SOME CLINICAL ASPECTS OF LACTATION*

BY

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This lecture is in memory of a great paediatrician who stood high in the regard of his colleagues and by his teaching and writing did much to encourage the study of children's medicine by general practitioners. Still's book on the common disorders of health in childhood must have stirred an impulse in many of us, and to read it was a lesson in his habit of patient clinical observation and methodical record from which we could hardly fail to profit. From my knowledge of him he would have been too courteous to express surprise at your choice of lecturer, but I am encouraged to think he would have approved your selection of subject for its bearing on the preventive side of medicine. And I believe I may add that this sign of your interest in breast feeding will be an encouragement to the large number of doctors who, like myself, spend much of their time working for maternal and child welfare.

I have heard this work described as a treadmill, but I protest I have not found it so. Its problems are various and complex, not unlike those which occupy the field naturalist. As a branch of medicine it has not lost for me the attraction it has held ever since I first saw it practised by Eric Pritchard, and I still recall the thrill of its early promise at a time when the rate of infant mortality was nearly three times as high as it stands to-day. I doubt whether even now its possibilities have been fully grasped, and I have sometimes thought its financial support by the Government was made prematurely; for certainly its direction by public health officials so early in its development seems to have had the effect of slowing progress and cramping individual enterprise in breaking new ground, and to have had the tendency to call a halt at a stage which was merely easy to administer. Outstanding among its problems is the unreliability of lactation, challenging us daily to find its solution; for it is at the infant welfare clinic, more clearly than anywhere else, that the contrast in growth between the naturally and the artificially fed infant is apparent. There we see the effects of artificial feeding, not as you would prescribe it, not always as

we ourselves prescribe it, but too often as it is used in the most haphazard manner on the direction of a relative, the recommendation of a neighbour, or the instructions of the manufacturer. Frequently also we see it adopted hastily because of some symptom which a mother's anxiety has attributed to breast feeding. Working against such influences as these, any attempt to study the causes of lactation's failure is difficult enough, but hitherto it has also meant groping about with little help from physiology or for that matter, from anatomy or pathology, and in consequence with no more success than could have been expected. In a large proportion of the women who bring their babies to us, breast feeding has already failed or has declined beyond the point at which its revival is practicable with the means at our disposal. So many of these failures occur within the first weeks that it is with them I shall be concerned here; not only because of the special risk of artificial feeding in the early weeks of life but because, of all the various aspects of this work for infant welfare, this is the most obstinately resistant to improvement. Moreover, besides the risk to babies, it involves something which I hold is too lightly regarded; the very real and lasting regret which the failure to breast feed brings to many women. And lastly, owing to special conditions which surround the start of lactation, women are at this stage involved in the risk of mastitis and breast abscess, a complication which certainly is far too lightly regarded and is often most indifferently treated.

And so it has come to pass that the necessity to save infant life has been the mother of more and more ingenious invention, and with the aid of the ancillary sciences of chemistry and bacteriology, not to mention the spur of commercial enterprise, artificial feeding has been transformed from a dangerous gamble into something approaching a successful makeshift for human milk. Meanwhile there has, of course, been no reluctance to speculate on the causes of the frequent failure of breast feeding, and a number of explanations has been evolved; some of them of a somewhat facile type which have come to be accepted almost uncritically. Such, for example, is the view that the function of lactation has suffered a decline in conditions of modern civilization. Even more commonly, perhaps, is it held that women have developed a

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widespread unwillingness to undertake the task. Both views may well contain elements of truth, indeed I suspect they do; but they are at present valueless since they have never to my knowledge been investigated in such a way as would establish their truth or falsity. They remain in the category of what have been so aptly called 'hieratic pronouncements which rise superior to the need of proof.' Certainly lactation ceases prematurely in a high proportion of women, and the plain truth is that of many we cannot say with any certainty what is the cause. There is not a textbook of obstetrics or paediatrics but pays tribute to the superiority of natural feeding, while mass statistics showing the higher death and morbidity rates of the artificially fed have been compiled again and again in many countries. The remarkable fact about this situation is that, whereas the effort towards increasing the safety of artificial methods has been unremitting, enquiry into the causes of failure to breast feed has scarcely been seriously attempted.

