impossible, and if, two-and-a-half hours after a feed of this kind has been given, the infant is allowed to have 2 or 3 ozs. of sterile water out of a bottle in the usual way, it will generally be found that if the infant vomits any of this it will not contain any residue of the condensed milk taken previously, proving that the milk has passed on into the intestines. In this way the infant's caloric requirements can be easily satisfied, and in the vast majority of cases the habit of vomiting is relinquished. The method of giving young infants milk feeds thickened with starchy or farinaceous foods is thoroughly unsound, for young infants cannot digest starch, and consequently no advantage, but rather the reverse, is secured if feeds of this nature are retained. Personally, I never use thickened feeds containing starch until I am quite sure the infant is old enough and capable of digesting farinaceous food of this kind. That is to say, till it is about three months old.

PYLORIC STENOSIS : A MISNÖMER

And now for a few words about so-called congenital hypertrophic pyloric stenosis. The commonly held views on this subject are, in my opinion, wrong. In the first place this condition is practically never congenital. It only represents one of the acquired forms of vomiting which are produced by faulty methods of feeding new-born infants. In the second place there is in my experience no stenosis of the pylorus, if by "stenosis"

is meant organic narrowing. In these cases the pyloric sphincter is not narrowed, but it is actually shut, barred and bolted. No ordinary means will induce it to relax. If, however, it can be induced to relax, the food passes out perfectly normally—hence the possibility of a cure, which would not be the case were the stenosis organic. The treatment of these cases therefore consists in measures directed to the relaxation of the spasm which maintains permanent closure. The spasm may be so obstinate that the quickest and surest remedy is to cut through the sphincter by means of a surgical operation. In the hands of an experienced and skilful surgeon the results are so excellent that there is no need to fear an unsuccessful result, but in the vast majority of cases there is no need to employ other than medical measures. The spasm can sometimes be relieved by chloral, opium, bromide or luminal, administered in appropriate doses, and the pyloric reflex can then be re-educated in the manner which I have described above as suitable in cases of habitual vomiting.

INDIGESTION DUE TO DISTURBANCES OF INTESTINAL FUNCTION

Turning now to the more numerous forms of intestinal indigestion, to which infants and young children are subject, I may repeat that the chief symptoms indicative of this condition are colicky pains, wind, diarrhoea, and constipation. It is not by any means easy to ascribe any one of these symptoms, or any combination of them as they arise, to the particular cause which excites them.

CAUSE OF INTESTINAL INDIGESTION REVEALED BY THE CHARACTER OF THE STOOLS

An intelligent examination of the stools is a very great help in the diagnosis. The presence of undigested remains of food will often indicate the particular element in the dietary which offends and causes the symptoms. In the case of older children in whom I have had the bowels lavaged by the high method of irrigation, I have often found in one wash-out several whole raisins, currants, large pieces of undigested banana, potato and orange peel, together with the cores and skins of apples, although I have been assured by the nurse or mother that the child was never allowed to eat such things, and that it always masticated extremely well. The following additional information may be derived from an examination of the stools :—

(1) They may be highly offensive in character. Stools of this kind indicate failure of protein digestion, and are usually, though not always, alkaline.

(2) Frothy stools indicate, as a rule, failure of carbohydrate digestion. Under such conditions microscopic examination will usually reveal the presence of unaltered starch granules, and such stools are generally acid.

(3) The presence of unaltered fat indicates failure of fat digestion. The presence of fatty acids and soaps in the stools does not indicate fat indigestion so much as failure of fat absorption.

(4) Light coloured stools indicate defects in biliary or pancreatic secretion, possibly both.

(5) Excess of glairy or stringy mucus in the stools, especially if combined with blood, indicates acute inflammation or catarrh of some part of the alimentary

tract. If the mucus is unmixed with faecal matter, the inflammation or catarrh will usually be of the lower part of the bowel, in fact, it is indicative of acute colitis of the dysenteric type. If the mucus is intimately mixed with faecal matter the inflammation is usually of a higher part of the bowel.

(6) Dry or caked plaques of mucus, like pieces of hard-boiled white of egg, adhering to the surface of constipated motions, usually indicate some form of chronic colitis.

All these forms of intestinal indigestion are common enough among young children, but it must be remembered that catarrhal inflammation of the bowel, from whatsoever cause originating, will lead to increased peristalsis and a too rapid transit of food through the bowel, and hence explains the presence of undigested food in the stools.

NORMAL STOOLS OF THE NEW-BORN

The black or dark green tarry matter of which the stools of the new-born normally consist, represents an accumulation during the last few months of pregnancy of various secretions and excretions of the liver and other organs of digestion. To this there is added a small quantity of solid matter, hair, epithelial cells, etc., which the foetus swallows along with amniotic fluid. Meconium stools persist for two or three days after birth, and then gradually change into the normal variety. Meconium subserves a useful purpose in providing semi-solid material for the stools until, with the establishment of lactation, material is provided from food sources. Hence, it is a mistake to clear out the meconium with castor oil or other aperients.

NORMAL STOOLS AFTER THE MECONIUM PERIOD

On the third or fourth day the stools should assume a normal "baby yellow" appearance. The colour is due to bile colouring matter, while the solid material consists for the most part of insoluble soaps, intimately mixed with varying quantities of mucus, epithelial *débris*, and bacteria. Contrary to what is generally believed, they rarely contain undigested casein or other food residues. The insoluble soaps are derived from butter-fat in the milk, which, under the influence of a fat-splitting ferment (lipase), is broken up into its two constituents, glycerine and fatty acids. The fatty acids unite with either calcium or magnesium to form insoluble soaps. All normal stools are consequently soap stools, and it is quite wrong to credit "soap stools" with any pathological significance. The stools will differ in character according to the amount of mucus they contain, and in colour according to the particular change which has taken place in the bile. Bile can be almost any colour of the spectrum, but it is usually either yellow or green. The normal colour of the stools is yellow, but sometimes when the stools are hurried through the bowel too rapidly for the ordinary changes to take place the colour may be green, or even almost white when there is great delay in opening the bowels.

The odour of the stools mainly depends on the presence or absence of decomposition of the proteins of the milk. If the proteins are properly digested and absorbed in the small intestine, no residue will remain in which decomposition can occur in the large bowel,

but if owing to any reason the proteins are not adequately digested and absorbed before they pass the ileocæcal valve, they are decomposed by the bacteria which are always present beyond this junction between the small and the large intestine. The normal odour of the infantile stool is due mainly to the presence of fatty acids.

The number of stools passed in the twenty-four hours is largely a matter of habit, but is also dependent on the quantity and quality of the food, also on the frequency of the feeds and the rate of feeding. Too rapid feeding, too great a frequency of the number of feeds, as well as excess in quantity, all tend to increase the number of the stools, the optimum number for which in the twenty-four hours is, in my opinion, two daily—one in the morning and one in the evening.

FREQUENT ACTIONS OF THE BOWEL

Frequent movements of the bowel, not actually amounting to diarrhœa, are among the commonest of symptoms displayed by young babies, and more especially in the case of those breast-fed. The condition represents, as already mentioned on p. 92, a disturbance of the motor functions of the bowel, which leads to the rapid passage of its contents through the entire length of the alimentary tract, and is not necessarily connected with, or due to, indigestion proper. It is usually accompanied by an irritable condition of the rectum and a high degree of sensibility of the defæcation reflex. In such cases it occasionally happens that whenever the infant has a feed a small slimy motion is passed containing what are usually described as “undi-

gested curds." This result is due to the setting up of peristaltic movements which pass from the stomach along the small intestine, and finally reach the colon and rectum. Such frequent actions do not necessarily imply that there is anything wrong with the food, or that the infant is suffering from any difficulty of digestion, but simply that the act of sucking or swallowing initiates a series of peristaltic movements which ultimately culminate in the passage of a motion. This soon becomes a fixed and intractable habit. The prevention of this troublesome condition is easier than the cure. One point to remember is that hard or prolonged sucking tends to promote active peristalsis. No infant should be allowed to remain at the breast, or suck at the bottle, for more than fifteen minutes at a time, and if it sucks too strongly or gulps its food, the feed should be controlled by "test" feeding in the case of breast-fed infants, or in the case of artificial feeding by giving the milk in a spoon.

A dose of castor oil sometimes helps by the reactionary constipation which it tends to produce, and so by its soothing influence may a bismuth mixture with opium or other sedative, but systematic training to use the chamber at stated times is better calculated to inculcate good and regular habits. It must be remembered that the frequent action of the bowels is not inconsistent with starvation. Starvation stools, however, are characteristic. They are small, slimy, stained with bile, and often contain those little white curds or "sago" grains which have the appearance of hard-boiled white of egg, and which are usually described as "undigested curds." It cannot be repeated too often that these curds consist of insoluble soap entangled in mucus,

and are not casein curds, and so far from indicating failure of the digestive processes, their presence implies that the fat consumed has undergone the normal stages of digestion which lead up to the formation of soap.

SUMMER DIARRHŒA IS AN INFECTION

Cholera infantum, or the acute summer diarrhœa of infants, is a case in point. The exciting cause of this form of diarrhœa is some virulent bacterial infection. These attacks either kill outright or leave the bowel in such a weakened condition that intestinal indigestion remains as an aftermath. Similarly, in infants, most acute infections, such as the common cold, influenza or pneumonia, are accompanied by diarrhœa.

INTESTINAL TOXÆMIA THE COMMONEST FORM OF INDIGESTION

One of the most serious, as it is certainly the most common form of chronic intestinal indigestion, is often unaccompanied by very obtrusive or noticeable symptoms of dyspepsia. The form of indigestion to which I refer is known as intestinal toxæmia. It is mainly characterised by constitutional symptoms, such as irregular temperatures, loss of weight, and a great variety of nervous symptoms. These symptoms are apparently so unconnected with the alimentary system that they are often not regarded as due to indigestion at all, but rather as due to tuberculosis or some nervous condition.

Intestinal toxæmia is primarily due to failure of digestion of protein food, either in the stomach or in

the small intestine, or in both. When such food is not properly digested in the normal way by gastric or intestinal secretions, it falls a prey to the attacks of bacteria in the large bowel, with resulting putrefaction. Such decompositions cause varying quantities of poisonous substances of the nature of toxins or ptomaines to develop in the bowel. These products are soluble and absorbable and hence find their way into the blood or lymphatic channels, for the most part into the blood, in which they are carried by the portal vessels to the liver where they are detoxicated or rendered harmless by the activity of the liver cells. As long as these poisonous substances are effectually deprived of their sting by liver activity, no serious results are likely to follow, but there is a limit to the liver's endurance, and when this limit is reached and its detoxicating functions are exhausted, these noxious substances pass on into the general circulation and damage the cells of the nervous system as well as other delicate tissues, causing thereby a series of symptoms, among the more common of which in children beyond the age of infancy are :—

- (1) Nervous irritability, disturbed sleep, night terrors, bed-wetting, lethargy, want of energy, or even convulsions or epileptic fits.
- (2) A sallow complexion, dirty tongue, dark rims to the eyes, a drawn appearance of the face, and skin diseases such as eczema, nettle-rash, and offensive perspiration.
- (3) Fœtid breath, lack of appetite and periodic attacks of actual sickness.
- (4) Amongst the constitutional symptoms there may

be irregular temperatures, loss of weight, and a condition of acidosis or ketosis.

- (5) Disturbances of the urine, with the presence of urates, phosphates, or excess of ammonia.

These symptoms in varying combinations constitute a clinical picture which is as well known as it is unmistakable. But the absence of the ordinary symptoms of indigestion, except perhaps the offensive stools and occasional abdominal pains, obscures the real origin of the condition, and raises suspicions, as I have already mentioned, of tuberculosis or some other constitutional disease.

TREATMENT OF INTESTINAL INTOXICATION

The treatment of intestinal toxæmia is primarily dietetic. The amount of decomposable foods, such as meat, fish and eggs, or even milk, permitted for young children should be limited in amount. The diet should be mainly a vegetable one with fruit and farinaceous foods, with plenty of vitamins and mineral elements. Intestinal decomposition can be controlled to some extent by the administration of liquid petroleum or petroleum preparations, by large doses of creosote, and by sour milk, or other preparations containing lactic acid organisms which are inimical to the bacteria which bring about protein decomposition. Although the foregoing is far from an exhaustive account of the different varieties of indigestion to which babies and children are most subject, I hope as an account of the more common varieties it will provide a means of recognising the nature and the origin of the majority of the forms which are likely to be met with.

CONSTIPATION

This condition is not a very frequent one in new-born infants, but when it does occur the possibility of an imperforate anus or rectum must be inquired into.

Constipation is liable to supervene after the passage of much meconium at the time of or immediately after birth. The old-fashioned practice of giving a dose of castor oil to clear out the meconium is also a prolific cause of early constipation. The latter may occasionally result from starvation, but this possibility in the case of breast-feeding is easily excluded by the application of the "test" feed. Constipation is more likely to occur with artificial feeding, especially when undiluted cow's milk or strong dilutions are employed. The commonly adopted practice of treating this condition with olive oil is not to be commended, for excess of fat may itself be a cause of hard, constipated stools—so-called "fat constipation." If the motions when they are passed are hard, the rational treatment is to soften them with petroleum emulsion, given simultaneously with the feeds, half a teaspoonful or more of semprolin emulsion may be given in this way. If, on the other hand, the motions when passed, are soft though infrequent, the indication is to give some drug such as Nux Vomica or Thyroid Extract, which acts upon the nerve centres, or some preparation of Cascara Sagrada, or Senna, which stimulates the neuro-muscular mechanisms of the bowel. Perhaps the simplest and safest line of treatment is to give a teaspoonful of Syrup of Figs as an emergency dose, or, if continued treatment is required, to give 10 drops of liquid extract of Cascara Sagrada in a teaspoonful of Semprolin Emulsion two or three

times a day. Massage of the abdomen judiciously applied is often very useful in curing constipation, but the most important factor is to induce regularity of habit by applying a porringer or soap dish to the buttocks at regular times every day. Night and morning before the bath are the best times, and twice a day is quite often enough for the bowels to act. It must be remembered that the more frequent the actions, the more liquid are the stools, and that with only one action a day the stools are nearly always formed. In breast-feeding the stools should be of the consistency of scrambled eggs ; in artificial feeding they should be formed and of the consistency of butter.

Constipation in new-born babies should never be treated by castor oil, glycerine suppositories or soap and water enemas, since all these lines of treatment are in themselves prolific causes of constipation.

CHAPTER XI

THE PREMATURE INFANT

DEFINITION OF PREMATURITY

THE usually accepted definition of prematurity is the termination of gestation at 260 days or earlier ; that is to say, three weeks or more before full term (280 days). The expression therefore pertains to "*time*."

The word "immaturity" is sometimes applied to infants who have the superficial characteristics (structural as well as functional) of prematurity, but who, as a matter of fact, may be full-time infants. This term therefore pertains to structure and function and not to time.

The term "congenital debility" is one which is often used in association with both prematurity and immaturity, although strictly speaking it simply implies that the infant, at the time of birth, is a weakling and incapable of carrying out the ordinary functions of life in the ordinary way by reason of mal-development or malnutrition. Such infants seldom grow into perfectly normal individuals, as premature infants very often, and as immature infants sometimes do, when they have made up for the delay in their ante-natal development.

Prematurity therefore applies to the time at which the infant is born ; immaturity to delay in development ; and congenital debility to some definite condition of weakness.

CAUSES OF PREMATURITY

These may conveniently be divided into two groups : firstly, those which result in the birth of a healthy baby, and, secondly, those which result in the birth of a damaged foetus.

In the first group are usually included those cases which are due to accidents—surgical operations, shocks, overwork, frights, strains, pelvic deformities, fibroids, etc.—conditions which do not necessarily damage the foetus, whatever injurious effects they may have on the precipitation of labour.

The second group includes those due to infections, both chronic and acute. Among chronic infections the more common are syphilis, tuberculosis and rheumatism, while of the acute forms the more common are pneumonia, typhoid, influenza, scarlet fever and diphtheria. This group also includes various intoxications, such as those due to alcohol, lead, phosphorus and ecboic drugs, as well as such constitutional diseases as pernicious anæmia, diabetes, exophthalmic goitre, nephritis, heart disease, etc. Many miscellaneous causes must be included, multiple pregnancies, habitual miscarriages and malpositions both of the uterus and of the foetus. Monstrous and developmental defects in the foetus may also bring about miscarriages.

PROGNOSIS

Although it is generally stated that only one premature baby in ten weighing less than 3 lbs. is likely to survive, methods of management have so improved of recent years that a baby of even $2\frac{1}{2}$ lbs. has quite a fair chance of survival, and the prospects of one

weighing 2 lbs. are by no means hopeless. We have recently had several babies under $2\frac{1}{2}$ lbs. at Queen Charlotte's Hospital who have survived and done well. A premature baby is less likely to survive or do well if its weight and length are less than would properly be expected from its foetal age. (See Table III.)

DEGREE OF PREMATURITY

The actual degree of prematurity cannot be fixed either by the length of the child or by its weight, though both factors in conjunction with others may be of use in fixing the approximate age of the infant. When the weight of the infant is less than would be expected from the known period of gestation, it is probable that the infant is also congenitally weak, and that both the prematurity and the weakness are due to the same cause, namely, some pathological condition affecting the health of the mother. It is usually assumed that any infant which is under $5\frac{1}{2}$ lbs. (2,500 grams) in weight or measures in length less than 17·7 inches (45 cm.) must be premature, but as a matter of fact in exceptional cases full-time babies may not reach these limits. Premature infants seldom weigh more than $6\frac{1}{2}$ lbs. or less than $1\frac{1}{2}$ lbs.

There is no means of estimating the exact degree of prematurity excepting by a very careful examination of the centres of ossification in the various bones, by means of X-ray examination. Those who are interested in this side of prematurity will find full information on this subject in Dr. Julian H. Hess's book on "Premature and Congenitally Diseased Infants."

The following is a table of weights and lengths of the normal foetus at different periods of gestation :—

TABLE III

Fœtal Age.	Weight.	Length.
24 weeks . . .	1 lb. 8 ozs.	11 $\frac{3}{4}$ ins.
28 „ . . .	3 lbs.	13 $\frac{1}{2}$ ins.
32 „ . . .	4 lbs.	15 $\frac{1}{2}$ ins.
36 „ . . .	5 lbs. 8 ozs.	17 $\frac{1}{2}$ ins.
40 „ . . .	7 lbs.	19 $\frac{1}{2}$ to 20 ins.

If a perfectly healthy fœtus is born prematurely, its weight and length ought to correspond more or less closely with these figures, but, as previously mentioned, neither weight nor length can be taken as exact and reliable criteria of the age.

EVIDENCES OF PREMATURITY

The following are among the more common evidences of prematurity :—

General Condition. A premature baby if otherwise healthy corresponds more or less accurately in weight and length with the foregoing figures (see Table III), which are given for normal fœtuses of various ages ; that is to say, in all cases it is smaller and weighs less than the normal full-time infant. All its nervous reactions are feeble. It is sluggish in its movements, sleeps almost continuously unless roused, has a feeble cry, and either refuses to suck or does so slowly and with difficulty. The eyes are often kept permanently closed until two or three weeks after birth. The temperature is low and is subject to wide fluctuations. The position in which the child lies is characteristically of the uterine type—

the body is curled up, the head being flexed on the chest, and the legs crossed and folded over the abdomen.

Circulatory System. The heart as a rule beats fairly strongly, although it may be incompletely developed. The *foramen ovale* and *ductus Botalli* are not completely closed. The control and distribution of the blood is usually defective, one of the results of which is a tendency to hæmorrhage. The extremities are often cold and cyanosed. There is also usually some degree of anæmia and preponderance of immature red blood cells.

Respiratory System. The breathing is shallow and irregular and usually of the abdominal or diaphragmatic type. The lungs are incompletely expanded, leading to atelectasis and predisposition to pneumonia sometimes of a hæmorrhagic type.

Digestive System. The premature infant, in addition to sucking badly, may also swallow with difficulty, and the stomach itself is small and functionally inefficient, although most of the digestive ferments are present in small amount. The meconium is scanty, since this usually accumulates during the last two months of normal pregnancy.

The following are the estimated capacities of the stomach at different periods of gestation :—

Weeks.	Fluid drachms.	Minims.
At 24	1	7 (5 c.c.)
At 26	2	18 (8 c.c.)
At 28	2	49 (9.99 c.c.)
At 32	5	4 (18 c.c.)
At 36	7	2 (25 c.c.)
At 40	12	40 (45 c.c.)

The small capacity of the premature infant's stomach, the difficulty in sucking, swallowing and the small quantity of ferments present in the digestive juices all contribute their quota to the difficulties of the management of the feeding, and combine to impress on us the necessity for very small quantities of easily digested food.

The Skin and Appendages. The colour of the skin of premature babies is redder than normal. The vernix caseosa is absent or present in small amount. The quantity of lanugo is greater. The external ears lie flat against the head and look like tabs of skin. The nails are short and do not reach the tips of the phalanges. The insertion of the umbilical cord is deeper than normal and lies nearer the pubis, and owing to deficiency of subcutaneous fat the skin lies in folds and is easily movable over the underlying parts. Miliaria and comedones are common on the face, especially round the nose.

The Genito-urinary System. The testicles are often undescended. The labia majora are not in contact, leaving the labia minora exposed. There may be suppression of the passage of urine owing to uric acid infracts in the urethra or other parts of the urinary tract.

The Skeletal System. The bones are soft and deficient in calcium salts. The cranial bones are thin and compressible, and the fontanelle is relatively large. The circumference of the head is greater than that of the shoulders. The centres of ossification as seen in X-ray films are not so far advanced as in the case of normal infants of full time.

MANAGEMENT

Owing to the immature development of all the organs in the premature infant, the management is at all times extremely difficult and demands the greatest care. There are, however, three special points with respect to which premature infants usually differ from the full-time infant. One of them is that they are more at the mercy of the environmental temperature, owing to the fact that their heat-regulating centres are not developed. From this it follows that their temperatures very rapidly reach dangerous levels unless special precautions are taken to prevent either loss or accumulation of heat.

The second point is that they are particularly susceptible to infection and very readily succumb if infected.

The third point is that, owing to the fact that it is only during the last two months of normal pregnancy that storage of fat, iron and calcium occurs in the tissues, premature infants have no reserves of these essential elements to fall back upon if their food does not contain enough. In the feeding of premature infants it is, therefore, particularly necessary that they should be supplied with ample quantities of fat-soluble vitamins, iron and calcium to make up for this lack of reserves.

FEEDING OF THE PREMATURE INFANT

The premature baby stands in even greater need of the educational properties of colostrum than the full-time infant, but, owing to the usually undeveloped condition of the mother's mammary glands at the time of birth, there is as a rule less colostrum than in the case of full-time deliveries. Moreover, it is more diffi-

cult to obtain and requires stronger sucking on the part of the infant. Since premature babies usually suck very poorly when they are put to the breast, this is an additional reason why natural feeding is difficult to manage. In spite of the fact that premature infants usually obtain very little colostrum at first, this is no argument against allowing them an opportunity of obtaining any that may be available, for by putting the child to the breast some little stimulus is afforded for the development of the mammary functions, and it is also a good thing to try to induce regularity of habit on the part of the infant and to teach it to suck. Personally, I am not in favour of frequent feeding of premature infants. There is no reason that I can see why they should be fed more often than full-time infants, provided that precautions are taken to ensure an adequate supply for the twenty-four hours, without over-distending the stomach at any one feed. This can be done by employing the "test" feed, and making good any deficiency of colostrum or milk by means of supplementary or complementary feeds. As a general practice, premature babies should be put to the breast about eight hours after birth, but they should not be allowed to suckle for more than two or three minutes. If as a result of the test feed it is found that the infant obtains practically no colostrum, a small supplementary feed should be given by means of pipette, premature feeding bottle or spoon. It is, however, of extreme importance that the supplementary feeds should consist of colostrum obtained from the mother by "expression," or failing this of some other fully pre-digested food which is equivalent to it. It is most unwise during the first three days to give even human milk. Breast milk is

no substitute for colostrum. After the third or fourth day, when the premature infant's digestive functions are a little more developed, it may be safe to give human milk derived from a healthy nursing mother.

After the first day the infant should be put to the breast regularly every three hours during the day, giving six feeds in all. A night feed is not usually necessary, but if the infant wakes up and is restless, one feed may be given during the night. The length of time which the infant should be left at the breast should be gradually increased, from three minutes up to about twelve minutes, but it should never be allowed to suck so long that it becomes tired, and as a matter of fact it will usually obtain in the first five or six minutes as much as it obtains in fifteen or twenty minutes. If at the end of the prescribed length of time, the "test" feed shows that the infant has not obtained the full amount, a supplementary feed should be given, as already described either of expressed breast milk or a peptonized milk mixture.

It is seldom wise to allow a premature baby to feed at both breasts at one feed. The right and left should be used alternately, since complete emptying of the breast is a stimulus to secretion. The actual amount of colostrum, breast milk, or substitute food that the premature infant should be allowed on successive days is as follows :—

During the first twenty-four hours 1 drachm at each feed is sufficient. On the second day 2 drachms at each feed, making a total of 12 or 14 drachms in the twenty-four hours, according as the child is fed six or seven times. On the third day the amount may be increased to 4 drachms at each feed, and on the fourth day to

6 drachms, and so on, with an increment of 2 drachms on each succeeding day, until the total amount for the twenty-four hours reaches the estimated requirements of the baby in accordance with its age and weight.

Although there is no definite criterion of the total amount of food required by a premature baby, in general terms it may be stated that an allowance of 60 to 70 calories for every pound of body weight may be regarded as correct. If, for example, a premature baby weighs 3 lbs. at birth, the total caloric requirement for the twenty-four hours would be $3 \times 60 = 180$ calories, or $3 \times 70 = 210$ calories, according as the allowance of 60 or 70 calories per pound weight is allowed. Since the caloric value of breast milk, or any appropriate substitute for it, is 20 calories per ounce, the total amount of food required for the twenty-four hours would be $180 \div 20 = 9$ ozs., or $210 \div 20 = 10\frac{1}{2}$ ozs., respectively, which would mean if the child is fed six times in the twenty-four hours, that at each feed $1\frac{1}{2}$ ozs. should be given in the first case and 1 oz. 6 drachms in the second. This amount would not be reached until about the end of the first week.

When premature infants are fed according to this scale, it is quite true that they do not receive a full caloric allowance at first ; all the same, they are obtaining a reasonable amount, and there is a steady increase, which is of very great importance, to secure the gradual development of their digestive functions. As long as premature infants are kept adequately warm they do not require a very large amount of food, for their output of energy is extremely limited owing to their sluggish habits and almost continual sleep. Personally, I do not advocate the independent administration of water over

and above that which is provided for in the above scale of feeding, but should the urine appear to be unduly concentrated or should it contain excessive quantities of urates, two teaspoonfuls of water containing 2 grains citrate of soda may be given independently two or three times a day.

MANAGEMENT OF DIFFICULT CASES

It not infrequently happens that the premature infant is too feeble or too irresponsive to suckle properly, and when this is the case the development of the mammary secretion is interfered with, owing to want of normal stimulation. In such cases the chances of the ultimate establishment of lactation in the mother must not be jeopardised, but must be encouraged by every possible means : massage, alternate hot and cold compresses, the employment of the breast pump or the application of a proper method of expression. If the offices of a lusty infant of another mother can be obtained, it should be put to the breast of the mother at regular intervals and allowed to apply the necessary stimulus ; while the premature infant may be allowed to be put to the breast of the foster mother and, under control of the "test" feed, obtain its due allowance of milk. It cannot be stated too categorically that there is no known galactagogue of any value which has any influence whatsoever except psychologically in promoting or increasing the mammary secretion.

TECHNIQUE TO BE EMPLOYED FOR THE EXPRESSION OF BREAST MILK

Before commencing, the hands of the operator should be carefully cleaned with soap, water and nailbrush, and

the nipples of the mother should be washed with sterile water. The breast should be grasped firmly between the thumb and forefinger, the remaining fingers supporting the lower segment of the gland. The thumb should be placed above and the fingers on the lower side, just outside the pigmented areola. Pressure is then made by the thumb in the direction of the fingers, squeezing the substance of the gland between them so as to empty the lacteal ducts in the direction of the nipple. This is followed by a slight forward pull in the direction of the nipple, although the nipple itself does not need to be touched. It is rather difficult to describe this combined action in words, but it is quite easy to demonstrate it. A certain amount of pressure can also be applied to the alveoli in the deeper parts of the glands, so as to empty their contents into the lacteal ducts by a simultaneous pressure of the whole gland against the chest wall just before the actual squeezing of the gland between the thumb and fingers takes place. A combination of the three movements has been described as a "back-down-out" movement, very much like the ordinary method employed in milking a cow. The "back-down-out" movement may be repeated thirty to sixty times a minute, according to the skill and efficiency of the operator. It is quite easy to teach the mother how to carry out the technique of "expression" for herself and provide several pints of milk daily. The milking may be repeated any number of times during the day, when it is found most convenient. Lactation may be maintained almost indefinitely by this means, certainly for a year or longer, as long as the health of the woman continues to remain good.

GENERAL MANAGEMENT OF THE PREMATURE BABY

The most important detail in this connection is to maintain temperature, either by preventing loss of heat or by stimulating its production. The heat-regulating nerve centres are so undeveloped in the case of the premature baby that the blood temperature tends to rise or fall with the temperature of the surroundings. I have known instances in which there have been as wide fluctuations as 15 degrees within an hour, owing to changes in the environmental temperature. Every effort, therefore, should be made to maintain the blood temperature at a normal level by adjustments in the external temperature. The chief danger is a rapid fall of temperature immediately after birth owing to want of adequate preparations for the reception of the baby, or a rapid rise in temperature by the maintenance of too high a temperature in an incubator. All the necessary details should be arranged in advance, and the moment the infant is born it should be wrapped up in cotton wool which has been previously warmed. Beyond cleaning the face and eyelids with sterile wool steeped in boracic lotion, there is no need to run any risk of chill by giving the baby a bath. The bath may be delayed in the case of a very small infant until the third or fourth day, or even omitted altogether. The real requisite is to prevent loss of heat. The ritual of the bath can wait.

The temperature of premature infants should be watched very carefully, and the temperature taken in the rectum by means of a low-reading thermometer, the index of which has been well shaken down before use.

The temperature should at first be taken four-hourly, or even more often.

The Clothing. For new-born premature infants it is better not to employ ordinary orthodox garments, during the first week or so. Improvised clothing with a hood or covering for the head can very easily be made out of gamgee tissue. A square of this large enough to wrap one-and-a-half times round the baby answers admirably. Hands and feet should, of course, be included in this emergency robe, and the whole of the head, except the face, should also be covered by a hood made of the same material and in one piece with it. When the infant is about fourteen days old, the improvised garment may be discarded for a set of knitted garments consisting of double-breasted vest, coat, bonnet and gloves. Directions for making of these will be found at the end of this chapter.

Oiling. The usual custom is to smear the whole of the baby with olive oil. This, in my opinion, is bad practice, for olive oil is easily decomposable. If any oil at all is used it should be a mineral oil, *i.e.*, liquid petroleum.

Temperature Regulation. The baby, wrapped up in its emergency robe, should be placed in an appropriate bassinet. For this purpose there is nothing better than an ordinary square Japanese basket. The baby should then be covered up with a soft unwashed blanket or woollen shawl, or, better still, if it is available, an electrically heated pad. We use, at the Infants Hospital, as well as at Queen Charlotte's Hospital, an electric pad which is known as "Thermega." As far as possible, these pads have been made "fool-proof," by the addition of certain devices suggested by Mr. Arthur Pott,

the Chairman of the House Committee at Queen Charlotte's. The special points about these pads, as compared with those in general use, are as follows :—



FIG. 9.—THERMEGA PAD.

The cable from the pad to the regulator is covered with rubber tubing, and there is a cab tyre cable between the regulator and the adaptor. There is also a standard two-pin connector inserted at the cab tyre cable near the regulator, and there is a spring attached to the flex to take the strain of any sudden interference which might otherwise break or cause detachment of the flex. Everything is done as far as possible to prevent short-circuiting and interruption of the connection. I can speak very highly of these pads and the degree of heat can easily be adjusted.

Incubators of the ordinary kind are now quite out of date and most of them have the very serious disadvantage that the head of the baby is included in the incubator, and is thus deprived of the valuable stimulus of moving air. It must be remembered that even by means of a hot bath heat cannot be forced into the body of a premature baby. The best that can be done is to prevent loss of heat, and one of the great troubles in connection with premature babies is that they have little independent power of generating heat within their own tissues, hence they cannot afford to lose what they have. To increase production of internal heat there is nothing so useful as the administration of thyroid gland. When I first tried this expedient in a somewhat desperate case I was quite astounded at the rapidity with which the infant responded to the stimulus. Since then I have used it constantly in all cases of hypothermia and in most cases of cyanosis and atelectasis, and this method is now in general use both at the Infants Hospital and at Queen Charlotte's. There is no known general stimulus to metabolism which compares with thyroid medication. I have found it the most valuable resource in the treatment of debilitated or premature infants that I have ever met with. As a rule, I find the best dosage is to give one-tenth of a grain of thyroid gland for each pound of body weight. This dose may be repeated every six hours or oftener. The temperature of the room in which the premature infant is kept should not be more than 75° F. or less than 65° F., and it should always be remembered that the stimulating effect of moving air, and of air which is not too hot, has a most beneficial and invigorating effect on the metabolism of the infant.

Infection. As regards the prevention of infection, it is impossible to be over-cautious. The catarrhal infection of an ordinary cold is almost as fatal to these babies as is that of sepsis. For this reason premature babies should not be kept in a ward with other babies, but in a room by themselves, to which the access of individuals who may possibly be carriers of catarrhal infection should be rigidly excluded. The nurse in charge should be the sole person to come into contact with the baby.

The antiseptic care of the eyes, nose, mouth, genitalia, cord, and of the skin generally, cannot be too strictly observed, and the use of a good talc powder, with or without the addition of some reliable antiseptic, is not likely to be overdone.

DIRECTIONS FOR MAKING KNITTED SET OF GARMENTS FOR PREMATURE INFANTS

Double-breasted Vest

2-ply Wool. Steel Needles No. 10

Commence at back, casting on 36 stitches.

Work this in stocking stitch for $4\frac{1}{2}$ inches, finish with purl row.

Commence sleeves : Cast on 6 stitches at beginning of row.

Knit to end of row, and cast on 6 more stitches (making 48 stitches in all).

Knit 16 rows smooth knitting, ending with purl row.

Knit 18, cast off 12 for neck, knit 18.

Slip first 18 on to a safety-pin.

Work 6 rows on last 18, ending at neck edge.

Cast on 10 stitches for left front.

* Knit 14 rows plain knitting.

Cast off 6 stitches at beginning of row (sleeve end) and knit to end.

Knit in stocking stitch for 4 inches and cast off.
Join on wool for right front.
Knit on 18 stitches for 6 rows, ending at neck edge.
Cast on 16 stitches for right front.
Continue from * to correspond with left front.
Press with damp cloth and hot iron, sew up sides.
On *outside* of left side attach 2 ribbons about 2 inches from edge.
On *inside* of right side attach 2 ribbons about 2 inches from edge.
This makes double fastenings.

Premature Baby's Coat

2-ply Wool. Steel Needles No. 10

Commence at back.
Cast on 42 stitches.
1st row : Knit into back of stitches.
2nd row : Knit in stocking stitch for 54 rows.
55th row : Knit to end of row, cast on 12 stitches.
56th row : Knit to end of row, cast on 12 stitches.
(These are for the sleeves.)
Knit 20 rows stocking stitch.
76th row : Knit 28, cast off 10 for neck, knit 28.
Knit 9 rows stocking stitch on this needle.
10th row : At neck edge cast on 5 stitches for left front.
Knit 14 rows stocking stitch ending at sleeve edge.
Cast off 12 stitches at beginning of row.
Knit 53 rows on remaining 21 stitches.
Cast off loosely.
Knit the other side to correspond.
Crochet round neck making ribbon holes, and down front and round sleeves.

Premature Baby's Bonnet

2-ply Wool. Needles No. 10

Cast on 48 stitches. Work 8 rows in rib, knit 2, purl 2.
9th row : Knit plain.
10th row : Knit 1, purl to last stitch, knit 1.

****11th row :** * Knit 8, wool forward, knit 2 together, repeat from * to the end of row.

12th row : Knit 1, purl to last stitch, knit 1.

13th row : Knit plain.

14th row : Knit 1, purl to last stitch, knit 1.

15th row : * Knit 4, wool forward, knit 2 together, repeat from * to end of row.

Repeat 12th, 13th and 14th rows once **.

Repeat from ** to ** once.

27th row : Knit plain.

28th row : Knit purl.

29th row : Knit plain.

30th row : Knit purl.

31st row : * Knit 8, knit 2 together, repeat from * to the end of row.

32nd row : * Purl 7, knit 2 together, repeat from * to the end of row.

33rd row : * Knit 6, knit 2 together, repeat from * to the end of row.

34th row : * Purl 5, knit 2 together, repeat from * to the end of row.

35th row : * Knit 4, knit 2 together, repeat from * to the end of row.

36th row : * Purl 3, knit 2 together, repeat from * to the end of row.

37th row : * Knit 2, knit 2 together, repeat from * to the end of row.

Cast off loosely. Fold together and sew from middle fold to edge and down for $1\frac{1}{2}$ inches. This shapes the head.

For back of neck. Commence at right side of edge, with a needle pick up 32 stitches. Make one plain row, then knit row of knit 2, make 1, knit 2 together, repeating to end of row to make ribbon holes. Knit 2 rows rib, 2 plain, 2 purl. Cast off loosely.

Premature Baby's Glove

2-ply Wool. Steel Needles No. 10

Cast on 28 stitches.

Work in rib of knit 2, purl 2 for $1\frac{1}{2}$ inches.

Work ribbon holes : Knit 2, wool forward, knit 2 together, repeat to end of row. Then work in stocking stitch (1 row purl, 1 row plain) for 1 inch.

To decrease then :

1st row : Knit 1, knit 2 together, knit 9, knit 2 together, knit 1, knit 2 together, knit 8, knit 2 together, knit 1.

2nd row : Purl.

3rd row : Knit 1, knit 2 together, knit 6, knit 2 together, knit 2, knit 2 together, knit 6, knit 2 together, knit 1.

4th row : Purl.

5th row : Knit 1, knit 2 together, knit 4, knit 2 together, knit 2, knit 2 together, knit 4, knit 2 together, knit 1.

Cast off loosely. Press out with warm iron.

Fold in half and sew up side and top.

Make another the same.

CHAPTER XII

WASTING IN NEW-BORN INFANTS

WASTING in infants may occur from many causes, both from those connected with the food itself as well as with defects in its digestion, absorption or usage.

Serious degrees of wasting do not, as a rule, occur in infants during the time they are under the charge of the midwife, excepting in those cases in which there is some definite congenital defect or some infection or other pathological condition acquired immediately after birth. All the same, it is desirable that midwives should have some knowledge of those causes of wasting which do not reach any considerable proportions until after they have relinquished charge, as well as of those which do. For this reason I give the following classification of the more common causes of wasting, with a few explanatory notes, specially of those cases which come most frequently under the notice of the midwife.

(1) WASTING FROM FOOD CAUSES :

(a) *Under-Feeding*

- (i) Total or general.
- (ii) In respect of one or more individual food elements.

(b) *Unsuitable Feeding.*

- (i) Indigestibility of the food.
- (ii) The presence of poisonous or toxic substances in the food.
- (iii) Faulty balance.

- (iv) Too short or too long intervals between feeds.
- (v) Two rapid feeding.
- (2) WASTING FROM DIGESTIVE DISTURBANCES.
Gastritis and other disturbances of gastric digestion.
Enteritis and diarrhoea, intestinal toxæmia, atrophy, or want of development of the mucous membrane of the bowel.
- (3) WASTING FROM DEFECTS IN OTHER ORGANS :
(i) The excretory organs.
(ii) The circulatory system.
(iii) The nervous system.
(iv) Endocrine or internal secretory organs.
- (4) WASTING FROM CHRONIC OR ACUTE INFECTIONS.
Syphilis, tuberculosis, sepsis, coli organisms, etc.
- (5) WASTING FROM GENERAL, CONSTITUTIONAL OR METABOLIC DISORDERS.
Anæmia, diabetes, dentition, allergic conditions.

It is, naturally, of fundamental importance to be able to distinguish between the causes of wasting which are due to faulty feeding, from those which are due to some defect in the infant—congenital or acquired. It is, therefore, advisable in all cases of wasting to exclude from the etiology any obvious defect in the method of feeding. If none such be found, every other likely source of the trouble must be explored. In these days of enlightenment it is not justifiable to remain satisfied with such convenient and comprehensive explanations as primary atrophy, marasmus, athrepsia, or congenital debility. Such nomenclature was all very well before we knew anything about the influence of vitamins, endocrine secretions and renal insufficiency. Nowadays we require a more precise and scientific explanation.

1. WASTING FROM FOOD CAUSES

(a) **Under-feeding.** (i) *Total or General.*—This is very rarely the primary cause of wasting in babies, especially in new-born babies. As long as infants get an adequate supply of water there is seldom any serious loss of weight during the first few weeks of life, however much they may be starved. Moreover, as long as starvation is the sole cause of wasting, the infant rarely looks definitely ill. It has not that drawn appearance and earthy complexion which babies present when they owe their wasting to some form of poisoning or intoxication. At the Infants' Hospital we use the term "under-caloried" to represent that form of under-feeding which depends on total deficiency of the fuel foods—protein, carbohydrate and fat, estimated on a "calorie basis," as contrasted with deficiencies in vitamins or other accessory factors. For instance, a calorie value of 100 in a case in which the estimated requirement of the infant is 400, would be described as one in which the baby was "under-caloried."

Artificially fed babies are not so often "under-caloried" as breast-fed babies. The calorie value of the food in the former case being more easily estimated, while in the latter it is necessary to apply the "test" feed. When, however, the latter cannot be conveniently applied, the following points may help to settle the question whether the supply of milk is really adequate or not. Firstly, by questioning the mother, information may be acquired on the following points :—

- (1) The condition of the breasts before and after a feed—whether, for instance, there is a definite alteration in size.

- (2) The existence of overflow or leakage during the night or between feeds.
- (3) The development of the so-called "draught"—*i.e.*, a feeling of engorgement of the breasts during feeding.
- (4) By "expression," or applying the breast pump.

Additional evidence may be afforded from an examination of the infant.

- (1) The degree of satisfaction after a feed.
- (2) The amount, if any, of the vomit.
- (3) The volume of urine passed in the twenty-four hours.
- (4) The size and number of the stools. Starvation stools are usually slimy and bile-stained, and often frequent, though without any obvious solid matter.
- (5) Progress and weight of the baby.
- (6) Loss of subcutaneous fat.
- (7) Size of fontanelle, and whether it bulges or is depressed. In over-feeding it is large and bulging, and the reverse in starvation.
- (8) Size of liver—small in starvation, large in over-feeding.
- (9) Blood temperature—generally low in starvation.
- (10) In starvation there is usually restlessness and want of sleep.

All the above evidences are seldom displayed in any one individual, but by an intelligent weighing-up of the pros and cons a good idea can usually be obtained as to whether an infant is being overfed or underfed, but the final criterion in the case of the breast-fed baby must be the "test-feed."

(ii) *Under-Feeding in Respect of Individual Food Elements*.—Although serious deficiencies in any of the three fuel foods—namely, protein, carbohydrate or fat—singly or in combination, can undoubtedly cause wasting or loss of weight in infants if of sufficiently long duration, they seldom occur in the case of new-born babies. Deficiencies in other essential elements, such as vitamins or minerals, may also lead ultimately to wasting, though such results are usually so long delayed that they rarely come under the notice of the midwife. For instance, even extreme deprivation of Vitamin A does not produce rapid wasting, but only some degree of retardation in development, and, consequently, is not likely to give any evidence during the first month of life. Again, although deprivation of iron may ultimately cause anæmia, and subsequent malnutrition, the results of this particular deprivation are very slow to appear, and, consequently, the omission of a sufficient quantity of iron in the infant's food is seldom realised at the time, and practically never causes any immediate wasting. What is true of these two accessory factors, which have been selected at random, is more or less true of all others. This emphasises what I have repeatedly referred to in these lectures in connection with the anti-scorbutic vitamin, namely, that it is necessary to give orange juice or some other concentrate of Vitamin C to babies under three months of age, whether they appear to be perfectly well or not. Owing to the deferred influence of deprivations of this kind, it is unwise to wait for symptoms to appear before correcting a dietary which on examination is obviously deficient in respect to any of its essential accessory factors.

(b) **Wasting from Unsuitable Feeding.** (i) *Indigestibility of the Food.*—Food may prove indigestible for various reasons—for instance, simply because the quantity is too great or because it is given in incompatible combinations, or it may owe its indigestibility to the presence of one or more particularly indigestible elements. But so far as infants are concerned, the main factors are either too much fat, which renders most other varieties of food indigestible, or too much casein, which, in itself, is very difficult to digest, and is specially liable to cause gastric indigestion by the throwing down of heavy curds in the stomach, which cause violent reactions and vomiting. But in whatever respect or from whatever cause food proves indigestible, the final result is the same—*i.e.*, wasting from starvation.

(ii) *The Presence of Poisonous or Toxic Substances in the Food.*—Wasting from this cause is comparatively rare, and is less likely to occur in the case of breast-feeding than in the case of bottle-feeding. Stale, dirty or decomposed cow's milk is quite capable of causing serious digestive disturbances which may lead to wasting. It is most likely to lead to this result in hot weather when milk easily "turns" or goes bad. Pasteurised or boiled milk is particularly liable to undergo dangerous forms of decomposition if kept too long, especially in dirty bottles or receptacles. Breast milk is occasionally toxic and liable to cause serious symptoms, such as vomiting and diarrhoea. Unfortunately, chemical analysis will not reveal the presence of such toxins. The reactions of the baby are the best indicators of the unsuitability of the food. It must not, however, be hastily assumed that because a breast-fed infant is sick or has diarrhoea the milk contains unknown

toxins. There may be many other reasons, and the presence of toxins is one of the least common causes. Although toxic substances in a baby's food usually cause acute symptoms, such as diarrhoea or vomiting, when once a baby's digestive system has been seriously upset, wasting soon follows.