Milking of Animals

But there is something even stranger here. The very discovery that the milk of an animal can be purloined and used for the service of mankind has depended upon mastery of the difficulty we are considering. It postulates that the first exploiters of artificial milking must, wittingly or unwittingly, have complied with certain fundamental principles governing milk secretion; an example of experimental physiology, made we know not how long ago, whose success would surely command more of our respect were it not so familiar. Those who recall Karl Pearson's learned reconstruction of the 'Mother Age' and the wealth of evidence he marshalled of its impress on language, folklore, and culture, will find it easy to believe this discovery was made by women; and I have wondered whether one of its earliest purposes may have been to shorten the period of breast feeding which must have extended to years rather than months. From what we know of the results of feeding raw and unclean milk to very young babies, it can seldom have brought salvation to the newborn, a fact which possibly accounts for the heroic place in myth and legend of the occasional survivors such as Romulus and Remus. But this is too wide a digression. We need to remember that, after many thousands of years of domestication and selective breeding, dairy farming today retains but a trace of the difficulty of persuading an animal to allow herself to be milked, which must have faced the early experimenters. As late as the Greeks a frieze depicts the device of tying the calf to the horns of its affronted plunging mother. The submissive animal we know today may still need to be calmed, but it is probably enough to place food in the manger at milking time. The lore of milking has its place in literature from Homer onwards, and to take a recent example it is described in Hardy's *Tess of the D'Urbervilles* with

all an expert's knowledge; how an animal will 'let down' her milk freely to one and withhold it from another; the need for the milker's hands to work with speed and gentleness; the inhibiting effect of pain or fright. There is a passage in which the men discuss the cause of a morning's unsuccessful milking which one attributes to disturbance of the herd by the arrival of a new farm hand, and the dairyman agrees that may account for it. There is the knowledge that the last milk to be withdrawn is richer in cream than the rest and, above all, the importance of complete emptying of the udder if the yield is not to decline and even to cease altogether. For this reason the dairyman reserves to himself the 'hard yielders,' for there are marked differences among animals in the ease with which the milk can be withdrawn. These facts are the common knowledge of the stock keeper, and have enabled him to maintain lactation in animals for many months and often at an abnormally high level.

The Mechanism of 'Letting Down'

Now the mechanism of 'letting down' has been the subject of much patient research by agricultural physiologists and insight into it was gained when Tgetgel (1936) showed it coincided with a sudden rise of intramammary pressure. This produces a downward movement of the gland's contents, forcing them into the larger ducts and their reservoirs or 'cisterns' with sufficient strength to open a kind of rudimentary valve situated at the base of each teat. Hammond, of the Cambridge School of Agriculture, holds that between milkings the most fat-laden fraction of the milk is delayed by capillary attraction in the lumina of the finest tubules and that some form of expulsive force is essential to dislodge it; the greater volume of what is secreted meanwhile drains down into the more capacious part of the duct system. This explains why milk obtained from the cisterns by catheter is all low in fat content, whereas when obtained with the aid of the expelling mechanism the fat content rises as milking proceeds. Again, if the four quarters are milked in turn this difference in the fat content of fore and hind milk is present in milk from the first quarter but diminishes progressively in the others. By the time the last quarter is milked it has disappeared, for by then the fat has become evenly diffused throughout the contents of the cistern.

It has been shown by Ely and Petersen (1941) that the rise of intramammary pressure can be greatly reinforced by the subcutaneous injection of pitocin; thus if the usual yield at milking is 16 lb., it can by this means be increased to 21 lb., and the fat content of the extra volume is as high as 17 per cent. This effect is obtained after the udder is completely separated from its nerve supply, and suggests that the action of the posterior pituitary is upon plain muscle around the alveoli and in the walls of the duct system. These investigators have also shown that the inhibition of the 'letting down'

mechanism caused by fright can be reproduced by injecting adrenaline into the blood stream, and that both types of interference can be overcome by pitocin. The mechanism, which normally is reflexly evoked by stimulation of the teats, requires that a certain degree of milk tension within the udder shall have been reached; that is to say, a certain volume of milk must have accumulated there. If milking is attempted before this it will not succeed, for the milk will not be let down.