(iii) *Faulty Balance*.—This is a common cause of defective nutrition and ultimate wasting. The commonest instance of want of balance leading to this result is an excess of sugar or other carbohydrate. At first the infant grows unduly fat and puts on more than the normal amount of weight, but, owing to the want of resistance to infection which these babies usually show, or for some other reason, a crisis frequently develops in which the infant suddenly loses weight and becomes seriously ill.

(iv) *Too Short or Too Long Intervals Between Feeds*.—These causes seldom lead to actual wasting, but extremes in either direction are unfavourable to the best results, and may impair nutrition.

(v) *Too Rapid Feeding*.—This may lead to wasting by causing vomiting and consequent starvation.

2. WASTING FROM DIGESTIVE DISTURBANCES

Any serious digestive trouble must inevitably lead to wasting, since one of the consequences of indigestion is starvation, although the supply of food may be plentiful. But the direct consequences of indigestion are often more serious than the starvation to which the indigestion gives rise. The production of abnormal products of decomposition in the food will poison the system and lead to wasting, or the wear and tear of the

nervous system, due to the pain and discomforts, will lead to the same results. Indigestion may be due to failure of the gastric, intestinal, pancreatic or even biliary functions. These may occur either singly or in combination.

(i) **Gastritis and Vomiting.** Gastric disturbances usually take the form of vomiting. Vomiting from this cause may be due to irritation of the stomach by indigestible food or to products of its decomposition in the stomach. Such irritation may lead to gastritis or catarrh of the mucous membrane. In such conditions the indigestion is usually of somewhat chronic type. As a matter of fact, gastric indigestion or vomiting in infants is more commonly due to dislocation of the so-called motor functions, especially those connected with the pyloric mechanisms, than to any other factor. Persistent vomiting, however, need not necessarily be a symptom of indigestion. It may occur in infants suffering from general disturbances, such as sepsis or influenza, or from direct involvement of the vomiting centre as in meningitis or tumours of the brain. But from whatsoever cause vomiting occurs, provided it is severe enough, it will always lead ultimately to wasting, owing to the starvation to which it gives rise.

In cases of serious diarrhoea from any cause, there must also necessarily be wasting owing to starvation, but the wasting is more rapid and more extensive in cases in which there is some definite infection of the bowel than when the diarrhoea is set up by the mechanical irritation of indigestible food. If food is not properly digested by physiological processes and absorbed, it is invariably attacked in the large bowel

by putrefactive and fermentative organisms which are always present in the colon. These decomposition processes lead to the production of toxic products which poison the whole system and produce wasting. This condition, which is generally known as "intestinal toxæmia," is a very common one in infants and productive of serious wasting. Children suffering from wasting of this kind generally have a toxic appearance and dirty complexions, with dry inelastic skins. This condition is usually included under the somewhat comprehensive term "marasmus." Long-continued catarrh of the mucous membrane of the bowel may lead to chronic enteritis or colitis, and one of the results of this prolonged inflammation is destruction of the villi, with denudation of epithelium. This leads to a particularly protracted variety of wasting, which may take years to cure.

Wasting from disturbances of the pancreatic function is usually rapid and extreme. It is generally accompanied by light-coloured and frothy stools, not unlike those which are characteristic of sprue. Wasting from disturbances of liver function is also characterised by the presence of light stools and an excess of fat.

3. WASTING FROM DEFECTS IN OTHER ORGANS

(i) **Wasting from Defects in the Excretory Organs.** This variety of wasting is not very common, but it may occur in cases of congenital defect of the kidney, or from an acquired nephritis. An examination of the urine, or possibly the blood, will generally help to reveal the cause. In these conditions there is usually both vomiting and diarrhoea.

(ii) **Wasting from Diseases of the Circulatory System.** Congenital disease of the heart is almost invariably accompanied by slow growth and development. Actual wasting may occur also owing to the proneness of such children to digestive disturbances.

(iii) **Wasting through Diseases of the Nervous System.** There are few varieties of wasting more rapid than these which occur in meningitis, but mentally defective babies may also show remarkable degrees of wasting which are otherwise inexplicable, but since mental deficiency is exceedingly difficult to recognise during the early months of life, in cases of unexplained and serious wasting the possibility of this diagnosis should be borne in mind.

(iv.) **Wasting from Disturbances of the Endocrine System.** Wasting from this cause is difficult to diagnose, excepting in the case of diabetes, when the cause may be recognised from an examination of the urine.

4. WASTING FROM CHRONIC OR ACUTE INFECTIONS

The wasting in syphilis is extreme. It is often absent in severe cases of tuberculosis. Vomiting often combined with diarrhoea is a marked symptom of sepsis, and, in the end, it always leads to wasting. Coli infections are extremely common in infancy—there is generally a high temperature.

5. WASTING FROM CONSTITUTIONAL OR METABOLIC DISORDERS

These varieties of wasting do not require special mention here, except that which may be due to denti-

tion, and even this should properly belong to the group of disorders due to nervous disturbances, but, in my experience, wasting during dentition is so common, and its cause so often not recognised, that this possibility should be taken into account by all those who have the care of children. Temporary cessation of growth is quite common during teething in the case of practically normal infants, so that it is hardly surprising that actual loss of weight or wasting should occur in unhealthy infants or infants in whom there is general instability of the nervous system, when they are cutting their teeth.

CHAPTER XIII

TEETH AND TEETHING

IF midwives and maternity nurses are asked by their patients whether anything can be done to ensure good teeth for young children, they ought to be in a position to give an intelligent answer. For this reason I propose to give a few hints on this subject to enable them to do so with satisfaction to themselves.

Caries of the teeth far more deserves the title which the Germans have given to rickets—namely, “*die englische Krankheit*”—than the latter disease itself. It is the rarest thing in the world to find any inhabitant of these islands with a perfect set of teeth after the age of twenty-five. There is no doubt that bad teeth can run in families just as well as throughout a nation, but it is by no means certain that heredity is the only factor concerned in both these unhappy possibilities. Dietetic habits are transmitted in descent just as much as physical peculiarities. Recent animal experiments on the feeding of whole colonies of dogs, rats and guinea pigs, with the continued pursuit of the research throughout many generations, clearly prove that bad feeding is very closely concerned with the development of bad teeth. Although the same results need not necessarily apply to the case of human beings, observations made with regard to the effect of diet on the teeth of children seem to confirm the view that a similar rule

holds good. Recent investigations in America * on large groups of institutional children very strongly suggest that a well-balanced dietary is the main factor in the prevention of dental caries. A "well-balanced" dietary is meant to include a full allowance of vitamins and mineral elements.

ANTE-NATAL CONDITIONS AFFECT THE TEETH

Since at the time of birth the tips of the incisors and canine teeth, as well as the cusps of the first molars, are already calcified in the gums, it is clear that if the deciduous or milk teeth are to be well formed and normal when they are eventually cut, the proper conditions for tooth formation must exist from the very beginning, *i.e.*, during the ante-natal period. We now know certain of these conditions, though possibly not all. It is true that the substance of teeth, the enamel, dentine, and pulp, are not exactly the same as the substance of true bone and bone marrow, but for all practical purposes it may be assumed that teeth are only specially modified bones, and that the main conditions which are concerned in bone formation and in the determination of rickets must also apply in the case of the formation of teeth.

For several years past very careful studies * have been made of the nature and origin of rickets, a disease which is essentially one of bone formation. The same conditions are now believed to apply in the case of teeth.

The main conditions necessary for sound bone formation are, first of all, good general nutrition ; secondly,

* " R. H. Bunting and Others," *American Journal of Diseases of Children*, September, 1930, pp. 536-548.

an adequate supply of calcium and phosphorus in the food ; and thirdly, an adequate provision of the three vitamins, A, C and D. In addition to these three main requirements, a certain amount of sunlight appears to be a favourable factor, as also active muscular exercise. It may, therefore, be reasonably assumed that the teeth in the developing foetus will not grow normally unless the mother's environment also fulfils these same essentials for development. The diet, therefore, and the general hygienic conditions under which the mother exists, are important factors in the final determination of the deciduous teeth in the offspring.

THE POST-NATAL CONDITIONS WHICH AFFECT THE DEVELOPMENT OF THE TEETH

After birth a large number of conditions are concerned in the development of sound teeth. First of all, the nutrition of the young baby must be maintained as far as possible at a maximum level by the provision of the same conditions which have already been described as necessary in the case of the expectant mother. A further essential is that the jaws themselves should be well developed so as to give ample room for the developing teeth and to ensure a good blood supply for their nourishment both before and after they have erupted. Exercise of function is the best way of ensuring the good development of any organ, and this also applies in the case of bone. Exercise of the jaws is therefore one of the conditions for normal dental development. This end can best be ensured in the young infant by breast feeding, for in this way the infant uses its jaws far more effectively than in bottle feeding. As soon as

the teeth are cut opportunity for further jaw work should be given, by allowing the infant to exercise the functions of mastication on hard substances, such as rusks, crusts, and suitable pieces of cooked bone.

The preservation of the newly erupted teeth involves keeping the mouth scrupulously clean and, what is perhaps of even greater importance, maintaining it free from the presence of acid substances which can corrode or dissolve out the mineral material which lends hardness to the teeth. Keeping the mouth clean from the débris of food consumed should not be a difficult matter. The teeth of even quite young infants can be cleaned with a soft brush or rag, and this oral toilet should be, if possible, carried out after each meal of solid food.

ACID CONDITIONS OF THE MOUTH ARE BAD FOR THE TEETH

The reason why débris of food should not remain in the mouth is because all such remnants undergo decomposition or fermentation, owing to the universal presence of bacteria in the buccal cavity. Most foods when they undergo such changes produce acids. Particles of bread or biscuit left in the mouth undergo fermentation and in so doing generate considerable quantities of acetic acid or vinegar. Lactic acid is also produced under comparable conditions from other classes of food, and these organic acids, along with certain others, exercise a corroding or decalcifying influence on the teeth, although as compared to the inorganic acids their action may be weak.

The resistance to such destructive influences will naturally depend on the structure of the teeth them-

selves. Hard, well-formed teeth will show far greater resistance than malformed or weakly mineralised varieties. But there is a degree of acidity which no teeth, however well formed, can resist.

CONDITIONS IN WHICH ACIDITY OF THE MOUTH EXISTS

High degrees of acidity in the mouth exist in certain conditions, of which the following are perhaps the most frequent and important :—

(1) When an infant or child is a “ dirty ” feeder—that is to say, allows large quantities of consumed food to remain wedged between the teeth, in irregularities of the teeth, or interposed between the gums and the cheeks.

(2) When the mouth is particularly septic through unhealthy tonsils or through the presence of other foci of infection—alveolar pyorrhœa, for instance.

(3) When the child is suffering from any acute fever, such as measles, chicken-pox, scarlet fever, typhoid or rheumatism.

(4) When the mouth is dry and improperly irrigated with saliva, especially in the case of mouth breathers, during periods of sleep, and high fever.

SALIVA NEUTRALISES ACID IN THE MOUTH

The chief defence against an acid condition of the mouth consists in the free irrigation of the latter with alkaline saliva. Saliva is, or should be, definitely alkaline. It is generally thought that the chief function of saliva is to digest carbohydrate food owing to its content of the ferment ptyalin. This is a dangerous

and erroneous view. The main functions of saliva are to keep the mouth clean, moist and alkaline. As long as there is a sufficiently free secretion of saliva and its reaction is adequately alkaline, there is little fear of the mouth becoming acid, no matter what degree of fermentation takes place in the food left in the mouth, but the moment the secretion of saliva is curtailed, as during sleep, or during conditions of pyrexia, the danger of the development of acidity in the mouth becomes imminent. If one examines the reactions of the mouths of children during varying conditions of health and disease by testing the saliva with litmus paper, occasionally it will be found to be acid, usually alkaline, sometimes neutral. Neutral saliva, owing to a high degree of buffering, is capable of neutralising quite a considerable amount of acid. Whenever, as in conditions of fever or acidosis, the reaction is found to be acid, there is always danger of the teeth becoming eroded. I have myself come across several cases in which individuals with previously perfectly good teeth have been the victims of extensive dental caries as the immediate result of acute attacks of rheumatism or typhoid fever, which have lasted sufficiently long and have produced a sufficiently high degree of acidity in the mouth to cause a widespread decalcification of the teeth. In such conditions alkalies should be given freely by the mouth and alkaline lotions used as mouth washes at frequent intervals.

SUGAR NOT SO BAD FOR TEETH AS STARCHES

It is often said that the consumption of excessive quantities of sugar is one of the chief causes of dental caries, and the explanation usually given is that the

sugar undergoes fermentation in the mouth with corresponding acid production. This is an entirely wrong explanation, even if it is admitted that on other grounds sugar itself is detrimental to the nutrition of the teeth. If the consumption of an excess of sugar is an adverse factor to teeth at all, it is due to the fact that such excess, like excess of any other element, interferes with general nutrition and metabolism. Sugar does not undergo decomposition in the mouth unless it is of a very sticky variety, for the reason that it is so soluble in saliva that it is removed and swallowed before it has time to ferment. On the other hand, any form of starch is a danger to the teeth if it is allowed to remain adherent to them. Starches are not soluble in saliva, and therefore they cannot be dissolved and washed away like sugar. Remaining in the mouth, they undergo fermentation, with the production of acid, which, if not neutralised by alkaline saliva, can exercise a corroding action on the teeth.

A further point of interest that emerges from the American inquiries previously referred to, is that the *Bacillus acidophilus* is *par excellence* the active agent in the production of acids which disintegrate enamel and dentine, and that diet itself can exercise a definitely inhibitory action on the growth of these particular organisms. Although irregularities in the structure and arrangement of the teeth, as well as want of well-polished surfaces of the crowns distinctly favour the adherence of food débris and subsequent fermentation with the production of acid, and although inadequate neutralising properties of the saliva as well as initial hypoplasia or want of hardness of the teeth may be contributory factors in the production of dental caries,

these investigations indicate that diet outweighs all other considerations.

Before leaving this part of the subject I must not forget to mention that one essential for the preservation of the teeth is a periodic examination of them by a qualified dental surgeon, in order that defects, if they exist, may be discovered while they are still amenable to treatment.

The following is a short abstract of the foregoing instructions :—

For the preservation of the teeth it is essential that—

(1) The expectant mother should be properly fed during the whole period of pregnancy. Her diet should contain an adequate supply of calcium, phosphorus and vitamins, best provided by an ample supply of milk, eggs, and fresh vegetables and fruit, or special vitamin-containing preparations.

(2) The infant after birth should be properly fed, preferably on breast milk.

(3) The jaws should be exercised by breast-feeding before the eruption of the teeth and active mastication afterwards.

(4) The mouth should be kept free of the débris of food, sepsis, and the acid products of fermentation. This is especially important during sleeping hours when little saliva is secreted.

(5) The saliva should be alkaline. If not, alkalies should be given by the mouth, and alkaline mouth washes used.

(6) Periodic visits should be paid to the dentist.

TEETHING

Some people still believe that since teething is a physiological process it cannot be accompanied by any

pathological symptoms. The late Professor Jacobi, a very eminent American pædiatrician, published quite a large volume in support of this thesis. There is no more reason why a physiological process such as dentition should not be accompanied by pathological symptoms than that childbirth, which is also an entirely physiological process, should not be accompanied by pains and throes. The more civilised we become and the more artificial our lives and habits, the more liable are such natural processes to be accomplished in an unnatural manner. Children are far more nervous and sensitive to pain than they used to be under more natural conditions, and further, there is a distinct tendency for the jaw of modern man to become smaller and more contracted, hence making dentition itself a more difficult process.

I find it difficult to believe that anybody who has had any real experience of normal and healthy infants can have failed to notice the almost universal development of symptoms during periods of dentition. In a strong and healthy child these symptoms may be very trivial. Salivation, running at the nose, running of the eyes, flushing of the cheeks, loss of appetite, failure to gain in weight, or loss of muscular activity and firmness. There surely cannot be any nurse who is not familiar with some or all of these ordinary symptoms during the period of dentition. There may, indeed, be far more serious symptoms in the case of sickly or delicate infants—high temperature, vomiting, diarrhœa, or even convulsions. It is a most common saying amongst the poor that their babies cut their teeth with some particular train of symptoms, such as bronchitis, diarrhœa, or sickness. There is much more than a

basis of truth in these old wives' beliefs. It appears to me to be perfectly clear why one infant cuts its teeth with bronchitis, another with vomiting, and another with diarrhoea. The particular form the symptoms take will depend entirely on the previous history of the child. The symptoms will always be referable to the most vulnerable or to the most damaged organ. If a baby suffers from diarrhoea soon after birth, or from fits, or from vomiting, although these symptoms may disappear after a time, they will almost invariably leave some special weakness behind and recur under conditions of stress. When, with teething, the whole of the nervous system becomes disturbed or disorganised, the outward manifestations of this disorganisation will take place in those parts or in connection with those nerve centres which are least stable and most liable to suffer loss of equilibrium. Hence it comes about that, if a baby has had a long-continued cough for instance immediately after birth, it is liable to a recurrence of the same symptoms during teething when the whole of the nervous system has its equilibrium temporarily disturbed. Symptoms of some kind may, therefore, be expected during dentition, but they need not be of a severe nature if the infant has previously enjoyed good health.

Retarded dentition is almost universally regarded as a symptom of rickets, but such strange vagaries occur in the times of eruption of the deciduous teeth—unaccountable precocity, as well as inexplicable delay—that I have long since given up attaching much importance to the bearing which the date of cutting holds with respect to the presence or absence of rickets. In fact, my own personal experience inclines me to the

belief that for the most part teeth which are cut late are better formed and last longer than those which are cut early and are simply little transparent spicules like glass, but recent investigations by Blum and Mellion * seem to show that there is usually a noticeable delay in the appearance of the teeth in cases which can be shown by means of X-rays and chemical examination of the blood to be definitely rickety. In spite of this assertion they add :—

“ As a diagnostic sign of rickets, delayed dentition possesses little significance.”

On the other hand, I think there is a close association between the troubles of dentition and rickets. The more rickety the child, the greater tendency does it display to those spasmophilic and nervous manifestations which are characteristic of dentition.

There is no special treatment for the troubles of dentition apart from the maintenance of a high level of nutrition previous to the eruption of the teeth. During dentition itself, relief may certainly be obtained by incising or scarifying the inflamed gums, or sometimes even by simply rubbing them with orange juice. Why this latter measure acts so satisfactorily I am unable to say, but from long experience I can confidently commend the trial of it. Large doses of bromide are generally useful, if only to ensure adequate sleep.

* “ Relation of Dentition to the Diagnosis of Rickets,” *Journal Amer. Med. Assoc.*, 1926, p. 677.

CHAPTER XIV

OPHTHALMIA NEONATORUM

THE term Ophthalmia Neonatorum is not confined to the inflammation of the eyes which results from gonorrhœal infection at the time of birth or immediately afterwards. It covers all cases of purulent discharge from the eyes during the first fourteen days of life from whatsoever cause arising. It is true that about 60 per cent. of all such cases are due to infection with the gonococcus, but the remainder are due to other organisms, such as streptococci, pneumococci, Klebs-Loeffler bacilli (*Bacillus diphtheriæ*), *Bacilli coli*, *Bacilli pyocyanei*, occasionally the *Xerosis bacilli*, staphylococci, or simple catarrhal organisms.

Failing a reliable history of gonorrhœa in the mother, it is impossible to identify the nature of the infection without a bacteriological examination of the discharge itself, which, as a matter of fact, should be carried out in all cases, the swab being sent to the local Public Health Department, unless there are other facilities for conducting the examination. From the point of view of the midwife, this uncertainty is a matter of small importance, since all cases of purulent conjunctivitis occurring within a period of fourteen days after birth, irrespective of the nature of the infection, must be notified, and of course medically treated.

Other forms of infective ophthalmitis, such, for instance, as that due to a streptococcal infection, are

equally serious, and may lead to perforation and panophthalmitis. In my capacity as Consulting Physician to the National Institute for the Blind, most of the totally blind babies presented for admission to the Sunshine Homes of this Association pass through my hands, and I generally inquire in cases which owe their blindness to ophthalmia neonatorum as to the date at which the discharge first appeared and the date of its notification. About a quarter of all the cases of total blindness are due to ophthalmia neonatorum. There seems to be a certain elasticity of conscience among a minority of midwives as to the moment when a discharge from the eyes is sufficiently pronounced to require notification. This is most regrettable, as the fate of an eye is often determined by the application of treatment at the first onset of symptoms.

SYMPTOMS, DIAGNOSIS, AND RESULTS

In cases in which the infection takes place, as it usually does, during the act of birth or immediately afterwards, the symptoms first manifest themselves about the third day, which represents the normal period of incubation of the gonococcus. As a rule, both eyes are involved, and a thin serous discharge, which may occasionally be blood-stained, is noticed to issue from between the lids. During the following forty-eight hours the eyelids will be glued together by the drying of this discharge. They are usually somewhat reddened, oedematous, and ballooned owing to the accumulation of discharge behind them. The conjunctiva covering the eyeball is injected and somewhat elevated by an underlying exudate. Sometimes the cornea itself shows

signs of involvement by infiltration and elevation of its epithelium. If there is actual loss of transparency it is distinctly an unfavourable sign, since it represents a severe degree of general inflammation. In the occasional cases in which there is perforation of the cornea there may be extrusion of the lens and panophthalmitis (inflammation of the whole eye). This is more often the case when the infective organism is a streptococcus. In mild cases the cloudiness of the cornea completely clears up, but in others, corneal nebulae of greater or less degree persist, with gradual thinning of the cornea and staphylomatous protrusion, which may finally prevent closure of the eyelids. If skilfully treated, a large proportion of cases of ophthalmia neonatorum clear up completely, even if at the end of six weeks a little corneal haziness still persists.

TREATMENT

Prophylaxis is obviously more important than any remedial treatment—it depends on the prevention of the entrance of infective material into the eyes during the act of birth or immediately afterwards. Very occasionally infection may be conveyed to the eyes at a later date by the fingers of the midwife or mother which have become contaminated by contact with infective lochia. If the mother is known to have a vaginal discharge before the birth of the infant, no matter what be its nature, it is necessary to employ every precaution. Even without any discharge the danger of infection is so pressing that in certain institutions the method of instilling a drop of 2 per cent. solution of nitrate of silver into the eyes of all new-

born babies has been adopted. The success which followed the adoption of this method at the Lying-in Hospital in Leipzig, at which the method was introduced in 1882, was so remarkable that many other institutions have followed suit. Previous to the adoption of this method, the percentage of infants with ophthalmia neonatorum at that hospital was 10·8, while as a result of this prophylactic treatment there was an immediate drop to 0·5 per cent. At the present time this method of treatment has been somewhat modified at most lying-in institutions, and prophylaxis takes the form of wiping the eyelids and surrounding skin with dry pledgets of cotton-wool or lint as soon as the head is born. By this means the vernix caseosa and other secretions which may have been infected during the act of birth can be removed from the danger zone. It is particularly important that a separate pledget should be used for the cleaning of each eye, and that it should be perfectly dry. During the bathing of the infant subsequent to its birth, care must be taken that the contaminated water in which the body of the baby has been washed does not touch the infant's face, or more especially the eyelids—a separate bowl of clean water must be used for cleansing the skin of the face.

In cases in which there is known to be a vaginal discharge, more elaborate provisions must be taken against infection of the eyes. Every precaution should be taken to ensure that all discharges from the maternal passages are removed by douching previous to the confinement, and the Credé method of instilling 2 per cent. nitrate of silver or some other antiseptic, such as a 10 per cent. solution of protargol or argyrol, into the eyes should be invariably carried out.

Mr. M. S. Mayou, as a result of his experiences at St. Margaret's Hospital, reports that there seems to be some risk in the indiscriminate instillation of nitrate of silver into the eyes of new-born babies by midwives, and he claims that the method of using Acriflavine in castor oil (1 in 1,500) is far safer and almost as reliable as a solution of nitrate of silver, but without any of the attendant risks. A few drops of this antiseptic may be instilled into the eyes of all new-born babies, and especially in those cases in which there is the slightest risk of gonorrhœal infection.

CURATIVE TREATMENT

On the treatment of cases definitely diagnosed as ophthalmia neonatorum depends the fate of the eyes. Since it is impossible to predict the result in any particular case, every instance of purulent ophthalmia should be treated as if it were definitely serious. To carry out all the details of the most up-to-date treatment it is really necessary to secure the services of a specially trained nurse. Fortunately, as far as London is concerned, the London County Council provides such treatment at St. Margaret's Hospital, Leighton Road, Kentish Town, which the Council has taken over from the Metropolitan Asylums Board. Into this hospital any infant suffering from ophthalmia neonatorum can be admitted with its mother and treated in the most approved fashion. The eyes are frequently irrigated with a cold solution of boracic acid and bicarbonate of soda (5 per cent. of each), in bad cases, every two hours, or even oftener. After the irrigation, the conjunctival sacs are filled up with Acriflavine in castor oil, as

described above. When the swelling of the eyelids is subsiding, which it usually does at the end of a week or ten days, a 2 per cent. solution of nitrate of silver is substituted for the Acriflavine, but employed only twice daily. A special table, of which the makers are Messrs. Weiss (of Oxford Street, London, W.1) is employed. If this table is used the baby lies on an inclined trough so that the irrigating lotion can run off the side of the face into a tray connected with a pan containing lysol solution. It must always be remembered that the discharge in such cases of ophthalmia is highly infective, consequently every precaution must be taken to protect a sound eye, if such exists, or to prevent the slightest trace getting into the eye of the operator.

CHAPTER XV

MINOR AILMENTS AND COMMON COMPLAINTS IN THE NEW-BORN

IN this chapter I have grouped together a number of pathological conditions commonly found in the new-born about which the practising midwife should have some knowledge. Certain of these conditions have been referred to in other lectures, but for easy reference it will probably be a convenience if in this book a short and independent account of each is given.

MASTITIS OF THE NEW-BORN

The mammary glands of new-born babies, both male and female, are generally enlarged and swollen at birth or soon afterwards. The outline of the glands can generally be recognised as a distinct and well-defined swelling on the second or third day of life, and a few drops of secretion can be expressed on manipulation. The enlargement of the glands is due to the functional activity of the latter under the influence of the same circulating hormones or internal secretions as are responsible for a similar condition in the mother. The swelling in the infant under normal conditions rapidly subsides owing to the diminishing supply of the hormones after the separation of the foetus from the mother. If, however, the breasts are mechanically stimulated by friction, massage, or other means, the glands may con-

tinue to be functionally active and there is a danger lest they become the seat of actual inflammation (mastitis). For this reason the enlarged glands of newborn babies should not be manipulated in any way, and if the swelling does not subside a little pressure evenly applied by means of a crêpe bandage encircling the chest will usually promote their involution. A little atropine or belladonna and glycerine painted on the surface may accelerate the disappearance of the swelling. If an abscess forms it should be opened and treated with fomentations. In former days abscesses of this kind were quite common owing to the prevailing practice of "dispersing the nipple strings by manipulation."

THRUSH

Thrush is a parasitic infection of the mouth in which the tongue and mucous membrane become covered with milk-white crusts, which look somewhat like casein curds, and with which they are sometimes confused. The patches of thrush, however, generally leave a raw surface when they are removed from the epithelium of the mouth, to which they are firmly adherent. The parasite which is responsible for thrush is variously known as *Oïdium Albicans*, *Saccharomyces Albicans*, or *Monilia*, a common form of fungus with a very wide distribution in the air and in dust. Thrush does not, however, always develop very readily in the mouth unless the latter is in an unhealthy condition. The symptoms of thrush are occasionally quite severe, with temperature and constitutional disturbances resulting in diarrhoea and sore buttocks, although it is rare to find the fungus in the stools.

The treatment is quite simple and effective, and consists in wiping out the mouth with cotton wool or soft lint which has been steeped in a solution of Monsol. The formula for preparing this is as follows :—

Monsol	.	.	.	1 in 200.
Glycerine	.	.	.	1 drachm.
Water to make 1 oz.				

The old practice of constantly wiping out the mouth with lint or cotton wool steeped in glycerine and borax was responsible for a good many cases of thrush, for by this means the buccal mucous membrane was damaged and denuded of its epithelial covering. Anything which damages the mouth predisposes to thrush. For instance, the use of the "comforter," thumb sucking, or even prolonged periods of sucking at the breast or feeding bottle. Thrush often starts from little ulcerations which appear at the back of the hard palate at points where in cleaning out the mouth pressure is brought to bear on the hard bony prominence of the pterygoid by the finger or finger-nail.

TONGUE-TIE

Inability to extrude the tongue, with accompanying difficulty in sucking, is often erroneously ascribed to so-called tongue-tie, or shortness of the frenum linguæ. As a matter of fact, it is not so much shortness of the frenum which prevents the tongue from being properly projected and moved as a definite incapacity in the neuro-muscular mechanism to effect these movements. Degenerate infants often show a variety of neuro-muscular defects in addition to not being able to suck properly. They cannot control any tongue movements,

neither can they swallow well, and they show clumsiness in their limb and other movements. If an infant cannot project its tongue properly the frenum linguæ does not get properly stretched, hence it remains short and gives the false impression of restraining the tongue's movements. As a matter of fact, if infants cannot suck properly owing to failure in the neuro-muscular mechanisms, on which its movement depends, there is no advantage in cutting the frenum, the movements are just as restricted after section as before, and later on these infants are found to have difficulties in swallowing solid food and in speaking clearly. For this reason there is no advantage in snipping the frenum linguæ in supposed cases of tongue-tie.

SEBORRHŒA CAPITIS

In this common infection a mousey-coloured secretion collects over quite a large area of the scalp. In certain cases the whole of it may be involved. There is always some little risk that simple seborrhœa capitis may develop into actual eczema and spread from the scalp over the whole of the body. Seborrhœa is due to the accumulation of excessive secretion in the ducts of the sebaceous follicles at the root of the hairs. It occurs in debilitated and unhealthy babies, and is, in my opinion, mainly the result of damage inflicted on the ducts of the glands as the result of misguided efforts to clean the scalp with soap and water, or by other means. The scalp is always liable to damage at the time of birth owing to the pressure which it experiences against the pelvic bones. Damage may also be afforded before birth by reason of obstetric examination, and

after birth by too vigorous attempts to remove the vernix caseosa, which is entangled in the roots of the hairs. Like eczema, these seborrhœic conditions of the scalp are made worse by the use of water. If there are any indications of commencing seborrhœa it is probably better to forgo all attempts to clean the scalp with soap and water and rely for treatment on gentle sponging of the scalp with liquid paraffin, or liquid paraffin containing thymol, 1 in 80.

INCESSANT CRYING

So many babies are brought up to hospital for advice with the complaint that they are always crying that a few words on this subject may not be out of place, since it is the midwife who can do more than anybody else to prevent this troublesome symptom becoming an established and fixed habit. Crying is a protective reflex and a very valuable one, for the reason that it informs the mother that the infant wants something to be done for it which it cannot do for itself. But there is always the danger that this valuable protective reflex may become habitual by frequent repetition. For this reason it is an essential of good mothercraft to anticipate every want that the infant is likely to experience and thus obviate the necessity of attracting the mother's attention by means of this tiresome reflex. If an infant finds that he gets a reward every time he cries he will soon realise that it is good business to earn the reward as often as possible. The chief reasons why infants cry in order to attract the attention of mothers is because they experience some discomfort in connection with the digestive organs, sometimes because they

get too much food, sometimes because they do not get enough, and at other times because the food is inappropriate and causes colic or flatulence. Babies who are fed in accordance with the principles laid down in this book are not liable to suffer from discomforts owing to any of these causes. They may, however, cry because they are uncomfortable from other causes, such as that due to want of changing of napkins, or to creases in their clothing, but good mothercraft will take precautions against all these possible sources of discomfort.

FISSURE IN ANO

This condition often causes trouble because it may give rise to spasm and pain when the sphincter becomes stretched on passing a motion, a state of affairs which may easily lead to enforced constipation. It is sometimes a little difficult to see the fissures on examination but little streaks of blood on the motion should raise the suspicion of their existence. If by gentle manipulation with the fingers the anal lining can be drawn down, little cracks can often be discovered which very easily bleed on pressing or pulling. The best treatment in this case is to keep the cracks as clean as possible by sponging, and to coat the inside of the anus with a cream which contains bismuth, or by the insertion of a suppository containing some soothing lubricant.

PHIMOSIS AND CIRCUMCISION

The foreskin of new-born babies is sometimes so tight that no opening can be discovered, but none the less, under such circumstances, the infant can pass quite

a good stream without straining. In such cases circumcision should be performed at the earliest possible opportunity, and if possible, without the administration of a general anæsthetic. The reason for operation is not for the immediate relief of difficult urination, but because of possible future complications and the fact that the prepuce is often adherent to the glans. If the prepuce can be stretched sufficiently to withdraw it beyond the corona of the glans either with or without separation of adhesions, the operation of circumcision may not be necessary, but whenever there is any doubt as to the desirability of so doing the decision should be in favour of operation. The operation should always be performed in accordance with the best methods of antiseptic or aseptic surgery, and should not be carried out by unskilled operators, and the method of slitting the foreskin is thoroughly irrational, and possibly dangerous. In all cases, whether the prepuce is tight or loose, it should be drawn back daily and the parts thoroughly washed, to prevent the accumulation of so-called smegma between the glans and the foreskin. Smegma consists of degenerated and exfoliated epithelial cells, and not of an inspissated secretion as is usually supposed.

HÆMATOMA OF THE STERNO-MASTOID MUSCLE

This condition is sometimes known as sterno-mastoid tumour. It is generally the result of rupture of some of the fibres of the sterno-mastoid muscle, due to torsion or traction on the after-coming head in cases of breech presentation. When such rupture takes place

hæmorrhage occurs into the substance of the muscle, and later on reveals its presence by the formation of the so-called "tumour," due to organisation and fibrosis of the blood clot. The condition is at times mistaken for an enlarged cervical gland, and is sometimes held responsible for wryneck, although this latter condition is practically always due to a totally different cause.

OBSTETRIC PARALYSIS

The two forms of paralysis resulting from obstetric trauma most commonly met with are those due to damage either of the facial or brachial nerves.

1. **Facial Paralysis.**—This is generally caused by the pressure of the blade of the forceps on the facial nerve at some point distal to where it emerges through the stylo-mastoid foramen of the temporal bone. The paralysis is not always evident immediately after birth. It may take two or three days to develop, but when it does occur the muscles supplied by the facial nerves on the side of the injury are limited in their movements. The eye may remain open, the forehead unwrinkled, and when the infant cries the corner of the mouth on the damaged side may remain immobile, giving the child a somewhat lopsided and sinister appearance; sucking however is not interfered with. Complete recovery generally takes place in a few weeks, and, meanwhile, no treatment is required except to protect the eye from mechanical injuries in those cases in which the lid does not properly close.

2. **Brachial Paralysis.**—In paralysis of this type one or more of the cords of the brachial plexus are torn or lacerated, leading to paralysis or weakness of the

muscles supplied by the damaged strands. Two types are commonly recognised :

(1) The upper arm type or so-called Erbs' paralysis, in which soon after birth the child's arm is seen to hang helplessly by the side—the elbow is unbent, the forearm pronated, and the humerus adducted and rotated inwards.

(2) The lower arm type (Klumpke) in which the muscles of the forearm and hand are mainly affected. The arm is bent at the elbow and the wrist is extended, while the hand is flaccid with the fingers flexed. Sometimes there is concomitant drooping of the eyelid on the same side as the paralysis, and the pupil may be small. These ocular complications are due to concomitant damage to the sympathetic nerves on the same side.

Both types of brachial paralysis require treatment by splinting or bandaging in order to avoid stretching of the paralysed muscles. In mild cases recovery may be complete, but in most cases the prospect is not too hopeful.

DISCHARGING EARS

Inflammation of the middle ear (otitis media), either with or without rupture of the tympanic membrane, and with discharge, is a very common complication of septic conditions in young infants. It is by no means always easy to make a correct diagnosis of inflammation of the middle ear or of the mastoid cells. Signs of meningitis or cerebral irritation are usually absent. Vomiting and diarrhoea are far more frequent. For a good many years past we have made a habit of examining the mastoid cells at all the post-mortems conducted

at the Infants' Hospital, and it is quite surprising what a large number are found to have pus either in the middle ear or the mastoid cells, although there may have been no suspicion of its presence during life. Whether otitis media in these cases is primary or secondary is very difficult to say, but in a good many cases we have come to the conclusion that it was the terminal result of a more or less generalised septic condition.

MENTAL DEFICIENCY

It is often difficult to recognise signs and symptoms of mental defect in young infants. At an age when a child has no mentality, it is almost a contradiction in terms to say that it is mentally defective, but infants who subsequently prove to be without doubt mentally defective often show physical abnormalities of the skull and other parts of the body, and especially is this the case with Mongols, Microcephalics, and Hydrocephalics.

Mongols. Mongolism is one of the commonest of the congenital types of mental and physical abnormality, and is usually characterised by functional as well as structural defects. The Mongol is by no means always an imbecile, indeed, a low-grade Mongol differs very little from an individual of normal mentality, but there are many degrees of this abnormality.

The most striking feature in connection with Mongols is the uniformity of their peculiarities, no matter to what race they may belong. Although the exact causation of the condition is not known, it is now generally regarded as being due to some germinal defect in the ovum or spermatozoon, and not due, as was formerly believed, to some endocrine or uterine deficiency in the

mother. This view is supported by the fact that in cases of twins, one may be a Mongol and the other perfectly normal.

The main structural characteristics of Mongols are the shape of the head, which is short from the front backwards (brachycephalic), and the back of the head or occiput is flattened. The axes of the palpebral fissures are oblique, as in Mongolian races, and hence the name. The folds of the skin which join the eyelids at the inner angle—the so-called epicanthic folds—are much wider than usual. The bridge of the nose is generally somewhat flattened. The tongue is too large for the mouth, and hence is generally protruding. The abdomen is flaccid and pendulous, and there is often an umbilical hernia. There is also frequently some abnormality in the development of the fingers, toes, ears, and other extremities, in fact the Mongol is generally what might be described as a physical degenerate, of fixed and uniform type—a badly finished individual. Functionally a Mongol is generally of debased mentality, sometimes an imbecile. Breathing is nearly always noisy or stertorous, depending partly on the anatomical structure of the fauces and partly on the inco-ordinate movements of the soft palate. There is no specific treatment, but adherence to thyroid and pituitary therapy is, in my opinion, of very definite advantage.

EARLY SIGNS OF MENTAL DEFECT

Quite apart from such physical abnormalities, however, mental deficiency may be suspected when the infant carries out the ordinary simple organic functions in an abnormal manner, that is to say, when it will

not or cannot suck properly, when it has difficulty in swallowing, breathing, defæcation, urination, etc. Incessant crying without adequate cause is one of the most constant of the early symptoms of mental defect in young infants. Convulsions or fits are also very suggestive, especially when no obvious reason for their occurrence can be discovered. Since colic and other forms of indigestion can give rise to a succession of fits in nervous infants, it is important from the point of view of prognosis to eliminate such causes.

HARE-LIP AND CLEFT PALATE

Both these conditions are often thought to be incompatible with breast-feeding, but, as a matter of fact, it is usually possible with a little patience and perseverance to keep the baby suffering from one or other of these abnormalities at the breast in spite of its physical disabilities. It must be remembered that infants normally obtain milk from the breast by a modified process of expression, and not by the formation of a vacuum in the mouth. It is possible for infants with hare-lip or cleft-palate, or indeed with both these malformations, to express milk from the breast by a slight modification of the ordinary mechanism of sucking. It may, however, take some little time before they learn how to accomplish this feat with any degree of success.

The operation for hare-lip can be performed at any age, but it is better as a rule to wait until the child is in a good physical condition for the operation. This result is more likely to ensue early in the case of breast-fed than in bottle-fed infants. The operation for cleft palate is usually left until the completion of the first dentition.

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CHAPTER XVI

JAUNDICE OF THE NEW-BORN

(Icterus Neonatorum)

SLIGHT degrees of jaundice are common, and possibly physiological, in the new-born. It is probable that the jaundice is due to the rapid destruction of red blood corpuscles (hæmolysis), which follows immediately after birth. Before birth, owing to the limitations of the placental circulation, the provision of an adequate supply of oxygen to the foetal tissues presents certain difficulties. To meet these it has been suggested that Nature supplies a larger number of red blood corpuscles than are requisite post-natally—consequently after birth a readjustment occurs and the excess of red cells is reduced during the neo-natal period. The blood colouring matter of the disintegrated red blood corpuscles is converted by the Küpfer cells of the spleen, liver and red marrow into bile pigment, which under normal circumstances is excreted by the liver and kidneys. Since neither the liver nor the kidneys assume their full functional activity during the early days of life, the retention of bile pigment in the blood with an icteric colouration of the skin is quite explicable.

The degree of icterus differs according to circumstances. In the case of premature and weakly infants the icterus is more pronounced and persists longer than in the case of full-time and strong infants.

This so-called physiological or idiopathic icterus of

the new-born is not, however, the only form of jaundice which presents itself during the first few weeks of life. There are other varieties of a more serious nature, and it is therefore obviously desirable to be able to distinguish the so-called physiological from the definitely pathological types.

In the simple jaundice of the new-born the discolouration of the skin is usually first noticed on the second or third day, and it seldom persists for more than a week or ten days. The colour varies from a pale lemon to a deep yellow. Slight degrees of jaundice are best recognised by drawing the finger briskly across the skin, when a yellow discolouration will appear in the track of the pressure. The icterus is most obvious round the mouth and on the forehead. The conjunctivæ are not discoloured in mild cases. The urine does not stain the napkins, and the colour of the fæces is normal. There are no constitutional symptoms and no hæmorrhages, while the pulse and temperature are, as a rule, normal.

The other forms of jaundice from which physiological icterus must be distinguished are :—

1. Obstructive Jaundice.

- (a) Catarrhal, which is rare.
- (b) Congenital absence of bile ducts—also rare.
- (c) Adhesions or growths which obstruct the flow of bile into the duodenum—also rare.

2. Toxic Jaundice.

- (a) Icterus gravis,* including all forms of septic jaundice.
- (b) Jaundice from other toxic causes.

* Some authorities classify Icterus gravis in the same category as physiological jaundice, only more severe in degree.

3. Congenital Acholuric Jaundice.

4. Cirrhosis of the Liver.

(a) Syphilitic.

(b) Simple.

OBSTRUCTIVE JAUNDICE

In obstructive jaundice from any of the above causes bile is present in the urine but absent in the fæces. There is, as a rule, no pyrexia, few constitutional symptoms, and no tendency to hæmorrhage, excepting in the case of congenital absence of bile ducts.

TOXIC JAUNDICE

In toxic jaundice, which includes so-called icterus gravis, the jaundice generally appears a few days after birth and rapidly increases in intensity, thus distinguishing itself from the physiological variety, which, as a rule, rapidly improves. There is sometimes an accompanying anæmia, at other times there is to be found some source of sepsis, such as suppuration of the navel. The infant generally becomes drowsy, refuses its food, and later develops convulsions or coma. As a rule there is not much pyrexia till towards the end. The absence of pyrexia is a bad rather than a good sign.

CONGENITAL ACHOLURIC JAUNDICE

In this form of jaundice the liver and spleen are enlarged. There is fragility of the red blood corpuscles, and usually a familial history.

SYPHILITIC JAUNDICE

In syphilitic cirrhosis there are other signs of the disease. In the following table the distinguishing symptoms of the several varieties are given :—

DIAGNOSIS OF JAUNDICE IN THE NEW-BORN

	Bile in the urine.	Bile in the fæces.	Time of onset of jaundice.	Fever.	Constitutional disturbance.	Tendency to hæmorrhages.
Icterus neonatorum .	Absent.	Present.	2-3 days.	Absent.	Absent.	Absent.
Icterus gravis and other varieties of toxic jaundice.	Present.	Present.	During the first day or later.	Absent at first.	Marked.	Absent.
Syphilitic .	Present.	Usually present.	Varies.	Usually Absent.	Marked.	Present.
Congenital malformation of obstruction of the bile ducts.	Present.	Absent.	During the first few weeks.	Absent.	None at first.	Present.
Congenital acholuric jaundice.	Absent.	Present.	After the first few days.	Absent.	Absent.	Absent.

(Adapted from Dr. F. M. B. Allen's handbook on "Diseases of Infants and Children.")

As regards treatment, nothing is necessary in the case of the physiological variety and little can be done in the case of icterus gravis, which is usually associated with severe general sepsis. The syphilitic variety must be treated on its own lines. Quite recently blood transfusions have been given with success in a variety of cases of icterus, and it is usually worth trying. The blood may either be injected into the longitudinal sinus through the anterior fontanelle, or by the simpler method of intramuscular transfusion. About 10 c.c. of the mother's blood is sufficient in either case.

CHAPTER XVII

CYANOSIS AND ASPHYXIA IN THE NEW-BORN

BLUENESS, and especially temporary blueness, is a very common symptom in new-born infants. It is essentially due to want of oxygenation of the hæmoglobin or colouring matter of the red blood corpuscles. When the latter have free access to air or oxygen they assume a red colour. When, however, they are deprived of oxygen or come into contact with free carbonic dioxide gas (CO_2), they become blue owing to the displacement of oxygen. A baby appears blue when the blood which circulates in the skin is venous, in other words, is poor in oxygen. Under similar conditions, when the blood is well oxygenated, the skin and mucous membranes are of a pinkish or red colour. It does not necessarily follow, however, that because the blood itself is blue or venous the baby's skin is also blue or cyanosed. For the skin to become cyanosed it is clear that blue blood must be circulating through it, but sometimes, as in white asphyxia when the blood is bluest, the skin is quite colourless; this is because the blood is elsewhere, generally in the interior of the body, and particularly in the large veins of the abdomen. For similar reasons babies may suddenly turn deadly pale, although the colour of their blood may be quite normal. This is usually the result of sudden shock, which causes interference with the circulation, so that the blood is driven from the surface to the interior of the body. The

skin will immediately assume an extreme degree of pallor simply because there is no blood circulating through it to give it any colour. It follows, therefore, that a baby cannot appear blue or cyanosed unless blood which is actually blue itself is circulating through the superficial blood vessels of the skin.