Outside the laboratory, and in conditions less artificial than those of the milking shed, there are opportunities to watch this mechanism in action; it is, for example, easy to observe in sheep grazing with their young lambs beside them, though it is not quite easy to keep close watch on more than a few at a time. In a group of five observed for a matter of two hours I found that the lambs, which were a little over three weeks old, sought their mothers for milk on an average every three and a half minutes. When the search is successful the lamb reveals it quite unmistakably by a vigorous wriggling of its tail which lasts rather more than a minute, and by means of this signal I found they were rewarded with milk at every sixth attempt, on average, or almost exactly three times in the hour. Now it was only at these times that the sheep would stand still and allow the business of grazing to be interrupted for suckling; at all others they countered the young's demands by moving forward and cropping the grass. On the other hand it sometimes happened that the lambs appeared to be late in applying at the appropriate interval and the sheep would then stop feeding and look around. It was evident the lambs had learned this was an invitation to feed for they rushed up at once and were always rewarded. To me it seemed the mothers were sensitive to the level of milk tension and perhaps experienced relief when the udder was drained. The udders of all these animals were small, but in districts where sheep's milk is used for making cheese and is withdrawn twice daily they become stretched to an enormous size. This is by virtue of the elasticity of both the duct system and the tissues which compose the gland's covering. From prehistoric times the dairy farmer has learned to take advantage of this property of the udder whereby normally the secreting cells are guarded from damaging compression by undue distension of the alveoli with milk. To obtain the largest yield he will, if he is wise, lengthen the intervals between milkings gradually so that the stretching can adapt itself to greater and greater volumes of milk. Too long an interval imposed suddenly at the start of the first lactation results in high milk tension and causes pain, and the yield declines and may cease within a short time.

I have reviewed these facts, many of which must be well known to you, since when taken together they allow us to define certain requirements which, it appears, must be met if the mammary gland is to fulfil its function. It is known that milk secretion

is continuous and we have seen the demands of the young are intermittent, and the mother must feed herself. For these reasons, and because leakage from a gland opening on the surface of the body means wastage, some capacity for storage is necessary. If the activity of the secretory cells is not to be hindered, this storage must be provided in the duct system; and, finally, when its limit has been reached milk must be removed. The gland's power of expulsion is not of itself great enough to do this and must be aided by withdrawal, a combination which is guaranteed by the recurring hunger of the young animal and the fact that stimulation of the teats reflexly evokes a rise of pressure within the gland. We know from artificial milking that this contribution from without is provided by compressing and emptying the terminal milk reservoirs; presumably the young obtains its food by the same means. (If a simile is permissible, this action is more akin to the principle of the Higginson syringe than to that of the suction pump.) It is worth noting that in natural conditions there would seem to be little likelihood of the gland becoming overloaded, for in the example of the lambs their demands for food were far more frequent than could be met. Five out of six were rejected by the mother and it is she, guided by her own sensations, who decides when the time for a release of milk has been reached. So much for a very fragmentary survey of facts revealed by comparative studies. Is there anything to be learned from them that can be applied to human affairs?

The Human Mechanism

Certain resemblances are clear enough. Most women, though not quite all, are fully aware of the expulsive reflex which they call the 'draught' and say it 'comes in' as the baby draws the nipple into its mouth or a moment or two afterwards. It is usually described as a 'drawing feeling' or as the tingling of 'pins and needles' and is felt in both breasts simultaneously, at which moment the child can be seen and heard to start drinking. The flow may come faster than the child can swallow, so that it may have to stop feeding if it is not to choke. If it draws away from the breast the milk can sometimes be seen spurting to a considerable distance beyond the nipple, but as a rule this is confined to the early weeks of lactation; later, when the duct system has become stretched, it is able to retain the milk without its overflowing. I have asked many women how long the draught lasts, and while they all say the sensation is quite brief they can seldom be more definite. From some who have tried to time it, it would appear to last between 30 and 45 seconds; 'though,' as one put it, 'it seems to help the milk to flow for much longer than that.' This may well be the elastic recoil of the distended ducts. Generally it is hard to obtain any clear or detailed description of the draught, which I take to be due to the well-known difficulty of describing