CAUSES OF CYANOSIS

There is always cyanosis or blueness, with the above exceptions, when for any reason the blood cannot gain access to oxygen in the lungs. Hence there will be cyanosis when there is any serious obstruction to the entry of air into the lungs through the blocking of the air passages, or for other reasons. There will also be cyanosis when there is any embarrassment of the circulation which prevents the blood reaching the pulmonary alveoli where the oxygen is. Local cyanosis is very apt to occur when there is spasm of the arteries or arterioles which supply any circumscribed area of the body, or when there is any local pressure or interference with the circulation. Blueness of the hands, feet, nose or ears, or local asphyxia as it is called, is a very common example of failure of circulation in a localised area. It occurs in various conditions, more especially owing to chilling or loss of heat.

The more common varieties of generalised cyanosis are :—

1. That which is known as “Asphyxia of the new-born.”
2. That due to congenital heart disease.
3. That due to cerebral hæmorrhage.
4. That due to atelectasis.

Cyanosis also sometimes accompanies convulsions, or when food is aspirated into the respiratory passages. It may be due to prematurity or to cooling of the body, and it also occasionally accompanies certain forms of jaundice, and lymphatism with enlarged thymus gland.

It is not always easy to distinguish what is the cause or origin of an attack of cyanosis. I propose, therefore, to take each of the more common varieties and describe how they may be caused and how recognised.

ASPHYXIA OF THE NEW-BORN

Beginning with the so-called asphyxia of the new-born, I would point out that there are two varieties : firstly, asphyxia livida, the so-called blue asphyxia ; and, secondly, asphyxia pallida, the so-called white asphyxia. Of these two, the latter is the more serious.

Asphyxia Livida, is that common form of blueness which is met with in varying degrees in the new-born, and which soon passes off under appropriate treatment, leaving no consequences behind. It is usually due to some temporary embarrassment of respiration, due either to occlusion or partial occlusion of the respiratory passages by the presence in them of mucus, amniotic fluid, or vomited material. If the obstruction is removed by suction with a catheter passed down the throat to the entrance of the larynx the asphyxia and the cyanosis soon pass off. This result may be facilitated by the application of artificial respiration, which should, however, be very gently applied. In all such cases the infant should be kept thoroughly warm, if necessary by immersion in a hot bath.

Other causes of asphyxia livida are prolonged or precipitate labour, premature rupture of the membranes, twisting of the cord, premature separation of the placenta, or premature respiratory efforts before the head of the infant is clear of the maternal passages. Asphyxia in these cases is usually due to exhaustion or over-stimulation of the respiratory centre in the medulla. The respiratory centre which controls respiration is normally stimulated to activity by the presence of CO_2 in the blood. If, however, the respiratory centre is over-stimulated before birth occurs by excess of CO_2 , owing to any of the above-mentioned causes, it may fail to respond after birth to the normal quantity of CO_2 present in the blood, and under such circumstances the infant does not breathe, but gives the usual evidences of asphyxia livida, of which cyanosis is the most prominent.

In cases of asphyxia livida it may become difficult to establish respiration, and it may be necessary to employ artificial stimulation to set the respiratory functions in action. Stimulation may take the form of slapping the infant with a wet towel or immersing it alternately in hot and cold water, or the administration of certain drugs, such as aromatic spirits of ammonia, strychnine or alpha lobulin.

Since carbonic acid gas stimulates the respiratory centre, and over-charging of the blood with oxygen tends to remove CO_2 , the giving of oxygen to the asphyxiated baby may only help to make matters worse, but the administration of oxygen gas with 5 per cent. to 7 per cent. of carbonic acid gas is, from all points of view, a rational method of treatment, and is now regularly used at Queen Charlotte's Hospital. The

mixed gas may be given intra-nasally through a catheter, or by means of a glass funnel.

The chief thing, however, to remember about asphyxia livida is that the condition is probably only temporary, and not due to any innate defect either in the respiratory apparatus or in the circulatory system, and hence, when it is relieved, there is no reason to anticipate a return.

Asphyxia Pallida. This is a much more serious condition. There is pallor rather than cyanosis, and this is because the whole of the circulatory system is simultaneously paralysed, causing a passive congestion of the internal and abdominal veins. The infant bleeds, as it were, into its own abdomen ; but paralysis of the vasomotor system is by no means the only indication of the widespread nervous prostration. The muscular system is in a condition of paresis, if not paralysis, with loss of reflexes. This paralysis affects the muscles of respiration, including the diaphragm, so that without artificial respiration there can be no entry of air into the lungs. The heart's action is also adversely affected, and hence, if the pulse can be felt at all, it is slow and feeble, both at the wrist and in the cord.

Infants suffering from severe degrees of asphyxia pallida are, as long as it lasts, incapable of sucking or swallowing. The whole condition is, in fact, one of very serious collapse or shock, and even if respiration can be established by artificial means there is always the risk of a relapse. The treatment is exactly the same as that for asphyxia livida, but it has to be pursued with greater energy, and probably for a much longer time, always with the possibility that such efforts may be useless

and that there may be relapses after apparent resuscitation.

CONGENITAL HEART DISEASE

Blueness from this cause is not, as a rule, difficult to distinguish from other forms of cyanosis, although in the case of premature infants, quite apart from congenital disease, the heart is seldom sufficiently well developed to carry on the functions of circulation with efficiency. Nonetheless, in premature infants development proceeds after birth, and the heart is, as a rule, functioning normally within a few weeks. In full-time infants the foramen ovale and other openings in the septum of the heart may not be completely closed, but they usually become so in a few days. It is not always easy to distinguish soon after birth between congenital heart disease, which is likely to be more or less permanent, and that which may be merely an embryonic condition persisting after birth which will probably rapidly disappear. A little blueness of the integuments, due to defects in the action of the heart, is not a serious symptom unless it persists. Blueness, due to real congenital heart disease, is practically continuous, although of varying degrees, and unlike the blueness due to atelectasis or intra-cranial hæmorrhage, which is intermittent and spasmodic. With congenital heart disease the skin and certain areas of mucous membrane which are visible remain more or less deep plum-coloured. The colour varies in its degree of blueness in accordance with the extent of cardiac distress. A skin which may be almost pink under normal conditions becomes blue or plum-coloured on exertion. The nature of the developmental defect can sometimes be

definitely diagnosed by means of a stethoscope, or by an X-ray examination, or the records of the electrocardiograph.

Treatment is always unsatisfactory. Points to attend to are to maintain bodily warmth, to prevent undue exertion and mechanical embarrassment of the heart by the over-distension of the stomach or abdomen with food.

INTRA-CRANIAL HÆMORRHAGES

These can be, and in most cases probably are, the main causes of asphyxia livida. Hæmorrhages are very liable to occur in the new-born in any organ of the body, but they are naturally extremely serious when they involve the central nervous system. The cause of such hæmorrhages may be the circulatory congestion which occurs as a result of pressure on some part or parts of the body during the act of parturition, and which is followed by reactionary hæmorrhages after relief of the pressure. Cerebral hæmorrhage may also occur as a result of direct trauma or damage in the act of birth or from the use of forceps. A particularly dangerous kind of hæmorrhage is that which results from tears in the dural septa, and especially laceration of the tentorium cerebelli. Serious intra-cranial hæmorrhage can, however, occur without obstetric trauma, as is proved by the fact that very severe bleeding can take place in infants delivered by Cæsarian section. I was able some time ago to show students at Queen Charlotte's Hospital a specimen of this kind in an infant who died recently from intra-cranial hæmorrhage after a Cæsarian delivery (see also Chapter XXV., p. 254).

The differential diagnosis of white asphyxia due to

intra-cranial hæmorrhage from that due to other causes is by no means easy, for most cases of white asphyxia are accompanied by feebleness and slowness of the pulse, by paralysis of most of the muscles, by atelectasis or irregular breathing and incapacity to suck or swallow, in fact, by all the ordinary symptoms of shock, but the following symptoms are suggestive of cerebral hæmorrhage :—

Convulsions occurring immediately or soon after birth. If these are one-sided, it is particularly strong evidence of cerebral hæmorrhage. The fontanelle may be bulging, but the most conclusive symptom of all is the presence of blood in the cerebrospinal fluid, which may be proved by lumbar puncture. It is particularly important however, if the presence of blood is discovered in the cerebrospinal fluid which has been removed by the operation of lumbar puncture, to make perfectly certain that the blood is not due to the pricking of a blood vessel by the exploring needle. Blood from this source may be distinguished from that due to intra-cranial hæmorrhage by allowing the discoloured cerebrospinal fluid to stand in a glass for a short time. If after the corpuscles have subsided the cerebrospinal fluid remains straw-coloured, it is evidence that the blood in the cerebrospinal fluid has been present for some little time and is not fresh blood from the prick of the needle. Although it is of primary importance to discover whether the symptoms of asphyxia are due to cerebral hæmorrhage, nevertheless but little can be done in the way of treatment after this diagnosis has been made. Lumbar puncture, repeated several times, may relieve intra-cranial pressure and prevent its immediate consequences. Coagulation of

the blood and subsequent adhesions may give rise to cerebral symptoms at a later date.

In one case of cerebral hæmorrhage which came under my notice, and in which it was possible by the symptoms to diagnose fairly accurately the seat of the hæmorrhage, an operation for decompression, *i.e.*, trephining, was successful, in that the baby recovered and is still alive at the age of five years. In this case a large quantity of blood was washed from the surface of the cortex. The worst cases of intra-cranial hæmorrhage are those in which bleeding occurs into the ventricles or into the basal ganglia of the brain. Cases in which the respiratory centre in the medulla is seriously damaged are practically hopeless.

ATELECTASIS

Atelectasis, or want of expansion of the lungs after birth, represents the persistence of a foetal condition. It may be due to various causes, chief among which are feebleness of the respiratory muscles, or exhaustion, or damage to the respiratory centre in the medulla. It may also be due to the aspiration of mucus, amnionic fluid, or vomitus into the respiratory passages. Some degree of atelectasis is a normal condition in the newborn, and especially in premature infants. The part of the lung most liable to fail in expansion is the paravertebral region of the lower lobes. The upper parts of the lungs usually expand fairly well, and especially the apices. A slight degree of want of expansion of the posterior portion need not be regarded as very serious. Although such want of expansion may be diagnosed by a physical examination of the chest, the detection of

atelectasis depends more frequently on the accompanying symptoms, which are, for the most part, mild degrees of recurrent cyanosis, feebleness of crying, and occasionally by recession of the lower intercostal spaces.

The treatment of atelectasis is more satisfactory than that of other varieties of asphyxia in the new-born. The respiratory passages should be cleared as far as possible by inverting the infant, and, if necessary, by suction through a catheter inserted as far down the throat as the opening of the glottis. It is not easy in most cases to pass the catheter through the glottis into the trachea, nor is it necessary if the infant is inverted. Artificial respiration can be carried out by alternate pressure on the chest and on the abdomen. This manipulation serves the double purpose of promoting the circulation of the blood through the heart as well as that of forcing air into the lungs. In this as in the treatment of all other varieties of asphyxia it is important to maintain the temperature of the blood by immersion, if necessary, in a hot bath or by the provision of an electric blanket ("Thermega," see page 126).

OTHER CAUSES OF ASPHYXIA

Beyond the fact that prematurity or immaturity may be causes of mild degrees of asphyxia in the new-born, it should be remembered that there are not many varieties of cyanosis, exclusive of those already mentioned, which call for detailed description. Undue distension of the stomach with food, or of the intestines with wind, may cause temporary embarrassment of the circulation, and, consequently, asphyxia or cyanosis. Cyanosis

from an unduly large thymus, with general lymphatism or increased development of lymphatic tissue throughout the body, may also be a cause of asphyxia and cyanosis. The treatment in this case is the same as that which is given under the heading *Asphyxia Livida*.

CHAPTER XVIII

SYPHILIS

SYPHILIS can be acquired by infants either before, after, or actually at the time of birth. When it is acquired before birth it is called congenital, which simply means that when the child is born it already has the disease (congenital or born with). Syphilis acquired before birth was at one time called "hereditary," a term which properly should be reserved for diseases, conditions or tendencies which are handed on from one generation to another through the continuity of the germ plasm. Thus epilepsy and insanity may be truly hereditary, since they can be transmitted through the germ plasm of either parent, but an infectious disease, such as syphilis, can only be communicated to another generation if the specific organism responsible for the disease actually comes into contact with the individual or with the ovum or spermatozoon from which the individual originates. In the case of congenital syphilis the specific organism (*Treponema pallidum* or *Spirochæta pallida*) can, theoretically at least, infect the ovum, the spermatozoon or the foetus itself, but it is probable that in the vast majority of instances the foetus is infected through the spirochæte reaching it by way of the placenta and maternal blood ; in other words, syphilis in the foetus presupposes an existing syphilis in the mother. With varying degrees of severity of infection, a foetus may be killed at an early

date and abortion result (macerated foetus), or with a less severe degree of infection the foetus may survive until full-time, when a still-birth may result, or the infant may be born apparently healthy and the evidences of the disease appear some little time after birth ; a small number are born with specific symptoms (rashes, etc.) already developed. The majority of cases of congenital syphilis are those in which the child is born apparently healthy.

Syphilis is now so easily detected by the Wassermann test, and so satisfactorily treated by improved therapeutic methods, that the disease is seldom allowed to continue untreated long enough either in the male or in the female for it to be transmitted to the offspring. Serious degrees of infection are seldom met with nowadays in infants, but owing to the relative immunity of women to the disease and to the mild symptoms of those actually infected, the disease can occasionally remain undetected and unsuspected in a pregnant woman before the birth of an infant, unless, indeed, there is some definite history in the father which leads to a sufficiently careful inquiry and examination of the mother. During pregnancy, women who actually have syphilis and have mild syphilitic symptoms do not always give a positive Wassermann reaction. This makes the diagnosis of syphilis in the infant all the more difficult. The natural immunity possessed by women—possibly due to the presence of antitoxins in their blood—may help to explain how it is that infants born apparently healthy and without symptoms can present unmistakable symptoms within a few weeks of the time of birth. This period of exemption from symptoms in the infant may be due to the presence in

their blood of the same antibodies which are present in that of the mother. It is interesting to note that infants with definite symptoms of syphilis do not infect their own mothers, although the latter may appear to be quite free themselves from syphilis. This phenomenon, which is known as Colles's Law, only goes to prove how mild the symptoms of syphilis may be in the mother ; it does not prove or even suggest that a woman who is free from syphilis can bear a tainted child, it simply proves that a mother can have syphilis without showing it. Another strange phenomenon is that infants who are apparently quite healthy and free from syphilis can sometimes be suckled with impunity by mothers or wet-nurses who definitely have syphilis. This is known as Profeta's Law, and seems to suggest that such infants have already acquired some degree of ante-natal immunity through the mother's blood, an immunity which persists after birth.

SYMPTOMS

There is no disease which has so many and such varied manifestations as syphilis. It can mimic, and has at times been mistaken for, almost every disease known to medicine. It spares no organs and no tissues. It would be out of place to give here a complete list of all these symptoms ; only a few of those which may be of interest to midwives will be given. One of the earliest symptoms is nasal catarrh (snuffles). A second one is a scaly dermatitis or psoriasis of the palms of the hands and the soles of the feet, sometimes also of the face ; and a third one is an erythematous or papular rash which appears on parts subjected to pressure or irritation.

At first this latter rash is red, but soon fades to a coppery colour, or so-called "lean ham" tint; it subsequently acquires a shiny or polished appearance. There may also be a bullous eruption (pemphigus), which is very diagnostic and characteristic, for it attacks situations which other forms of pemphigus spare, namely, the palms of the hands and the soles of the feet, while the contents of the bullæ are generally bloodstained and purulent. The so-called mucous patches are also very characteristic, and occur at the corners of the mouth and round the anus, vulva, and the folds of the groins or axilla, or other moist situations subject to irritation. Those which occur at the angles of the mouth and round the anus generally result in somewhat deep ulcerations and eventual fissures, which, when healed, leave permanent scars called rhagades, which also are highly characteristic of the disease.

Wasting is often well marked, and may at first be the only symptom. It generally begins about the end of the first month. The skin becomes dry and inelastic, giving the well-known "old man" appearance. Sometimes the skin also becomes yellow, earthy, straw-coloured, or of the so-called "café-au-lait" tint.

Undue softness of the cranial bones (craneo-tabes) is also most characteristic of congenital syphilis, and may be accompanied by hydrocephalus or with prominence or dilatation of the veins of the scalp, especially those at the side of the head. Professor Marfan, of Paris, regards this latter symptom as almost pathognomonic of syphilis. Many other bone defects occur in congenital syphilis, such as ulceration of the nasal bones, with ultimate falling in of the bridge (saddle nose), thickening or bossing of the two parietal and frontal bones

(Parrot's nodes) encircling the anterior fontanelle like four buttresses, giving the so-called "hot-cross bun" appearance to the top of the skull. The liver, spleen and testicles may become enlarged. There may also be jaundice. Later symptoms are chronic inflammation of the cornea, with dulness and loss of lustre of the surface (interstitial keratitis), thickening and exaggerated curvature of the tibiæ, giving the so-called sickle-shaped appearance of the bones ("sabre-tibia"). Painless sinusitis of both knees may also occur, and the permanent upper incisor teeth may be notched (Hutchinson's notch), but it must be remembered that the milk teeth are not affected. Another very characteristic symptom is the growth of the hair of the head in a wig or shock-like arrangement. In these cases the hair is long, straight, silky, and very dark, presenting altogether a very unnatural and artificial appearance.

An association of several of the above symptoms in older children—I mean such symptoms as the "saddle nose," notched teeth, rhagades at the corner of the mouth, and keratitis—give such a definitely characteristic appearance that a mistake in diagnosis is hardly likely to arise; but in the case of new-born babies in which no such pathognomonic evidences are present, diagnosis may be very difficult. Nasal catarrh, which is usually regarded as one of the most characteristic symptoms, may be due to other causes. In my experience, at least three out of four cases are of simple causation and not due to syphilis. When due to the latter, however, the catarrh has certain characteristics which are not found in cases of simple infection of the nose. The discharge is sometimes bloodstained and highly irritating, causing inflammation or even

ulceration of the surfaces over which it passes. The copper colouration of the rash is very suggestive of syphilis, and hardly occurs in any other condition. The mucous patches also, together with hoarseness of the voice, are very suggestive of syphilis. The painless enlargement of the liver, spleen and testicles hardly ever occurs in any other disease, but, unfortunately, these pathognomonic symptoms do not always occur to lighten the difficulty of diagnosis, which finally has to depend on the results of the Wassermann test, which in all cases of doubt should be applied to the parents as well as to the child, or the newer test, the "Kahn Flocculation Test," may be applied to help solve the problem.

PROGNOSIS

Prognosis is generally good in mild cases, but when a rash is present at the time of birth the prognosis is less favourable. The earlier the appearance of the symptoms, the worse the prognosis, and in all cases in which there is any severe degree of marasmus there is very little hope of recovery. If the mother is able to feed her baby its chances of living are greatly enhanced.

TREATMENT

The prophylaxis of syphilis in infants is most satisfactory when treatment is applied to the pregnant woman, even when such treatment is delayed until a few months before the infant is born. The success which attends the treatment of the infant after it is born is almost directly proportional to the dispatch with which the treatment is commenced. Mercury still

holds the field as a specific remedy, whether it be administered by the inunction of blue ointment or given by the mouth in the form of grey powder, but the newer arsenical preparations (Neo-kharsivan, Sulphostab and Sulpharsenol) and the bismuth preparations (Bismostab and Bistosol) are extremely useful when given in conjunction with mercury.

The general treatment of syphilitic infants is of importance. Breast feeding should always be employed where possible, and every precaution should be taken against chills.

CHAPTER XIX

THE SKIN OF THE NEW-BORN : ITS MANAGEMENT AND DISEASES

THE skin of new-born babies is very liable to become the seat of rashes and other inflammatory affections, owing to the fact that after soaking in amniotic fluid for many months it becomes soft, macerated and vulnerable. Infections of all kinds are liable to occur where the skin has been denuded of its epithelium or damaged by friction, washing or trauma. For this reason every care should be taken with respect to the ablutions after birth—that is to say, there should not be too much washing with soap and water, or too much friction with a towel, and the skin should be kept as dry as possible and protected with a liberal application of a suitable dusting powder. Powders consisting of, or containing, starch, do not fulfil the desired ends, as they mop up moisture and become converted into paste which easily decomposes or ferments. All dusting powders should consist of a basis of refined talc, French chalk, Kaolin, China clay, or Fuller's earth, all of which are different varieties of silicates, but insoluble and non-decomposable. To such a basis, if thought desirable, additions may be made of antiseptic, soothing or healing preparations, such as stearate of zinc, oxide of zinc, carbonate of bismuth or very finely powdered boracic acid. The whole of the skin of the new-born baby should be

thoroughly dusted with a powder of this kind. It is, in my opinion, quite incorrect to believe that comedones (blackheads), miliaria (minute blisters connected with the sweat glands), or pustules (minute points of infection) are caused by the blocking up of the ducts of the skin by means of these dusting powders. All these skin conditions are caused by damage and infection from want of proper protection or antiseptic treatment. Probably nothing prevents these accidents better than free dusting with a good face powder, the basis of which is French chalk.

ECZEMA

Eczema in young babies, or "eczema neonatorum," is one of the most difficult and intractable conditions to treat in the whole category of infantile complaints. Heredity undoubtedly plays a part in the etiology, just as it does in the case of asthma; indeed, these two complaints are often complementary in the same individual, or one member of a family may suffer from one while another may suffer from the other. Both conditions are similar in this respect, that they are "allergic"—that is to say, in each there is some pronounced susceptibility.

In the case of eczema the skin is particularly vulnerable to mechanical trauma, though sensitive also to every other form of irritation, chemical, physical, or psychic. In infants suffering from eczema the symptom called "dermographia" is usually present—that is to say, if the finger-nail or some blunt instrument is drawn briskly across the skin, the track of the scratch is soon made evident by the appearance of a longitu-

dinal weal of very much the same appearance, though different in shape from that of the usual urticarial spots, or nettle-rash, in its early stages. In eczema this vulnerability of the skin to all forms of irritation usually shows itself as redness followed by an inflammatory infiltration, and later by vesication or oozing, and finally by the formation of scabs or crusts. There is at first itching or burning and not infrequently a secondary infection if scratching is indulged in.

The eczema of infants more often than not originates in the scalp, and spreads over the face, neck, and the rest of the body. The starting-place is quite commonly a patch of seborrhœa, or an accumulation of greasy scales in or around the sebaceous glands at the roots of the hair. Eczema also tends to develop in certain parts of the skin which are specially exposed to the macerating influences of moisture or perspiration—for instance, it may appear at the back of the ears if soapy water has not been properly removed in drying, or it may appear in fat infants in the folds of the skin on the abdomen, groin, wrists, etc. The flexor surfaces at the knees and elbows are also favourite situations for the rash to appear.