visceral sensations. When feeding goes smoothly and the baby habitually sleeps for a space of some hours, the draught becomes conditioned to the interval and may be so punctual that it anticipates the act of suckling should the baby sleep beyond the usual time. When this happens many women realize it is wise to rouse it and are glad of the relief which emptying the breasts brings, a fact that recalls what I said about the unpunctual lambs. The child feeds contentedly, and fractional test weighing shows it feeds rapidly; of this I have many records, such as 8 oz. taken in the space of three minutes. In my view any harm which results from babies taking large feeds in a short time has been much exaggerated. Many give up as soon as the flow wanes, and will only resume if put to the other breast. So, too, if for any reason the draught does not immediately come to its aid, the baby may give vent to a storm of protest, and I see this at my clinics from time to time if a woman is embarrassed by a request to feed her child so that I may watch some point in her method. If she can be calmed and the inhibition be removed, the feed goes smoothly enough. All my experience goes to prove that women in general are aware of the importance of the draught, and of the assistance it gives the child, indeed that without its aid the child can obtain little. They realize that its punctual recurrence means the breasts fill regularly and the yield is being maintained; and, conversely, if its strength declines and its arrival is irregular, production is waning. This, of course, is reflected in the child's behaviour.

It has long been known that the difference in fat content of the first and last milk to be withdrawn corresponds with what has been found in animals, and the difference which I mentioned can be demonstrated when the four quarters of the udder are milked in turn applies to milk from the two breasts. By the time the first breast has been drained the same diffusion of fat has taken place throughout the milk in the second, and fore and hind milk have approximately the same fat content (Waller, 1943). When investigating this point some years ago, I found that after the breasts had been fully drained a further flow could readily be obtained by injecting pituitrin, and this extra yield had a fat content as high as 11 and 13 per cent. We can, I believe, assume that the draught and the letting-down mechanism are not only identical but are essential for effective drainage of the mammary gland.

If this view is correct, then it becomes a fact of much significance that in many primiparae any aid from the expulsive mechanism is difficult to detect during the first fortnight after delivery; indeed it is often conspicuously lacking. The account just given scarcely applies to the initial phase of the first lactation but is rather a description of its action from about the fourth week onwards. I have discussed the characteristics of the early days in some detail in a paper published recently in this Journal (Waller, 1946), giving reasons for believing

it is a period when drainage of the breasts is commonly incomplete, with the risk this always involves of reversionary changes. Yet adequate emptying at this stage is, I believe, so essential to the ultimate success of breast feeding that I will summarize as briefly as possible the difficulties which arise, as well as certain methods of dealing with them.

Difficulties of Breast Feeding

There are two factors, particularly in the first lactation, responsible for a high degree of milk tension occurring at this time. The start of milk secretion may be sudden and the volume produced so great that it cannot be accommodated by the duct system, as yet unstretched. Together with this the skin covering the breasts may be thick and unyielding, and in consequence the breasts become rapidly swollen, heavy, and oedematous, and the outflow of milk is then hampered and sometimes entirely obstructed. For various reasons the newborn may be unable to make any effective contribution to emptying the breasts; it may, for example, take several days to recover from the effects of labour, or it may be premature, or weakly from other causes. Even the drowsiness and lethargy of the ordinary icterus neonatorum may be enough almost to extinguish its desire to feed for two or three days. Then developmental defects of the nipples are extremely common, and in a high proportion appear to be associated with poor development of the lacteal sinuses. The nipple that cannot easily be drawn far back into the baby's mouth is liable to get damaged and this is a source of great pain to the mother, and often of apprehension as well; while the combination of injury and incomplete drainage is a very fruitful source of infection.

Management of Feeding

Together these make a formidable list of which any one is capable of frustrating breast feeding at its outset, and in the article to which I am referring I told how, at the hospital at which I work, we have tried to overcome them. This includes the systematic examination of all patients for structural defects of the nipples early in pregnancy and the use of a simple orthopaedic appliance, which has proved effective in all but those which are grossly deformed. We teach the manual expression of colostrum to all primigravidae and ask them to practice it daily during the last six weeks of pregnancy. The subsequent outflow of milk during the first days of lactation is so much more free that we believe it dilates the duct system and enables a primipara to start with something of the advantage possessed by a woman who has already breast fed a baby. When the start of secretion is sudden and threatens to produce engorgement it is controlled by using the synthetic oestrogens. Lastly, we set great store by the manual removal of milk to ensure adequate drainage which at this stage we do not expect the baby to be able to accomplish. The

women learn how to do this themselves and with a little supervision at first become exceedingly skilled at it.

From this combination of measures the most important fact to emerge is that the reflex expelling mechanism is usually well in evidence before the mothers leave hospital on the twelfth or thirteenth day, and the primiparae can by then recognize the draught, if not as clearly and regularly as the multiparae, nevertheless quite distinctly. Moreover it is evident that milk is expelled, not only by the freedom with which it flows from one breast as the child feeds at the other, but by the fact that the child obtains it much faster, and that the amounts taken at each feed become approximately equal, with a tendency to rise steadily day by day.

Management on these lines demands a delicate appreciation of what constitutes excessive milk tension; and, since it cannot be measured as blood pressure can be measured, it can only be gained by clinical experience. In this the nursing staff at my hospital have attained a very high degree of efficiency and they keep a close watch on each woman, not only from day to day but several times during each of the first six or seven days. Even so, when going round the wards I can often tell from the first half-dozen patients that there has been a rush of admissions and the staff has been overworked. The size of the babies' feeds then shows too great variations and they have had to be complemented too often by milk expressed by hand. The charts record the oestrogen preparations have been used more than is usual. There may be two or three mothers with injury to the nipples, and suckling has had to be withheld for forty-eight or seventy-two hours to allow healing. I shall be asked to advise certain women to stay longer than they had expected in order to ensure that feeding is secure. I emphasize this because it serves to show how delicate are the points of nursing technique during these early days if the secretory needs of the breast are to be met so that production will be maintained. If half a dozen patients are delivered within a few hours of each other they will all simultaneously reach the stage when, for reasons I have mentioned, the risk of engorgement arises; and this may coincide with the arrival in the wards of a group of new pupil nurses. This is the nature of maternity work in present circumstances. On another day the records will be quite different, for the staff have been able to give the necessary watchfulness to each patient, to anticipate in whom difficulty was likely to arise, and to circumvent such difficulty successfully.

There is nothing particularly difficult in establishing such a regime; nothing more, shall we say, than training a staff in the detail of routine to achieve asepsis in the operating theatre. The underlying principles must be understood by the whole team, and the technique learned by every member; its detailed observance must become a matter of conscience. Perhaps I should have put first the necessity to renounce the view that breast feeding

is a simple physiological function which needs for its success nothing more than a woman's willingness, and accept the fact that this only holds good for about a quarter of our primiparous women, and that some degree of preparation and skilled help is needed for the rest. I attach great importance to this attitude because I feel sure the tendency to attribute failure to unwillingness often serves as an evasion of problems for which the solution can be found. Certainly it is our experience that, if the start of breast feeding can be made easy and painless, and the woman saved anxiety about her capacity to succeed and given the assurance that her baby is thriving, she will not lightly give up. It is also essential to get acceptance by everyone in the maternity hospital that their responsibility extends beyond the short period of the puerperium, and that in the matter of infant feeding the aim is not merely to see that by one means or another the baby receives the necessary quota of milk, but that the mother's lactation is so managed that it is secure. Like most hospitals we return some 85 per cent. of women 'wholly' breast feeding when they leave our wards; but we have learned that there must be many reservations before this figure can be taken as synonymous with 'securely' breast feeding. The soundness of methods employed during the lying-in period cannot be assessed at fourteen days; it must be tested by results at intervals such as three and six months. Thus, in an experiment which I have described elsewhere, we found that, out of a hundred primiparae who had been taught the daily removal of colostrum, eighty-three were successfully feeding at six months compared with but forty-two of a similar number of controls, the management of the two groups after delivery having been identical. We were at the time concerned to test the value of the pre-natal exercise and were highly gratified with the result. On reflection, however, it was chastening to realize how unsatisfactory was the performance of the controls; for of these we had recorded eighty-three as 'wholly' breast feeding when they left the hospital in the belief that we were duly on guard against the fallacies latent in that deceptive term. The discovery served to drive home once more how dependent the maintenance of milk production is upon the prompt establishment of free drainage, and pre-natal tuition has since become the rule for all primigravidae and those who have failed in a previous attempt to breast feed. A recent review of three hundred primiparae who passed consecutively through the wards showed that 237, or 79 per cent., were still yielding their babies at six months all the milk they needed.