Treatment.—Since the particular characteristic of the eczematous state is the hyper-sensitiveness of the skin, with exaggerated responses to stimulation or injury, it is clear that to prevent its development the skin must be protected from every form of damage or irritation. Thus, water, heat, cold, strong winds, rough clothing, scratching, and chemical substances such as soap or soda, are all irritants to be avoided in susceptible subjects. Babies with eczema, or those with a tendency to eczema, should be washed as seldom as pos-

sible, and it is a wise precaution to keep the skin clean by sponging with liquid petroleum, rather than by washing in the ordinary manner with soap and water. It is possibly better to leave it dirty than to wash it too much.

The curative treatment mainly consists in protecting the damaged skin from additional injury, especially that inflicted by scratching, to which the almost intolerable itching usually disposes. At the Infants' Hospital we employ a variety of devices to prevent infants suffering with eczema from scratching or rubbing. We splint the arms, apply masks to the face, tether the body and tie down the legs. A cure is impossible if scratching of any form is allowed.

As for local applications, the skin should be differently treated in accordance with the particular stage at which the inflammatory process has arrived, according also to the nature of the dermatitis, whether it is of the dry or oozing variety. It is often necessary to apply two or three different forms of medication to the same child, in accordance with the character of the inflammation. For the early stages, in which the skin is red, hot and irritable, calamine lotion, to which may be added an equal part of lead lotion (*Lotio Plumbi Subacetatis*) or a small quantity of *Liquor Carbonis Detergens*, may be used. Ten drops of opium to the ounce also increase its effectiveness. For the next stage, in which there may be denudation of the skin with oozing, a simple soothing ointment is more suitable—such, for instance, as *Unguentum Acidi Boraci*. For the more chronic stages, one or other of the following ointments may be tried :—

Unguentum Picis Co

Crude coal tar.	.	.	.	2 drachms.
Zinc oxide	.	.	.	2 „
Corn starch	.	.	.	1 oz.
Yellow soft paraffin	.	.	.	1 „

or—

Unguentum Resorcini

Resorcin.	.	.	.	35 grains.
Zinc oxide	.	.	.	35 „
Bismuth subnitrate	.	.	.	35 „
Birch tar	.	.	.	35 „
White wax	.	.	.	80 „
Soft paraffin	.	.	.	$\frac{1}{2}$ oz.
Hydrous wool fat	.	.	.	$\frac{1}{2}$ „

If one application fails, another may be substituted, for it is almost impossible to predict in any case what formula will best meet the requirements or how particular idiosyncrasies may be most satisfactorily humoured.

In very chronic cases in which there is considerable thickening of the skin, with or without cracks, Unna's Zinc Oxide Paste (*Gelatinum Zinci*), with or without the addition of ichthyol, is often of great service. It should be painted on warm and then thoroughly well dabbed with cotton wool. It thus forms a dry and protective coating.

As regards dietetic treatment, I have very little advice to offer beyond that of avoiding overfeeding, whether as a whole or with respect to particular elements, such, for instance, as proteins, carbohydrates or fats. The principles of physiological feeding should be strictly adhered to. For some reason or other—allergic possibly—breast-feeding does not seem always to suit eczematous babies. With a persistence of the symptoms in spite of local treatment, I advise the

relinquishment of breast-feeding in favour of cow's milk modifications. If there is known, or suspected, to be any protein hypersensibility, peptonisation of the milk mixture will obviate anaphylactic reactions. In very chronic cases, with a dry and indurated skin, a course of arsenical treatment may be tried. In such cases, also, ultra-violet or X-ray treatment may be of advantage, and a yeast preparation containing the vitamin B complex often has a good effect.

Bromides and chloral are sometimes indicated to allay irritability of the nervous system and induce sleep.

GUM RASH

A great number of different names have been applied to this condition—the better known ones being lichen urticatus, strophulus infantum, teething rash, red gum, and hives. The rash consists of hard circumscribed papules of the size of a split pea. These usually undergo a certain amount of vesication and umbilication like the spots of chicken pox, with which they are often confused. The distribution is mainly on the back, flanks, abdomen, legs and arms. They seldom appear on the face, and practically never on the scalp. The general irritation to which the spots give rise usually leads to much scratching, and in such conditions the papules often become infected with pyogenic organisms, which may result in a condition which is indistinguishable from ordinary contagious impetigo, or even in a spreading and weeping dermatitis, which is identical in appearance with a long-standing eczema.

The Causes of Gum Rash.—The etiology of this papular and vesicular rash has given rise to much

speculation. Some authorities regard it as associated with digestive disturbances, and consequently of dietetic origin. Others consider it to be an allergic manifestation like eczema and due to protein hypersensitivity. Others regard it as a neurosis allied to herpes. The latest view is that it is due to the presence or liberation of the amido-acid histamin, which has an irritative and local influence on the connective tissue cells. There may be an element of truth in all these speculations, but what is definite and clear is that when a child has had one attack he becomes exceedingly susceptible to successive attacks of the same nature on very slight provocation ; in fact, a series of crops can appear, just as in the case of ordinary urticaria, from very insignificant causes. Certain foods, such as milk, yolk of egg, and acid fruits appear capable of determining an attack. Many drugs, including salicylates, chloral, iodides and bromides, can also have the same effect, while emotional disturbances, shocks, frights and falls are very frequent determining causes. During the period of dentition, when the equilibrium of the whole of the nervous sphere is upset, gum rash is very common. The diagnosis is not, as a rule, difficult. Recurrence of the attacks should distinguish it from chicken pox, moreover the distribution is different. In chicken pox the vesicles appear on the scalp, forehead and buccal mucous membrane, situations in which strophulus is never found. In gum rash the spots nearly always take a linear or patterned distribution which does not correspond with the distribution of the cutaneous nerves, but nevertheless has certain superficial similarities with it. The spots in chicken pox have a far more irregular distribution, they seldom conform

to any definite pattern such as is characteristic of strophulus. Gum rash and scabies (itch) are often mistaken the one for the other, and not perhaps without reason, for the irritation of scabies frequently produces urticarial weals with a similar distribution to that seen in ordinary cases of strophulus. Since the cause of gum rash is not definitely known and there appears to be more than one factor as an exciting cause, it is clear that there can be no one dependable line of treatment. At the best the plan adopted must be regarded as empirical and experimental.

Treatment.—As far as local treatment is concerned, there is probably none better than the application of calamine lotion, with or without the addition of tincture of opium. The lotion should be dabbed on the seat of irritation and allowed to dry. As for internal medication, in my experience the bromides are the most efficacious owing to their soothing influence on the nervous system, which in cases of strophulus is nearly always disturbed, either as a cause or as an effect. Inasmuch as digestion is usually upset, practical experience proves that a mixture of rhubarb and soda, to which bromide has been added, serves the double purpose of correcting the gastric and intestinal trouble and of quieting the nervous system. I strongly recommend the following formula for a baby of about six months of age :—

Tincture of rhubarb.	.	.	minims	10
Bromide of potassium	.	.	grains	5
Bicarbonate of soda.	.	.	„	5
Heavy carbonate of magnesia	.	.	„	5
Syrup	.	.	minims	20
Dill water	.	.	„	20
Emulsion of petroleum to make 1 drachm.				

Both adrenalin and ephedrin appear to have some specific influence on most varieties of nettlerash. The preparation called Adrephin Rx "B," which is a combination of the two drugs, and therefore possesses the properties of each, is very well spoken of by those who have tried it in cases of strophulus, which have proved irresponsive to other lines of treatment. It should be injected subcutaneously in doses of about 2-5 minims and repeated daily as long as occasion warrants.

Personally, I have not had much success in attempting to secure immunisation to those articles of food which have been recognised by cutaneous protein tests as responsible for the spots. On the other hand, non-specific peptone therapy has been more successful, and is worthy of a trial in an allergic condition such as strophulus presumably is.

GIANT URTICARIA OR ANGIO-NEUROTIC ŒDEMA

Closely allied to strophulus is that giant variety of urticaria which is known as Angio-Neurotic Œdema. This condition is essentially allergic and often arises after the consumption of the same kind of foods or drugs as those which produce ordinary urticaria or asthma. The special feature of the condition is the sudden development of a large œdematous, painless swelling, which may appear on any part of the body or on the mucous membranes, but the favourite seats of election appear to be the eyelids, lips, or the external genitals. As a rule the œdema is of the "non-pitting" variety. There is occasionally some extravasation of blood into the swelling which gives it a purplish appear-

ance not unlike purpura, in fact, there appears to be some affinity between giant urticaria and that variety of purpura which is known as Henoch's. Although these attacks often cause great alarm they usually disappear as rapidly as they develop, and they are without danger unless they involve the larynx or some other part of the respiratory system and cause obstruction to breathing. If any treatment at all is required, it is only in those cases in which respiration is interfered with. The subcutaneous injection of adrenalin or adrephin, as mentioned in the section on gum rash, should be resorted to without delay.

ŒDEMA NEONATORUM

Œdema as it occurs in new-born babies is not a specific disease. It is a symptom of general weakness, prematurity, sepsis or syphilis. It is particularly common in association with atelectasis, and, like the latter, is symptomatic of congenital debility. It is usually of serious significance. In new-born babies œdema very rarely connotes renal or cardiac disease, but there are several degrees of œdema which occupy an intermediary position between the ordinary mal-nutritional form and that rare variety which is known as sclerema. This latter variety usually appears later than other forms, generally about the second or third week, commencing in the feet and gradually extending over the whole body, giving the skin a marbly appearance, and the face a rigid mask-like look. Movement of the limbs is often interfered with by the stiffness of the integuments. A marked feature of this variety of œdema is the low temperature which accompanies it.

This sometimes sinks to 80° F. It was at one time thought that the induration of the skin in sclerema was due to coagulation of fat in the subcutaneous tissues in consequence of the low temperature and the high melting point of the fat, thus distinguishing it from other forms of œdema. This view is now abandoned, and the cause is referred to some obscure form of inflammation which brings about fat necrosis and the deposition of fatty acid crystals and calcium.

The treatment of all varieties of œdema is to keep up the bodily temperature, if necessary, by the internal administration of thyroid extract, as well as by the external application of heat. Nutrition must be maintained by correct feeding.

SORE BUTTOCKS

Sore buttocks may arise from many causes, among others from irritation of the skin as the result of soiled napkins, from urticarial spots, from syphilitic condylomata of the anus, from inflammation or irritation of the rectum or colon, and also as part of a general eczema of the body.

Although the treatment of sore buttocks, from whatsoever cause arising, is a matter of considerable importance, it is more important still to prevent this discreditable condition. As regards prevention, the skin in this part of the body, as elsewhere, can become so hard and thickened that no subsequent irritation or rough usage can leave any impression on it. But usually this result is only attained after much tribulation. By the merciful intervention of Providence, when infants are neglected and allowed to lie for long periods

of time in soiled napkins, the skin, though at first inflamed and even sometimes ulcerated, later proceeds to cure, which involves considerable thickening of the skin. This is Nature's method of protecting the helpless infant against the "slings and arrows of outrageous" mothercraft, but the same result can be arrived at artificially by the simple means of hardening the skin by deliberate prophylactic measures.

What to Avoid.—The skin of a young baby is necessarily tender and delicate owing to the fact that it has been soaking in warm water (amniotic fluid) for many months before birth. The macerated epithelial cells of the buttocks are very easily removed by any rough usage after birth, and by the removal of the superficial parts the tender underlying layers become exposed. It is more particularly the province of the maternity nurse or midwife to look after the buttocks during the dangerous period which supervenes after birth, and during this period the fate of the skin is usually sealed. The commonest form of damage which is inflicted at this period is the removal of adherent faecal matter by scraping the buttocks with a clean part of the napkin. Any sweeping or scraping movements of this kind are practically certain to remove the superficial epithelial cells. The proper way to clean the buttocks is to sponge them gently with warm water, and then to dry the skin by dabbing or patting with a towel or clean napkin, but *not* by rubbing. It is most important to keep the skin at all times as dry as possible, so as to enable it to become cornified or hard. For this reason the desirability of changing the napkins as soon as they become wet is obvious, but in many institutions, and in certain nurseries, it is the custom

to change the napkins at stated intervals, irrespective of the times at which they become wet. Infants who are well trained are, of course, saved from some of the dangers attaching to soiled napkins.

To Harden the Skin.—A good deal can be done to anticipate the natural hardening of the skin by the use of astringent applications. A very convenient method is to smear the buttocks very thoroughly with Hazeline cream, which contains a small quantity of tannin. This application is far better than smearing the buttocks with olive oil, which tends to soften rather than to harden the skin, and, which, is itself liable to undergo decomposition and become an independent source of irritation. The Hazeline cream treatment can be followed up after a fortnight by painting the skin with a solution of tannic acid in rectified or methylated spirits—one part in eight. This in a short time renders the skin as hard as boot leather, but it does not leave the brawny, puckered appearance which is characteristic of buttocks which have become hardened by exposure to wet napkins.

To Prevent Soreness.—The treatment of sore buttocks depends very largely on the cause, as it is far more important to obviate the cause than to attempt to mitigate its results. For this reason, an irritating condition of the fæces, especially when it is associated with looseness or frothiness, must be met by dietetic treatment and the administration of from 10 to 15 grains of prepared or aromatic chalk. When the urine is strongly acid this can be corrected by the liberal exhibition of an alkali, such as bicarbonate of soda or citrate of potash. That particular form of sore buttocks which is accompanied by deep excavation or

ulceration, and is part of a general urticarial rash, must be treated in the same way as urticarial spots on other parts of the body. The spots are specially common during periods of troublesome dentition. The treatment of condylomata of the anus should form part of the general treatment of syphilis.

Napkin Rash Due to Ammonia.—Napkin rash deserves special description. It is not due, as appears to be generally believed, to an acid condition of the urine, nor to the decomposition of urea by bacterial activity as is so frequently stated in books which deal with the diseases of infants. It is always due to one particular cause, *i.e.*, to irritation of the skin by ammonia, which manifests itself to the person who removes the napkin, by its pungent and characteristic odour. In such conditions, nurses and mothers often complain that their eyes are irritated when they change the napkins. Since this gas very easily diffuses, it spreads under the whole of the napkin and by it is retained in close contact with the skin. The inflammatory rash caused by this irritation corresponds therefore accurately with the area of the napkin. The reason for the liberation of this ammonia from the urine is that any ammonium salts existing in the urine are decomposed when they come into contact either with the air or with soda, if the latter remains in the napkin after washing. It is not the soda in the napkin which causes the irritation, for soda is rather soothing to the skin, but the fact that soda liberates free ammonia gas from fixed ammonium salts in the urine.

If ammonium salts always existed in the urine to any serious extent, every baby would be liable to napkin rash, but this, of course, is not the case; excessive

amounts of ammonium salts are only present in the urine of babies who are suffering from acidosis, a condition which very frequently occurs during periods of dentition, and seldom at other times. This is the reason why napkin rash rarely exists in very young babies, and is so frequent at or about the ninth month, when they are teething.

The distinction between soreness of the buttocks due to irritation by urine, by fæces, and by free ammonia (napkin rash) is as follows :—

When due to the first cause, the area of inflammation is immediately confined to the front where the napkin is usually most wet : when due to fæces, it is confined to the posterior areas where the napkin is usually most soiled : when due to ammonia, the redness corresponds with the whole napkin area, *i.e.*, assumes the “ bathing drawers ” pattern.

The treatment of napkin rash is perfectly simple. The local treatment is of little consequence as compared with that of the acidosis itself, and the treatment of this condition is not by glucose, the common but erroneous method now generally employed, but by the administration only of large quantities of either bicarbonate of soda, citrate of potash or both combined.

Local Treatment.—The local treatment of sore buttocks is comparatively simple. The choice of medicaments lies between calamine lotion, zinc oxide and castor oil ointment, or picric acid lotion. For syphilitic condylomata ordinary Black Wash is perhaps the best. For very severe conditions with deep ulceration, there is nothing to equal the picric acid treatment which should be applied just as it is in cases of severe burns.

In very intractable cases it may be necessary to dispense with a napkin and allow the buttocks to remain exposed to the air by placing the infant on its abdomen with the head turned to one side. In such circumstances every precaution must be taken that the child does not turn on its face and become suffocated. I have found ozonised air extremely valuable in difficult cases. The ozonised air is allowed to escape from a delivery tube into the air, under a fracture cradle which covers the buttocks of the baby.

Rubber Knickers.—In connection with napkin rash, and, indeed, with sore buttocks in general, the question of the desirability of the use of rubber knickers often arises. Inasmuch as napkin rash is due to the presence of ammonia which is pent up in the napkin in contact with the skin, anything which interferes with the escape of this gas into the air must necessarily aggravate the trouble, and, consequently, from this point of view the use of rubber knickers should be condemned. But napkin rash ought never to exist. It can always be cured by the administration of a sufficient quantity of bicarbonate of soda, or other alkali. Hence this argument against the employment of these articles of apparel is not particularly cogent. I feel inclined to admit that rubber knickers are a real convenience in travelling, and on other occasions when the napkins cannot be changed sufficiently often, as they certainly protect the general clothing of the infant from being soiled. It is true, however, that they may be hot and stuffy, but this is not of very great importance if they are only used as temporary expedients.

PEMPHIGUS

Pemphigus, when it occurs in older children and in adults, is a serious disease, because the degree of inflammation which is necessary to elevate extensive areas of the skin into large blebs must be considerable. In the case of the new-born baby, however, in whom the skin is soft and macerated, considerable areas of the epidermis may be easily elevated into large bullæ by degrees of inflammation which under other conditions would probably only produce small vesicles or possibly papules. Pemphigus neonatorum does not therefore necessarily imply serious inflammation, indeed, it represents the results of the same degree of inflammation which occurs in contagious impetigo in older children. It is, in fact, the same disease and is produced by the same organisms—*i.e.*, either staphylococci or streptococci. It is usually associated with unclean midwifery, and it occurs in epidemic or endemic form in maternity institutions and in the practice of doctors or midwives who have foci of septic infection, such as whitlows or impetigo about their person.

The degree of virulence, and consequently the danger to life, varies greatly in different cases and in different epidemics, but as a rule the mortality is low. The syphilitic form of pemphigus is, however, of a more serious nature, and can be distinguished from the non-specific variety by the fact that the syphilitic bullæ usually contain blood and occur on the palms of the hands and soles of the feet—a distribution which never occurs in the case of simple pemphigus. The treatment of syphilitic pemphigus is that of the disease itself. Treatment of non-specific pemphigus is simple. The

contents of the bullæ should be evacuated by snipping with a pair of scissors and an antiseptic ointment applied. Every precaution should be taken to prevent the spread of the infection to other parts of the skin.

CHAPTER XX

INFECTIONS OF THE NEW-BORN

INFECTIONS of the new-born are probably more common than is usually supposed, and they often prove fatal without revealing their identity by the development of the symptoms, which are easily recognisable in the case of older children and adults. A new-born baby, for instance, can suffer from a fatal septicæmia without the development of any temperature. Indeed, the attack may run an entirely apyrexial course. A new-born infant can suffer from most of the infectious diseases common to older infants, but they appear to have some degree of immunity to certain of those to which the mother herself is immune. For instance, a recently vaccinated mother, and one therefore presumably immune to smallpox, imparts some degree of immunity to the new-born child, and the same within limits may be true of other types of infectious disease from which the mother has recently suffered. This kind of immunity is probably passive and temporary only. Infants are very resistant to the infection, up to the age of one year, of scarlet fever and diphtheria, and up to the age of three months they seldom contract measles. On the other hand, they are particularly susceptible to the common cold, influenza, whooping cough, and various forms of sepsis.

The most frequent varieties of infection in the new-born are included in the general term "Sepsis," and

are due to one or other of the many forms of streptococci or staphylococci, although infections with pneumococci, gonococci and coli organisms are common enough. Infection with the Tetanus bacillus is exceedingly rare, although the symptoms, especially the meningeal symptoms, due to septic and other infections, may simulate those of tetanus very closely and may be mistaken for them. A groundless prejudice against the use of Fuller's earth as a dusting powder is largely due to the fact that meningeal symptoms have arisen in babies who have been dusted with Fuller's earth, and have been supposed to be suffering from lock-jaw, a disease usually due to infection with contaminated earth.

Infections may occur before birth, during birth, or immediately afterwards; through the amniotic fluid, vaginal secretions, or even breast milk in cases of mastitis or cracked nipples. Probably the most common site of infection is the raw surface of the umbilical stump, although abrasions of the mucous membrane of the mouth, or injuries to any part of the skin through rough handling, also predispose to infection. In recent years these sources of danger have been minimised by improved obstetric methods and the almost universal adoption of antiseptic or aseptic expedients in the handling of both mother and child. Improved feeding has also played some part, because with bad feeding various forms of damage are inflicted on the mucous membrane of the intestinal tract and pave the way for infection by this route.

COURSE AND SYMPTOMS OF SEPTIC INFECTIONS

The onset of sepsis may occur at any time, but fever is by no means an invariable symptom. Many of the

serious cases, as already mentioned, may run an entirely apyrexial course, which is most misleading to those who expect to find the same symptoms of sepsis in a baby as are found in adult individuals. Some cases so far from having fever have a definite subnormal temperature.

One of the most universal of the symptoms of sepsis in new-born babies is vomiting, but loss of weight, mainly due to dehydration, is also rapid and extreme. The pulse is usually rapid and respiration irregular. The general appearance of such infants gives the impression that they are seriously ill. They often have an ashen colour and look definitely toxic, refuse their food, and lie in an apathetic state, with feeble cry and flaccid muscles. The skin sometimes has an icteric tinge. Œdema is a common symptom, and there are also often hæmorrhages visible in the skin.

Although local evidence of sepsis is common, it is by no means always easy to discover the seat or the source of the primary trouble in cases of general infection. The umbilicus is so frequently involved, either primarily or secondarily, in these infections that the part of the body should always be subjected to a very careful examination. Apart from superficial suppuration of the stump, or inflammation of the circumjacent skin which may in certain cases amount to definite erysipelas, the inflammation may spread downwards along the umbilical arteries towards the bladder, or upwards along the umbilical veins towards the liver, in either case leading to a general pyæmia with multiple abscesses. The inflamed and thrombosed vessels can usually be felt by pinching up a fold of the abdominal wall, either above or below the umbilicus, and rolling

the interposed tissues between the fingers. In the case of involvement of either the umbilical arteries or the umbilical veins, a thickened cord can usually be felt which sometimes on squeezing gives rise to the issue of pus from the free surface of the umbilical stump. (See also chapter on "Abnormalities and Diseases of the Umbilicus (p. 232).)

Œdema of the skin is a frequent complication of sepsis in the new-born, and it may involve any part of the body, but the feet and legs are favourite situations for the anasarca to appear. The œdema takes the form of a peculiar induration of the skin which is not unlike that which is seen in a more intense form in sclerema. In this condition areas of the skin of various sizes become so hard and brawny that movement is actually interfered with. At times also the œdematous areas assume a purple colour not unlike purpura. Blebs or bullæ not uncommonly develop on the skin and assume the ordinary appearance of pemphigus—in fact, the condition sometimes passes under the name of Spurious Pemphigus. This condition is practically the same as Contagious Impetigo in older children.

Although almost any organ or area of the body may be involved in the septic inflammation of the new-born, the lymphatic glands constitute a marked exception. They seldom re-act or show enlargement, and, further, there is not as a rule any leucocytosis—a fact which may partly account for the low degree of resistance shown by the new-born to such forms of infection.