Duties of the Paediatrician in Relation to Feeding

Is our customary advocacy of the advantages of breast feeding sufficiently sincere to see that the rather meticulous detail I have described shall be forthcoming? and, if so, shall we demand it of

the obstetricians or undertake it ourselves? You will have guessed that I favour making it the responsibility of the paediatricians, and for this reason: though there are outstanding exceptions, I believe it true to say that to most obstetricians the supervision of infant feeding comes as an anticlimax to all the problems and anxieties involved in safeguarding women through pregnancy and labour. The majority are very content to leave the care of the infant to the nursing staff. I recall an animated discussion on this subject many years ago, during which an eminent obstetrician confessed that he asked to be relieved of all responsibility for the newborn once the cord was tied. Several of those present insisted he should be logical and appoint someone to assume responsibility from that moment. To this he agreed, and was as good as his word, for shortly afterwards a paediatrician was appointed to the staff of his maternity hospital. There are now many such appointments, but the interests and range of duties of those holding them seem to vary. Thus in one teaching hospital which I visited recently the paediatrician does not, as the sister put it, 'interfere' with the management of normal infants but expects to be consulted only about the abnormal, the sick, and the premature. It is my belief he has got to interfere a great deal; perhaps even to establish the right to interfere. It cannot ever be assumed that because the baby is of normal development breast feeding will be easy. The obstetrician may leave the conduct of normal labour to the midwife, but he does recognize the possibility that uterine inertia may arise and has laid down explicit instructions to meet it.

Nursing Staff and Infant Feeding

Rather more open to question is the ideal constitution of the nursing staff for the kind of management I have outlined. In my own hospital it has been happily solved by the appointment of a sister whose duty it is to see that a careful examination of the breasts is part of the routine ante-natal care, and that the preparatory treatment is carried out. She lectures to the pupil-midwives on breast feeding and teaches them the detail of the use of the hands for the removal of milk, advises when suckling should be suspended, when oestrogen is called for, and so on. She works in the lying-in-wards in co-operation with their sisters, and attends the hospital infant welfare centre. She also has charge of the nursery for premature babies. It is a great asset that in addition to having taken her general and midwifery training she has also qualified as a health visitor and is thus inclined towards the longer view of the subject and is able to teach its importance. This arrangement seems to me to have advantages over the employment of a staff of specially trained nurses solely to tend the babies, for it retains their management in the hands of the pupil midwives, where surely it should be if there is to be any hope of improvement in their work when they

undertake independent practice. There is an increasing tendency for various aspects of maternal and infant care to become detached from each other, even to be delegated to groups of special workers; as, for instance, in the care of the excessively premature infant. Against the convenience which this plan sometimes provides must be placed certain distinct disadvantages. An extreme example of the latter is the intrusion of the staff of the massage department into the lying-in-wards to deal with the overloaded breast. Inevitably this has the effect of suggesting to the ward staff that it is a task beyond their skill, instead of being, as I hold, one they should learn as an essential part of their training. At any rate what I have outlined is one plan, and after three years' trial we are satisfied it can be made effective.