PROGNOSIS

Septic infections in the new-born are very fatal, especially in the case of premature, immature and con-

genitally debilitated infants. Should there be definite erysipelas, peritonitis, or multiple abscesses, recovery is very rare. Involvement of more than one organ makes the prognosis still more hopeless.

TREATMENT

Since the treatment of sepsis in new-born babies is at all times and under all conditions extremely unsatisfactory, it is the more important to rely on every possible means of prevention. In hospitals or institutions where numbers of babies are segregated the risk of infection is always greater than under ordinary domestic conditions, and, consequently, every antiseptic or aseptic expedient known to science should be exercised in the handling both of the mother and of the child, and should any case of sepsis occur under such conditions it is advisable to remove the baby from the dangers of the environment, even at the cost of weaning it from breast milk. Midwives who have any focus of infection, such as a whitlow or open sore, should temporarily give up practice.

As for curative treatment, beyond ordinary good management, breast feeding and the administration of stimulants, little can be expected; but blood transfusions and the use of anti-streptococcic serum should always be given a trial. In all cases in which the temperature is subnormal every effort should be made to maintain warmth by the use of electric blankets or hot water bottles.

CHAPTER XXI

HÆMORRHAGES IN THE NEW-BORN

HÆMORRHAGES of different degrees of severity are liable to occur at or soon after birth from various causes. They may be due to obstetric trauma, sepsis, syphilis, or to that peculiar and innate tendency which new-born babies have to bleed, which in its more intense form is known as Hæmorrhagic Disease of the New-born. All these examples of the condition, excepting the last mentioned, are dealt with in the Chapters on Birth Injuries, Sepsis or Syphilis.

HÆMORRHAGIC DISEASE OF THE NEW-BORN

Hæmorrhages which belong to this group usually commence at the second, third or fourth day of life, and they last from one to three days, and often cease quite spontaneously without any form of treatment. They are not, as a rule, very pronounced, but take the form of steady oozing, which may ultimately result in the loss of sufficient blood to make the baby extremely anæmic. One case which was admitted to the Infants Hospital was so blanched that even the lips were completely colourless, and the hæmoglobin content of the blood was only 10 per cent. of the normal, and we have had several cases in which the hæmoglobin was reduced to below 20 per cent.

The more common situations for the bleeding are the

bowel (melæna), stomach (hæmatemesis), umbilicus, adrenals, vagina (spurious menstruation), kidneys (hæmaturia), or the central nervous system (brain or spinal cord). At one time this condition was regarded as being very much of the nature of hæmophilia, but that view is now abandoned, because there is no hereditary tendency, and because of the comparative ease with which the condition can usually be cured. This tendency to bleeding in the case of new-born babies appears to be associated with some quite temporary incapacity on the part of the blood to coagulate, and thus stop further bleeding. Both the coagulation and bleeding time are more prolonged than is the case with older babies. The normal coagulation time is about five minutes. In hæmorrhagic disease it may be prolonged to half-an-hour or more. The bleeding time is normally two to five minutes : in hæmorrhagic disease it is often twice as long. The tendency for all new-born babies to bleed, but which is accentuated in so-called hæmorrhagic disease, is now thought to be associated with a restricted supply in the blood of a substance to which the name prothrombin has been given. It is derived from the blood platelets. The blood platelets in the case of new-born babies, or even in those suffering from hæmorrhagic disease, do not appear to be reduced in number, consequently it is supposed that they have some peculiar characteristic which prevents them from providing prothrombin.

TREATMENT

Although there appears to be a strong tendency to spontaneous cure, it is not safe to rely on this

natural process; especially as we have at hand a very safe and efficacious method of treatment in blood transfusion, or the intramuscular injection of blood. Before this method was introduced the mortality in cases of hæmorrhagic disease was considerable; now it is much less. In those cases in which a serious condition of anæmia has been brought about by the hæmorrhages, it may be necessary to transfuse blood, which has been properly grouped, into the longitudinal sinus or other accessible vein. As a rule 10 c.c. of whole blood for every pound weight of the baby is sufficient, but the transfusion may have to be repeated. In the case of severe anæmia already mentioned, in which the hæmoglobin was only 10 per cent. of normal, transfusion into the longitudinal sinus was carried out within half-an-hour of admission to the hospital, and the infant's life was thereby undoubtedly saved. But in cases of less serious bleeding, in which a condition of obvious anæmia has not been produced, it may be quite sufficient to inject intramuscularly 5 c.c. of the whole blood of the mother or of some appropriate donor. As this is a comparatively simple matter, it can be carried out without difficulty under normal home conditions. For an intravenous transfusion it is usually necessary to have all the resources of a hospital.

CHAPTER XXII

CONGENITAL MALFORMATIONS

WHEN we consider how complex is the process of development of the body, and how the latter arises from a single impregnated cell or ovum, and reaches the full shape at the time of birth, it is hardly surprising that so many different defects in structure are found at times to mar its completeness. During the early stages of the development of the embryo the slightest interference with the normal physical conditions under which it grows, or with the nutritional requirements, may produce quite disproportionate results, and the earlier the period that such interference takes effect the more serious will be the sequel.

At the time of birth many malformations are so obvious that they cannot escape detection, but others may have to be looked for carefully before they are found. In bathing, changing, and clothing new-born infants, many opportunities are afforded for the discovery of abnormalities, but such abnormalities as slight degrees of asymmetry of the two sides of the face or body, congenital cataract, or absence of parts of the pupil of the eye (*coloboma iridis*), often remain undiscovered until after the midwife has given up charge of the infant. Although every new-born baby should be carefully examined for gross abnormalities of development of the trunk, limbs and head, special care should

be taken to exclude the possibility of herniæ of the brain or bowel, imperforate anus or rectum, or varieties of hermaphroditism, since failure to recognise these malformations reflects little credit on the reputation of the midwife. Cleft palate and imperforate rectum are probably the two congenital malformations which are most often missed during the early days of life. It is hardly the duty of the midwife to discover congenital deformities of the heart, or congenital obliteration of the bile ducts, but the former condition may be suspected by anyone without special medical knowledge when there is persistent blueness of the lips and fingers, and the latter with persistent jaundice and light coloured motions.

CAUSES OF CONGENITAL DEFORMITIES

Most congenital deformities are due to arrest of development before the affected part has had time to be completed, that is to say, development proceeds along perfectly normal lines up to a point and then stops. Why development should be thus arrested is by no means clear, but there is reason to believe that in most cases it is due to some innate or hereditary defect in the germ plasm itself. The progress of development proceeds up to a certain stage and then ceases abruptly from inertia or lack of vital energy. Quite a large number of congenital malformations represent the persistence of structures which though normal in an embryo of some particular stage of development, are quite out of place in an infant at full time. Thus the condition of hare-lip represents the persistence of a stage in the development of the bones out of which the

upper jaw is formed, which under normal conditions should coalesce before the time of birth. The same is true of many cases of congenital heart disease. In these cases the defects usually represent openings from one cavity of the heart into another, or other structural deficiencies, which are quite normal, and indeed physiologically essential in the heart of the embryo before the pulmonary circulation is established, but are quite abnormal and out of place in the full-time infant at the time of birth.

These defective powers in the germ plasm to continue growth and development, seem to be inherent and hereditary, for the reason that the same defects are sometimes found in several members of the same family. What brings about this hereditary tendency is however difficult to explain. We know, however, that chronic poisoning of the germ plasm of either parent by alcohol, lead, syphilis, tuberculosis, malaria, and other chronic forms of poisoning, may so devitalise the cells, out of which the spermatozoön or ova develop, that if impregnation occurs the resulting embryo may exhibit various abnormal developmental tendencies. It is of course possible that if the same sort of poisoning continues to damage the germ plasm in two or three consecutive generations it may become permanently injured and fail to reach normal development.

Congenital malformations may, however, be due to other causes than damage inflicted on the germ plasm before impregnation. They may be due to the incidence of mechanical or physical injuries on the embryo during the course of development *in utero* after impregnation has occurred. Such injurious influences as limitation of the amnionic fluid, cramped positions, or strangling

effects of adhesions, amnionic bands or loops of umbilical cord, may interfere mechanically with the circulation or the processes of growth. Anything which interferes with the blood circulation in any limb or part of the body will of course interfere with its normal development. The so-called intra-uterine amputations of limbs are instances of interference with the circulation. In the stumps of such amputations there are sometimes to be found the rudiments of a toe, finger, or other part of the extremities, which indicate by their size or stage of development the date on which the strangulation first occurred. Maternal impressions can have little or nothing to do with the development of congenital malformations for the reason that it can generally be proved that the arrest of development has occurred at a date which does not correspond with the incidence of the supposed impression. Although at the present time we cannot claim to have a very accurate knowledge of the causation of functional or structural "stigmata of degeneration," we know sufficient about them to believe that they are due to one or other of the above-mentioned causes.

I have already referred to the great number of possible congenital malformations. There is no organ or part of the body which is not liable to present malformations of some kind or other. Indeed, there is always the possibility that more than one kind of malformation may co-exist in one organ. It is therefore obviously impossible in a short account of such malformations to refer to more than a few of those which are the most commonly met with. Such cases of malformation as the absence of one eye (cyclopia), the absence of head or part of the head (anencephaly), the

absence of limbs or part of limbs, the possession of supernumerary finger (polydactylism), or webbed fingers or toes, the absence of part of the abdominal wall with protrusion of viscera, etc., cannot escape recognition and require no special description.

One of the most common forms of congenital malformations is a hernia or protrusion of an organ or part of an organ through the wall of the cavity to which it properly belongs. Herniæ are particularly common in the case of the abdominal organs ; also herniæ of the brain substance or of the spinal cord are not uncommon. Malformations occur frequently in connection with the development of the various orifices of the body, especially of the mouth (hare-lip and cleft palate), and of the penis (epispadias and hypospadias), and of the vagina and rectum. Tongue-tie is often included in the list of congenital malformations, but, properly speaking, it can hardly be regarded as such, and it will be briefly referred to in the Chapter on "Minor Ailments and Common Complaints in the New-born," see p. 160.

HERNIÆ

Herniæ of the Brain.—These may consist of actual protrusions of brain substance, when they are called cephaloceles or encephaloceles ; or they may consist merely of protrusions of the membranes distended with cerebrospinal fluid, when the conditions are called meningoceles. These protrusions or herniæ occur at some weak spot in the cerebral vault, namely, through one of the sutures which normally exist between adjacent bones, or through abnormal apertures or defects in one of the cranial bones. Encephaloceles are

more serious malformations than meningoceles, owing to the fact that the sacs contain brain substance which cannot be returned to the interior of the skull, and are thereby subject to mechanical injury with possibly serious results. An encephalocele can generally be distinguished from a meningocele by the following features: An encephalocele is usually small, often irregular in shape, sessile, pulsating and non-translucent; whereas meningoceles are usually smooth, regular, pedunculated, reducible and translucent. When pressure is applied to the latter there is usually a simultaneous bulging of any open fontanelle, and the baby may cry or even have convulsions.

Herniæ of the Spinal Cord (*Spina Bifida*).—This malformation is such a common one that midwives should know something about its nature and treatment. It occurs when one or more of the vertebral arches fails to complete the spinal canal. It occurs most frequently in the case of the lower dorsal vertebræ, and it may possibly be due, like hydrocephalus, to an abnormally high degree of pressure in the cerebrospinal fluid. Protrusion or hernia of part of the contents of the spinal canal occur through the defective arches. If the hernial sac only contains cerebrospinal fluid it is called a spinal meningocele. When, however, part of the spinal cord or spinal nerves are included in the hernia it is called a meningomyelocele or syringomyelocele. The latter condition is often accompanied by paralysis or spasticity of the muscles supplied by the nerves involved in the hernia, and in such cases there may also be various deformities in the lower extremities, such as club foot. Occasionally the defects in the vertebræ are too small to allow of actual protrusion or

hernia, but the deficiency in the bone can be detected by X-ray examination. Such a condition is known as spina bifida occulta, and the skin covering the defective vertebra may be the seat of a nævus or hairy mole. The common condition of sacral dimpling, which is a little depression on the upper extremity of the crease between the two buttocks and which represents the normal seat of closure of the neural canal, is sometimes mistaken for spina bifida occulta.

The treatment of cases of spina bifida, whether they contain actual nerve structures or only cerebrospinal fluid, is highly unsatisfactory. Little or nothing can be expected from operative procedures, and the most that can be done is to protect the sac from ulceration and rupture. The application of a specially fitted celluloid cup, which can be kept in position by tapes encircling the body, is the most practical form of protective appliance.

Herniæ of the Bowel.—Loops of the intestine are liable to escape from their position within the abdomen if there should happen to be any abnormal opening or weak spot in the abdominal wall or diaphragm large enough to permit of their passage. Sometimes there is congenital absence of a part of the abdominal wall large enough to allow of the escape of other abdominal organs besides the bowel. In fact, in a severe case, practically all the abdominal viscera may lie outside the abdominal wall in a huge hernial sac. The most usual situation of a hernia of the bowel, apart from the umbilical opening, is through the inguinal canal—the little passage in the male which allows of the descent of the testicle into the scrotum. This little canal sometimes fails to close up normally after the testicle has entered the scrotum. In

such cases, if there is any undue abdominal pressure by coughing, straining, or crying, a loop of the intestine may be forced through the inguinal opening and descend into the scrotum in the track of the testicle. When there is any undue enlargement of the scrotum on one or both sides, the possibility of a hernia should be at once considered. With a hernia of the bowel there is usually a marked impulse on crying or coughing. The tumour is not completely translucent if illuminated by a torch, and if the sac be manipulated and attempts made to empty it, the contents will usually be returned to the abdomen with a gurgling sound. Sometimes the hernial sac does not contain a loop of intestine, but simply fluid, which is known as hydrocele fluid, and the tumour is called a hydrocele. Hydroceles can usually be emptied on pressure, but if their contents fail to be evacuated by this means it implies that the sac or passage is closed at the upper or abdominal end, in which case the tumour is known as an encysted hydrocele.

Inguinal herniæ, if not severe, can usually be treated and cured by the application of a wool truss, that is to say, a large skein of wool applied in such a manner that the knot or loop lies over the inguinal opening and prevents the descent of the bowel. For male babies, pneumatic horseshoe-shaped trusses maintain their position better and are more effective in restraining the descent of the hernia than wool trusses. If neither of these means are effective an operation may be necessary, but this is usually deferred until the baby is a year old. Hydroceles, as a rule, require no treatment at first, but if encysted and very large, may be punctured. Operations for reducible hydroceles are,

like hernia of the bowel, usually deferred till the child is a year old.

Umbilical Hernia.—Umbilical hernia occurs in the same way as other herniæ, that is to say, because there is an unduly large opening, or because there is high abdominal pressure. If the hernia is easily reducible, the treatment is to apply a short piece of strapping about 4 inches long over the opening. If, in spite of this, there is still some bulging, a bone disc should be included between two layers of strapping and firmly fixed over the opening. (For fuller details regarding this condition, see Chapter on “Abnormalities and Diseases of the Umbilicus,” p. 232.)

TORTICOLIS—OR WRY-NECK

Wry-neck is not a very uncommon deformity. It sometimes arises owing to tearing or rupture of the fibres of the sterno-cleido-mastoid muscle, by traction or application of forceps during delivery. Such damage to the muscle (sterno-mastoid tumour) results in, or may result in, a shortening of its length and a turning of the chin to the opposite side. This variety of wry-neck is not, strictly speaking, congenital. It is an acquired form due to trauma. But there is a true congenital form which may be due to some cramped position of the head during development *in utero*, or the cause may be some truly hereditary one, as indicated by the fact that congenital torticollis is often accompanied by other congenital malformations, or may occur in more than one member of the same family. The only cure for this variety of wry-neck is surgical operation.

CONGENITAL MALFORMATION OF THE HEART

Congenital malformations or defects in the structure of the heart (*morbus cordis congenitalis*) are of common occurrence. They are usually recognised readily enough by a blue or plum colouration of the skin, although these are not the only causes of cyanosis in new-born infants. The defect may involve any part of the heart, the valves, the septum, the musculature, or the large blood vessels. The most common defects depend on the persistence of the foramen ovale and the ductus arteriosus, embryonic structures which should disappear at birth. The heart may be completely transposed or the pulmonary arteries and the aorta may change their respective positions.

The prognosis is not good, and depends largely on the character and extent of the malformations. It is best measured by the degree of persistence of the cyanosis and the influence which exertion has upon it. Infants who are permanently blue have less prospect of survival than those who only become blue on sucking, swallowing, crying, or otherwise exerting themselves. The effect of the malformation is always to retard general growth and development, and it is a mistake to expect an infant of this kind to keep pace with a normal infant. The chief factors in successful treatment are the maintenance of temperature, avoidance of exertion, a plentiful supply of fresh air, and a limited dietary.

CONGENITAL DEFORMITIES OF THE FEET

Club Foot (*Pes varus*).—This is a very common congenital deformity. Whether it is a serious condition or

not depends on the degree. Most infants when they are born hold their feet in the flexed or *varus* position. This tendency however soon disappears. Mild degrees of club foot can be very satisfactorily dealt with by wrenching the feet and maintaining them in the corrected position by strapping. More severe degrees may require plaster of paris splints, but in any case it is important that the condition should be diagnosed at once and treatment commenced.

Congenital Talipes Equinus.—This condition is comparatively rare. It consists in the foot being held in a position of extreme extension, with the toes pointing to the ground when the infant is held upright. There is usually however overaction of the gastrocnemius muscle and shortening of the tendo-achilles. Unfortunately, this condition generally points to some serious nervous affection, and is not necessarily cured by section of the shortened tendons, but in all cases tenotomy should be practised, and the foot put into splints in the corrected position.

CHAPTER XXIII

ABNORMALITIES AND DISEASES OF THE UMBILICUS

THE umbilicus can be the seat of a number of different abnormalities, some of which may be present at the time of birth, while others develop soon afterwards. There are various foetal structures connected with the umbilical cord or its ring which, under normal conditions, undergo atrophy and disappear before birth, but which, under abnormal conditions, may persist and give rise to certain troubles or abnormalities. Thus the vitelline duct, which originally connects the yolk-sac with the primitive intestinal tube and which should become obliterated by the end of the second foetal month, may fail to do so and persist as a vestigeal remains and ultimately become what is known as Meckel's Diverticulum. Or again, the remains of the allantois, which extends from the summit of the bladder to the umbilicus, may also remain unobliterated, giving rise to a urinary fistula—the so-called fistula of the urachus. The umbilical cord itself should shrivel up by a process of dry gangrene and fall off at the end of the first week, but it may leave a moist granulating surface instead of a clean, dry scar. Under such conditions septic infections may occur and give rise to considerable trouble. Further, the umbilical opening itself may fail to close up and thus give opportunity for the escape of a piece of omentum or a knuckle of intestine, producing a so-called umbilical hernia.

Thus, in connection with the umbilicus, the following abnormal conditions may exist :—

1. Persistence of omphalo-mesenteric or vitelline duct (Meckel's Diverticulum).
2. Persistence of allantois (fistula of urachus).
3. Suppurating navel stump.
4. Septic infection of the umbilical stump.
5. Umbilical hernia.

These conditions will now be considered in greater detail.

MECKEL'S DIVERTICULUM OR PERSISTENCE OF THE OMPHALO-MESENTERIC DUCT

When the omphalo-mesenteric or vitelline duct which connects the yolk-sac with the primitive intestine does not become obliterated as should be the case at the end of the second month of foetal life, part or whole of it may remain as an open or closed tube. The most serious form of it is when the whole tube remains unobliterated and has a free opening on the umbilical stump when the cord comes off at or about the seventh day of life. When this is the case there will be an open channel between the intestinal tract and the surface of the cord through which faecal matter can exude. When, therefore, the umbilical dressing has a faecal odour this condition should be suspected. As a rule, however, only part of the vitelline duct remains unobliterated, and there is no free opening on the umbilical stump, nor indeed any direct connection with it. But the remains of this embryonic structure known as Meckel's

Diverticulum, however long or however short it may be, is always a trouble and danger when it exists, although its presence may not be detected until the actual trouble arises—this usually takes the form of intestinal obstruction.

FISTULA OF THE URACHUS

The urachus, which is the intra-abdominal portion of the stump of the allantois, and reaches from the umbilicus to the summit of the bladder, should, under normal circumstances, be completely obliterated by the time of birth, but occasionally the channel remains open and affords connection between the bladder and the free surface of the umbilicus through which urine can trickle and cause irritation to the part, thus preventing the normal healing of the umbilical stump. A fistula of the urachus is a rare event, but may be suspected when the dressing of the umbilicus has an odour of urine or shows the presence of urea on chemical tests.

SUPPURATION OF THE NAVEL STUMP

Under normal conditions the cord should fall off by a process of dry gangrene or mummification before the end of the first week, and its surface should be completely healed and coated with epithelium before the end of the second week, but it occasionally happens that, instead of healing up, the surface is covered by granulations or even by a moist polypoid tumour or adenoma. The best way to prevent this trouble is to keep the cord thoroughly dry before it comes off by the free application of an antiseptic dusting powder, or by

touching with nitrate of silver if the surface does not heal up quickly.

UMBILICAL SEPSIS

There is always a risk of septic infection of the umbilical stump when the latter does not heal up quickly. The infection may take the form of cellulitis or erysipelas which invades the surrounding superficial tissues, travelling up towards the xiphisternum or downwards towards the synthesis pubis. Septic infection of this kind is always serious, although it may not give rise to a high temperature; indeed, some of the worst cases run an altogether apyrexial course. The inflammation may not always spread superficially; it may track inwards along the course of the obliterating umbilical vessels, either in the direction of the liver along the umbilical veins, or downwards in the direction of the pelvis along the umbilical arteries. Umbilical arteritis is more frequent and more dangerous than umbilical phlebitis. The former may be diagnosed by pinching a large fold of the abdominal wall below the umbilicus and rolling it between the fingers, when the thickened arteries may be felt. Occasionally a bead of pus may be squeezed out by this procedure, and observed on the free surface of the umbilicus. The same means of diagnosis may be applied in the case of umbilical phlebitis, only in this case a fold of skin above the umbilicus must be taken up. The treatment for all varieties of umbilical sepsis is most unsatisfactory, but anti-streptococcal serum or anti-erysipelas serum should be given in those cases in which the nature of the infective organism can be determined by bacteriological examination of the pus.

UMBILICAL HERNIA

The umbilical ring in new-born babies is the weakest spot in the abdominal wall, and hence the commonest seat of hernia. Under normal conditions the opening should be firmly closed soon after the separation of the cord, but when the internal abdominal pressure is, for any reason, abnormally high, the aperture may be kept open by the occasional escape of the abdominal contents, usually a small piece of omentum or small loop of intestine. The causes of increased abdominal pressure are usually incessant crying, coughing, sneezing or hiccough, but over-distension of the intestine with flatus or food will have the same effect. It is a mistake to think that either constipation or a tight foreskin are predisposing causes.

Although it may not always be easy to cure neglected umbilical herniæ, they are exceedingly easy to prevent in the early stages. All that is necessary is to apply a strip of good and non-irritating adhesive plaster across the umbilicus at right angles to the recti muscles. The plaster should be about 2 inches wide and 4 inches in length, and it should be applied in such a way as to draw, if possible, the two recti muscles together and thus help to close the umbilical opening. The later treatment of established herniæ should be on the same principle, but it may be necessary to confine a bone or celluloid disc between two layers of strapping. It must be remembered, however, that the sticky side of the plaster should be in close contact with the skin over the hernia. If lint or other dressings are applied between the plaster and the skin the hernia is seldom properly controlled, and the use of an ordinary rubber

belt or thick piece of cork covered with lint strapped in position, is equally unsatisfactory. In those cases in which a wet surface of the wound precludes the direct application of plaster, the wound must be dressed with gauze or lint, and as much restraining pressure as possible applied by means of strapping on the top of the dressings. If these expedients are resorted to surgical interference is very rarely required.

CHAPTER XXIV

NURSERY FALLACIES

To anyone interested in the above subject I confidently commend the reading of Dr. George Still's recent work on "The History of Pædiatrics." Many of the most egregious nursery practices find their sanction in antiquity, and owe their perpetuation to the conservative adhesion to authority which is shown by even the greatest of the masters of medicine, including Hippocrates (460-370 B.C.), Soranus of Ephesus (A.D. 98), Galen (A.D. 130), François Mauriceau (A.D. 650), and a whole host of others, who, each in turn, followed blindly in the footsteps of his predecessors. Dr. Still contributes a delightfully written account of these pædiatric solecisms. I can only refer to a few.

THE HISTORY OF BINDERS

First, as regards binders. These monstrous inventions, which in modified and mitigated form have survived until the present day, originated in the dark periods of medicine when "swaddling," along with "salting," was regarded as an essential part of the hygienic ritual of the new born (Galen, A.D. 130). In 1472, Paolo Bagellardo, a physician at Fiume—not the Fiume with which we are familiar, but a small place of the same name between Venice and Udine—gave full details of the method of binding up the arms, body and legs of new-born babies, so that the child might be

properly shaped—"ut infans nullam gibbositatem recipiat," and so—"omnia recte figurabuntur," which, interpreted into the vernacular, means "to the end that the baby should not become a hunchback, but be properly pressed into shape."

François Mauriceau, a famous obstetrician in Paris, writing two centuries later—in 1668—perpetuates the old fallacy in the following words: "Let his (the baby's) Arms and Legs be wrapped in his bed and stretched strait and swathed to keep them so, viz., his Arms along his sides and his Legs equally both together with a little of the bed between them that so they may not be galled by rubbing one another: after all this the Head must be kept steady and strait with a stay fastned on each side the Blancket, and then wrap the Child up in Mantles or Blanckets to keep it warm. He must be thus swaddled to give his little body a strait Figure, which is most decent and convenient for a Man and to accustom him to keep upon the Feet, for else he would go upon all four as most other Animals do."

It was not, however, left entirely to the Association of Maternity and Child Welfare Centres (1908–1931) to protest against this particular form of malpraxis, for, unheeded and unsung, William Cadogan, an English physician wrote in 1748: "The first great Mistake is that they think a new born infant cannot be kept too warm: from this Prejudice they load it and bind in with Flannels, Wrappers, Swathes, Stays, etc., commonly called Cloaths, which altogether are almost equal to its own Weight." John Cooke, another Englishman, writing in the year 1769, protested in "A Plain Account of the Diseases Incident to Children"

that infants, "if they were not swathed, but allowed as much freedom as puppies, it would be much better for them, as I have shown in former discourses on the cause of the surprising mortality of infants under two years of age."

Binders, long clothing, tight shawls and other impediments to free movement, by hampering muscular action, delay the general development of the body as a whole, encourage weak backs, spinal curvatures and pot belly, and by restricting the expansion of the abdomen predispose to inguinal hernias.

CERTAIN UNNECESSARY OPERATIONS

Another fallacy, happily now fast dying out, is the belief that the functionally active and congested mammary gland of the new-born infant, male or female, should be massaged to disperse the milk or to break the nipple strings. This procedure, like cutting the frenum linguæ with a pair of scissors to untie the tongue and improve the infant's capacity to suck well, and, later, to talk, as also the wiping out of the mouth to prevent thrush, are forms of malpraxis which die hard. The operation of circumcision is still performed to cure bed wetting, hernia, and so-called congenital hypertrophic pyloric stenosis, while operations for the removal of the appendix are resorted to far too frequently on very little justification.

NIGHT AIR, DUMMIES, WAKING AND LULLABIES, AND LIME WATER

Portia's animadversion against risking "The vile contagion of the night" with its "rheumy and

unpurged air," was well supported by contemporary medical opinion and later. It is only quite recently that it has been considered safe to open the nursery windows at night.

In Dr. Still's book there are pages and pages giving classical authority for the use of dummies, rocking and lullabies for the treatment of restlessness, and for vile and filthy nostrums in the treatment of teething. It is not, however, only in ancient and mediæval times that authority lends justification for the many varieties of pædiatric malpraxis which have interfered with the evolution of rational mothercraft. Authority still teaches that lime water should be added to milk dilutions to prevent rickets or to make the milk more digestible, although it only contains one-tenth of a grain of lime to 1 drachm. If the addition of lime is required for these purposes, it would be better to add an equivalent measure of tap water, since the latter is cheaper and usually contains about the same amount of calcium. It is sometimes advised that lime water should be added to cow's milk to compensate for, or to neutralise the acid which develops in the latter on keeping, and which is due to the fermentation of milk sugar by lactic acid organisms. Such an addition is not only unnecessary, but also irrational, for the reason that a certain degree of acidity in milk is required for gastric digestion, and a pre-existing condition of acidity in the milk promotes this end, and saves the stomach. The use of lactic acid milk acknowledges this principle and is of value in those cases in which there is a deficiency of acid in the gastric secretions. On the other hand, the indiscriminate use of lactic acid milk irrespective of the reaction of the stomach or its hydrogen ion

concentration, is one of the many irrational proceedings which reflect no credit on the scientific discernment of many modern authorities—perhaps more correctly described as writers—on infant feeding. The popular practice of adding citrate of soda to cow's milk to make it more digestible is founded on a similar want of scientific knowledge. Such an addition delays the coagulation of casein in the stomach, and thus prevents vomiting—in fact, cloaks the unsuitability of cow's milk as a food for infants by removing a very useful danger signal. It does not, however, make the milk any more digestible, but only enables it to remain fluid and thus pass into the intestines in an undigested condition, throwing the onus of digestion on the intestine, which in most cases is ill-fitted to bear the strain.

Another erroneous belief is that the main reason why dairy cream is more indigestible than the cream of human milk is that the fat is less finely mulsified in the former—in other words, that the globules of the emulsion are larger. Seeing that the first stage in fat digestion is to break up the emulsion by agitation in the stomach, in the same way that cream is converted into butter in the churn, the absurdity of this belief is apparent. The larger the globules, the more easily are their membranes broken and the fat thus set free. The real reasons why dairy cream is more indigestible than the human variety are, firstly, because it contains a much larger amount of the indigestible casein, and, secondly, because it contains a considerable proportion of butyric acid, which has an irritating effect on the mucous membrane of the stomach.

DANGEROUS AUTHORITIES ON MOTHERCRAFT MATTERS

Authority also advises that condensed milk should be taken out of its clean tin and poured into a necessarily unclean—that is to say, unclean in the bacteriological sense—jar or cup for the purpose of preservation. It also advises that for economy of time and trouble, condensed and dried milk mixtures should be made up with their proper proportions of water for the twenty-four hours' requirement, instead of each feed being made up separately. Do not those who advise this practice know that foods of this kind will keep almost indefinitely in the dried and concentrated state and in their tins, and rapidly go bad when they are diluted or exposed to the air ?

THE INACCURACY OF DOMESTIC MEASURES

I could talk for a long time on the subject of weights and measures and the estimation of bodily temperatures by means of thermometers, but I must content myself with making a few remarks on these subjects. It is commonly taught by authority that an infant doubles his weight in six months, and trebles it at the end of the first year. There is only one infant who behaves in this simple and accommodating fashion, and that is the absolutely normal infant with a birth weight of $7\frac{1}{2}$ lbs. Infants of other birth weights behave in totally different ways, even if they are otherwise normal. It is commonly believed that "test" feeds which are an essential element in breast-feeding, can be performed on spring balances, although from the nature

of things such machines cannot register accurately. It is also believed that breast milk differs in composition at different periods of lactation ; some think it becomes poorer in solid constituents, others that the percentage of protein increases towards the end of lactation—mistaken beliefs which have led to the irrational practice of making substitute milk modifications stronger and stronger as the baby grows older—that is to say—richer in protein. It is also believed that prolonged breast feeding disposes to rickets, and consequently infants are almost invariably weaned at about eight months. There is no scientific foundation for any of these customs or beliefs. As long as infants are given some farinaceous, and certain other varieties of solid food at or about the sixth month, it is safe to let them continue to have breast milk, which is eminently suited to their requirements, until the end of the first year or longer.

AVOIRDUPOIS AND TROY MEASUREMENTS

Pædiatricians are just beginning to make use of the method of calorie estimations in measuring food quantities. They calculate their calories, or the calories are estimated for them in ounces avoirdupois, but the foods, whether liquid or solid, are dispensed on the troy scale, introducing an error of 10 per cent. Moreover, no allowance is made in the volumetric estimation of liquids of different specific gravities. Huge errors can be introduced in this way in the measuring of condensed milk. A teaspoonful of condensed milk more often than not will be found in practice to weigh $\frac{1}{2}$ oz. avoirdupois, not 1 drachm troy. Moreover, it is

generally believed that an ordinary domestic teaspoon holds 1 drachm by volume, whereas it will be found as a rule to contain from $1\frac{1}{2}$ to 2 drachms of water, and different weights of other fluids in accordance with their specific gravity. A tablespoonful of water will usually measure about 1 oz.—a tablespoonful of dried milk will generally be found to weigh less than $\frac{1}{2}$ oz. There is no end to the errors that creep in by the confusion of the avoirdupois and troy scales of measure, and the want of discrimination between volumetric and gravimetric estimations, a confusion which is made worse confounded by relying on the domestic spoon as a measure of quantity.

I often hear or read with amusement controversies on the subject of the quantities of food an infant should have, calculated on the basis of calories or on any other method of measurement. Some authorities claim that the quantity should be estimated on a basis of weight, others on the age of the infant; indeed, one well-known authority urged that it should be based on the length of the infant! All of these methods are wrong, except in the case of the normal infant; in the latter instance it makes no difference whether it is fed according to weight, age, or height, all will give exactly the same result. As regards the abnormal child, none of these methods is correct—the physiological allowance will always be somewhere between the maximum amount calculated on the basis which gives the largest result, and the minimum amount calculated on the basis which gives the smallest result. To give an example: An abnormal baby of six months weighing 8 lbs. would, if fed on a basis of weight, require food of the value of 400 calories (8×50), but if fed on a basis of age, 750

calories (15×50), a difference of nearly 100 per cent. The correct amount will lie somewhere between 400 and 750, nearer the maximum or the minimum according to conditions and circumstances.

LOW READING THERMOMETERS

Finally, one word with regard to the taking of the temperature of infants, and more particularly of premature infants, by the ordinary clinical thermometer, which, when shaken down, is unable to register a temperature lower than 95° F. Many infants, and particularly premature infants, have low temperatures, which cannot be estimated except by means of low-reading thermometers with an index which registers to 88° F., and when employing them the mercury should always be shaken down to its lowest point before the thermometer is used.

CHAPTER XXV

BIRTH INJURIES

The human baby is exposed to great traumatic risk during the act of parturition, for the reason that the circumference of the head and the width of the shoulders of the full-time foetus are, relatively to the diameter of the pelvis and size of the genital passages in the human female, larger than in any other viviparous animal. Hence, it is not so surprising that many injuries occur at the time of birth, as that the number is not even greater.

As a result of the more serious of these obstetrical injuries the new-born infant is liable to suffer from various degrees of "shock"—a condition which is indistinguishable from the so-called "Asphyxia Pallida." Under this comprehensive title are no doubt included a number of fatal cases of internal hæmorrhage, which are difficult to diagnose during life, but which are now more often revealed at autopsy, owing to the greater interest which is taken at the present time in the subject of neo-natal mortality. Traumatic birth injuries include damage to the skin, the subcutaneous tissues, muscles, bones, viscera, and nervous system. Each of these groups will be described independently, and for this purpose I have borrowed very largely from an excellent paper on this subject read by Dr. G. B. Fleming before the Section of Diseases of Children at the Annual Meeting of the British Medical Association,

held at Eastbourne, 1931, and subsequently published in the *British Medical Journal* of September 12th, 1931, to which paper I would refer those desirous of fuller particulars.

DAMAGE TO SKIN AND SUBCUTANEOUS TISSUES

The soft tissues of the foetus are liable to be damaged by pressure under quite normal conditions of delivery. The ordinary caput succedaneum is itself an instance of damage to the scalp in cases of uncomplicated vertex presentation, and although it often happens that minor degrees of injury of this kind clear up and leave no trace behind, occasionally in breech or face presentations a degree of bruising occurs which may become septic and give rise to cellulitis or areas of necrosis. The use of forceps, and especially Willett's forceps, may occasion serious degrees of sloughing. The chief anxiety in all conditions of superficial abrasion in the new-born is the supervention of sepsis.

Cephalhæmatomata are very common results of difficult labour, especially when the application of forceps in vertex presentations is necessitated. The seat of predilection is the right parietal bone, on which the pressure in L.O.A. presentations is mainly exercised. The foetus is especially liable to this form of trauma in the case of primaparæ. It is naturally more common in cases of contracted pelvis, difficult labour, premature rupture of the membranes, and asphyxia neonatorum. The ordinary variety of cephalhæmatoma is brought about by the rupture of blood vessels just under the periosteum and the elevation of the latter by the extravasation of blood, but there are

also two other forms of cephalhæmatoma—one is that in which the hæmorrhage occurs between the cranial bone and the dura mater, that is to say, on the under surface, in contradistinction to the outer surface of the bone. This variety is known as “Cephalhæmatoma Internum.” Another less common variety is that which is caused by a hæmorrhage between the scalp and the periosteum. This kind is known as “Cephalhæmatoma Subaponeuroticum.” It is usually distinguished from the subperiosteal or internal variety by the fact that it is not limited by the lines of the sutures or the edges of the individual cranial bones. It is usually larger and more diffuse, and can be mistaken for a caput succedaneum, but generally develops at a later date. An ordinary cephalhæmatoma generally appears two or three days after birth in the form of a soft fluctuating swelling over the damaged bone. Its outline corresponds accurately with the shape of the bone and with the sutures which surround it. The swelling soon becomes encapsuled in a thin film of bone, beginning as a sharp edge at the confines of the corresponding cranial bone and offering a superficial resemblance to a depressed fracture, for which it is at times mistaken. When finally the layer of bone covers the whole of the swelling, it give a curious parchment-like crackling when pressed upon by the fingers. The whole of the swelling with its shell of bone disappears in the course of time and leaves no trace behind.

HÆMATOMA OF THE STERNO-CLEIDO-MASTOID MUSCLE, OR STERNO-MASTOID TUMOUR

This common condition (which is also mentioned in the chapter on “Minor Ailments and Common Com-

plaints," p. 166) is due to the rupture of fibres of the sterno-cleido-mastoid and consequent hæmorrhage under the sheath when traction is applied to the head in breech, or to the shoulders in vertex presentations, either with or without forceps delivery. The swelling is usually to be noticed on the second or third day. It is then soft and sometimes fluctuating. Later it becomes hard owing to the organisation of the blood clot.

In unassisted labour, the accident must be attributed to undue traction on the muscle owing to excessive rotation of the head. The muscle which corresponds to the side towards which the head is rotated will be the one to be torn. It is somewhat doubtful whether wry-neck is ever due to hæmorrhage into the muscle. It certainly is not so in the majority of cases, and a sterno-mastoid tumour without wry-neck is of such common occurrence that it is improbable that it can be an important determining factor. In ordinary cases the condition requires no treatment. The swelling usually disappears within a few weeks, but the muscle often remains permanently indurated at the seat of the hæmorrhage.

FRACTURES OF BONE

The commonest fracture is that of the skull, especially in vertex presentations. Death occasionally takes place as a result of the hæmorrhage or of laceration of brain substance.

The next commonest fracture is that of the clavicle—equally common in breech and vertex presentations and impartially affecting either side. In rare cases both clavicles are broken. The diagnosis is made by the presence of a local swelling of the soft tissues at the

seat of the fracture. The only treatment necessary is to place a pad between the shoulders and fix the arm on the affected side to the trunk with a bandage of strapping which encircles the shoulders, with slight traction, so as to throw the shoulders back.

Fractures of the femur also occur occasionally. Surgeons recommend that the accident should be treated by an extension apparatus fixed to a wooden bar supported by the sides of the cot. Personally, I believe this elaborate form of treatment quite unnecessary, especially as it causes considerable irritation to the baby. It is quite sufficient in my experience to bandage the thigh firmly with a soft bandage. The bone unites so rapidly without shortening or deformity, even if left alone, that the less done in the way of treatment the better.

INJURIES TO VISCERA

Serious injuries to viscera with extensive internal hæmorrhage are far more common than is usually thought to be the case. Post-mortem examinations prove that injuries of this kind are present in 10 per cent. of neo-natal deaths. The common sites of the hæmorrhage are the lungs, suprarenals, kidneys and liver. They are difficult to diagnose definitely, but can, however, be suspected when the usual symptoms of surgical shock are present, *i.e.*, in cases of white asphyxia. If recovery takes place there is often a persisting debility with marked anæmia.

INJURIES TO THE NERVOUS SYSTEM

These injuries take two forms—injuries either to the peripheral nerves with paralysis or to the central ner-

vous system—brain or spinal cord, both of which give rise to serious consequences, either death, permanent paralysis or mental defect.

Injury to the Peripheral Nerves.—The two common forms of injury are either to the facial nerve or to the brachial plexus—very occasionally the sciatic or perineal nerves are damaged. In the latter case, however, it is often difficult to distinguish between paralysis due to damage to the spinal cord and paralysis due to the peripheral nerves.

Facial Paralysis.—Facial paralysis is generally caused by pressure of the blades of forceps on the facial nerve distal to its exit from the sterno-mastoid foramen. Very occasionally it may occur in unassisted labour or even in Cæsarean deliveries. Since all the branches of the nerve are usually involved, there is complete paralysis of all the muscles on one side of the face supplied by the nerve. The affected side is immobile, the eyelids cannot be closed, the forehead is free of wrinkles, and when the baby cries the mouth is drawn to the normal side. There is no interference with suckling, as the tongue and palate are not involved. Recovery within two or three weeks is usual, and no treatment is necessary apart from protection of the conjunctiva against injury. Paralysis of the facial nerve in young babies is occasionally due to infantile paralysis, or to some developmental defect in the nucleus of the nerve. Obstetrical injury to the nerve must be distinguished from these two rare conditions. (This condition is mentioned in the Chapter on "Minor Ailments and Common Complaints," see p. 167.)

Brachial Paralysis.—Paralysis of the arm from injury to the brachial plexus is a most important peri-

pheral nerve lesion, for the reason that it does not show the same tendency to recovery which is usual in the case of facial paralysis.

There are two principal forms. The upper arm kind is known as the "Erb-Duchenne" type. In this case the paralysis is due to damage to the 5th and 6th cervical roots or the trunk formed by their union. In the other type (Klumpke's), the injury involves the 7th and 8th cervical and 1st dorsal roots.

In the first case the affected muscles are the deltoid, brachialis anticus, supinator longus, supra- and infraspinati, and sometimes the supinator brevis, serratus magnus, and teres minor. The result is that soon after birth the child's arm is noticed to hang motionless by the side, with extension at the elbow and the forearm pronated.

In the lower arm or Klumpke's type, the arm is flexed at the elbow, the wrist is extended, the hand is flaccid and the fingers are flexed. Occasionally there is slight ptosis of the eyelid on the same side, with a small pupil due to concomitant paralysis of the sympathetic nerves.

Causes of brachial paralysis are either traction on, and tearing of, the fibres of the plexus or its roots, or pressure on the plexus caused by the use of forceps ; by a narrow pelvis ; or by the finger in cases of difficult labour. Obstetric paralysis is hardly ever observed in unassisted labour.

The prognosis varies—the fewer the number of muscles involved the quicker the recovery. The majority of cases recover completely, although in a certain number of instances recovery is only partial.

The treatment is most important, and involves the principle of keeping the affected muscle or muscles in a position of relaxation so as to avoid stretching. It is advisable that the arm should be put in an appropriate splint by an experienced orthopædic surgeon. (See also Chapter on "Minor Ailments and Common Complaints in the New-Born," pp. 167 and 168.)

INJURIES TO THE SPINAL CORD

These commonly occur as a result of breech presentation. Damage to the upper cervical region is practically always fatal. Damage to the lower dorsal or lumbar region is generally indicated by paralysis and œdema of the legs, and possibly by involvement of the rectal and vesical sphincters. Although sensory disturbances also occur, they are difficult to distinguish in young babies.

INTRACRANIAL HÆMORRHAGE

These hæmorrhages are exceedingly common, perhaps almost universal in some slight degree. It is very rare indeed not to find some slight indication of damage to the tentorium, falx cerebri, veins of Galen, or longitudinal sinus at autopsy in cases of neo-natal deaths. It is only when the hæmorrhage is considerable that serious symptoms are likely to result. The diagnosis during life is very difficult. Some cases can be readily recognised, but large hæmorrhages are often found post-mortem which have not been suspected during life.

Among the symptoms which point to intracranial

hæmorrhage are intermittent attacks of cyanosis, inability to suck, feebleness of cry, drowsiness, muscular rigidity, convulsions, bulging of the fontanelle, and marked irregularity in the respirations. None of these symptoms, or indeed any combination of them, is conclusive proof of intracranial hæmorrhage, but, in my experience, the most convincing evidence is intermittent attacks of cyanosis combined with great irregularity of breathing. The presence of blood in the cerebrospinal fluid, which can be demonstrated by lumbar puncture, is conclusive evidence of some degree of intracranial or intraspinal hæmorrhage, but capillary oozing in these situations is so common and, if of slight degree, of so little importance that too much reliance must not be placed on the presence of blood in the cerebrospinal fluid to explain the existence of serious symptoms. Moreover, there are many pitfalls in the interpretation of the significance of blood or blood-colouring matter in cerebrospinal fluid, for hæmorrhage may be caused by the needling itself; and, further, it is possible that a slight degree of yellow staining of the cerebrospinal fluid is normal in the new-born, and especially in premature infants owing to capillary oozing. For the diagnosis to have any special value, the discolouration of the fluid must be extreme, and clearly not due to trauma in the act of performing the operation of lumbar puncture.

The ultimate results of intracranial hæmorrhage are mental deficiency, hydrocephalus and asymmetrical spastic paralysis if the infant survives. It is very doubtful whether ordinary cases of spastic diplegia (Little's disease) are due to intracranial hæmorrhage

unless there have been very severe symptoms generally, with convulsions immediately after birth. (See also Chapters "Cyanosis and Asphyxia in the New-Born," p. 177, and "Hæmorrhages in the New-Born," p. 218.)

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