Clinical Research

I have described this method of managing breast feeding in a maternity hospital in some detail because I am convinced that unless the problems surrounding the start are successfully solved we are unlikely to see any appreciable rise in the proportion of naturally fed infants. I do not doubt the plan can be improved and we are continually trying to devise improvements. This brings me to what I hold to be by far the greatest need of all; the need of clinical research. It is wholesome to remind ourselves that in its main principles the management of infant feeding today is almost exactly where Budin (1907) left it nearly half a century ago. It requires a considerable effort of imagination to realize how radical a change of method was his plan of putting a baby on the scales to find out how much milk it obtained when drinking at the breast. There are indeed hints in his lectures that, great man that he was, he did not find his task easy. Such innovations are usually resented. He saw the need to ascertain how much food a baby required to secure its growth and to supply any deficiency in a form that was safe. He was, in fact, determined to replace guesswork by measurement. He was greatly interested in lactation, and made careful observations on the variations in the yield of the wet nurses he employed for weakly infants; but it does not appear that he applied himself closely to the problem I have been considering, the instability of lactation. He was, however, dealing mainly with very ill-nourished women and starving babies; for you will recall his work was done in the eighties and early nineties of the last century, when France was suffering from her losses in the Franco-Prussian war, her birthrate was declining, and in her cities the rate of infant mortality often stood at 200 per 1,000. Budin set himself the tremendous task of finding means to check this huge wastage of infant life. If we exclude the discovery of vitamins and the control of scurvy and rickets which we owe to it, it is fair to say that beyond the many refinements in artificial feeding no notable

advance in method has been made in the last half century.*

It may be retorted that this delay is because it is only within the past ten years or so that physiologists have unravelled even some of the part played by hormones in milk secretion, and that until this point was reached no material advance was possible. Must we then wait passively until the whole story is unfolded instalment by instalment? The very fact that the present stage of knowledge was so long delayed contains its warning, for as Wilfred Trotter (1941) has reminded us, 'Physiology is an independent science which must follow its own inspiration, finding it sometimes here and sometimes there and only occasionally in medicine.' I should be much surprised to learn that any of its recent discoveries in lactation were inspired by concern for the fact that half this country's babies are artificially fed by the time they are three months old. To extend the quotation I have just read, 'It is on the most ordinary phenomena of medicine that the illumination of physiology is most dimly cast. . . . Medicine, more and more understanding the lost opportunities of past years, will take to itself the methods of experimental science and lead the *direct* attack on its own problems.' Here surely is a challenge. With the resources of the universities and the great teaching hospitals, can it be doubted such a direct attack would provide the enlightenment we need?

Other Aspects

There are many aspects of this subject on which I have not touched and about which there is almost everything to be learned; whether, for example, it is possible clinically to correlate what is known of

the histological differences with the wide variations in the size of the breasts, and these again with differences in their capacity to yield milk. There is a type of gradual but still premature failure of milk secretion which, though I suspect it is often dependent on incomplete drainage, does not always seem to be so. This would repay study and might possibly be influenced by suitable additions of protein to the diet. The lactopoietic properties of thyroxin have scarcely been studied in the human. There are instances of the sudden cessation of lactation which are commonly attributed to emotional disturbance but on which there are few reliable observations. Upon the mechanism whereby milk is expelled from the breast, to which I have referred, there is clearly much more information needed, not only of its exact nature but of the possibility of its conditioning. On the side of administration there is a great opportunity to demonstrate the value of co-ordinating the work of obstetricians and paediatricians, of midwives and health visitors, and welding it into a truly effective unified service. The list could be enlarged to almost any extent and I am convinced that anyone applying himself to the subject would find problems interesting and worth while. Indeed, in accepting your invitation it was my hope that something in this lecture might enlist your help to raise this branch of preventive medicine to a standard worthy of its importance.

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* In fairness I should mention that to Truby King we owe the demonstration that failing lactation can be augmented and a full yield can sometimes be reached when breast feeding has been interrupted, and even when it has been given up for a considerable period. I cannot be sure, however, that he realized this possibility to be closely dependent upon the degree to which involution has proceeded. The value of 'massage' of the breasts in bringing about a revival of secretion probably consists in emptying the duct system and evoking the expulsive mechanism, rather than in producing some local circulatory change, as he held. Nevertheless, whether his interpretation was correct or not his method was original and helpful. For our purpose it is worth reflection that it has proved of much more lasting value than all the energy he expended in the advocacy of breast feeding as a moral duty.