the cartilages, following on several attacks of inflammation, apparently of the synovial membrane, extending over a space of about twelve months, and caused by an accident received at that time. He recovered partially under a course of mercury and counter-irritation to the joint, and was discharged with the knee put up in a starch bandage. The increase of pain and swelling, however, soon compelled him to take off the bandage, and he re-applied at the above date—the same symptoms, viz., starting of the limb, and great pain at night, with fluid effusion into the synovial membrane, having recurred. He was again treated on the same plan; but as it was not thought desirable to give him calomel again, the bichloride of mercury was administered, and issues put in on either side of the joint. He experienced some relief at first; but after a two month's trial of this treatment it became evident that suppuration had been established, and that it was necessary to sacrifice the joint. It was therefore determined to excise the knee.

This was done on July 9th by the H-shaped incision, the patella being turned up in the upper flap. Two large cavities were found filled with pus in connexion with the joint. The synovial membrane was much thickened, and the cartilages quite removed from the ends of the bones, which were themselves slightly carious. The caries, however, penetrated no great distance. The ends of the tibia and femur were removed, but the patella was left behind, its deep surface having been gouged where it was eroded.

The limb was then put in a splint swung from the cradle. There was a little tendency to hæmorrhage during the next few days, and considerable pain in the wound, so that opiates were necessary every night. The incisions soon began to unite, so that it was necessary to break them down in order to liberate confined matter. When the parts had become a little consolidated, a good deal of comfort was experienced from removing the splint and placing the limb in a "junk-pillow." On August 27th, the swelling having much diminished, and the parts being considerably consolidated, it was thought safe to allow him to lie outside the bed with a bandage over his knee. This, however, soon brought on some pain and inflammation about the wound, so that he had to keep his bed ten days longer. He was finally released from confinement to bed on September 6th, by which time the wound had contracted to a sinus on each side of the patella. On the 18th of September the consolidation had so far advanced that he was able to raise his leg. Finally he was discharged on Nov. 11th, being then able to walk well with the assistance of a stick, and with so little shortening of the limb, that a high heeled boot sufficed to afford him firm standing.

REMARKS. This case is offered as an example of one in which all the circumstances met which are held to indicate excision of the knee-joint, and in which all the success was attained of which that operation is capable. The indications were these:—1. That the patient's health was sufficiently good to stand the drain upon his system, and to promise good repair and sound anchylosis. 2. That the disease had commenced in the soft parts, and that there was no constitutional taint which might render the local measure nugatory. 3. That the disease in the bones was so limited as to render it certain that it could be completely removed by excision.

The justice of the selection was proved by the event of the patient's recovery in a moderate time (little more than would have been required after amputation), and with a perfectly useful limb.

As this operation is now undergoing a pretty warm discussion, such instances as these may be useful. The case may also serve to show that the surgeons of this Hospital are not opposed on principle to the operation, and that the severe remarks made upon them, on that supposition, by Mr. Butcher, in a recent paper, were perhaps somewhat hasty.

ST. BARTHOLOMEW'S HOSPITAL.

PAIN AS A SYMPTOM OF ULCERATION OF THE NECK OF THE BLADDER.

WITH reference to the case of lithotripsy about which Mr. Eyton Jones wrote a letter of inquiry, which appeared in the number for March 27th, we have made inquiries of the gentleman who furnished the notes, and learn that the patient did complain of more pain towards the conclusion of the case. It was not, however, of an excruciating character, and so it did not form at all a prominent diagnostic symptom—nor was this to be expected, as the ulceration probably proceeded merely

from the irritation produced by the fragments of stone being pressed down upon that portion of the mucous membrane. It is in severe inflammatory affections of the bladder, and especially of the neck of the bladder properly so called (not merely of a piece of the membrane near the neck), that the excruciating pain which Mr. Jones speaks of is to be expected.

Original Communications.

ON THE MORTALITY OF INFANTS IN FOUNDLING INSTITUTIONS, AND GENERALLY, AS INFLUENCED BY THE ABSENCE OF BREAST-MILK.

By C. H. F. ROUTH, M.D., Physician to the Samaritan Free Hospital for Women and Children; late Physician to the St. Pancras Royal Dispensary; etc.

PART III.

ANIMAL SUBSTITUTES FOR HUMAN MILK.

In my first paper, it may be remembered, I laid great stress on the abuses of the recumbent position of children, so beautifully explained by M. Hervieux, and so fearful a cause of their mortality. The effects produced were cold and starvation. (See p. 66.) Decidedly, therefore, in any plan adopted to bring up a child by hand, these effects must be especially combated against and avoided. I would lay down, therefore, the two following positions as necessary for success.

1. That, in early ages especially, a child should be kept warm, artificially or naturally, especially during feeding periods.
2. That the position which a child is made to take at such periods should, as nearly as possible, resemble that of nature; namely, a semi-erect position.

I believe that the comparative anatomy and physiology of warm blooded animals (aves and mammalia) entirely proves this necessity.

Warmth required by an Infant. The records of mortality prove indisputably that cold is very deadly in its influence upon children. Whenever a week is more severe than the preceding one, instantly the Registrar-General's returns show an increase of deaths; and this especially among the very old and very young. It is of the latter only that I have to speak. The whole bearing of comparative anatomy goes to prove that heat is essential to the preservation of new born and very young animals. Among the sparrow tribe, some, as the common sparrows, ortolans, and swallows, are born quite naked; others almost so, as in the case of linnets and magpies. Among the gallinaceous birds, the *Grallatores* and some of the *Palmpedes* are covered by a species of down, which, albeit transitory and succeeded by feathers, is notwithstanding very warm. It is observed that this down is preserved longer on young birds obliged to remain in the nest a long time, and which are unable to seek abroad for their food; as, for instance, in the goose; and the parent birds themselves are provided with similar down on the belly between the feathers, which only disappears some time after incubation. Many of the young, besides this down, are provided with a thick coating of grease, to preserve them against external cold. This is the case among the procellaries. But even among mammalia, the first coating is not like that which follows, albeit also transitory. The hedgehog has a fine velvety hairy coating; the phocas, a long soft hair. Added to this, as has been well shown by Edwards, the calorifying power is always imperfect in the very young. Birds and mammalia, which are born naked, have little proper heat, and derive it chiefly from the parent. The animal heat of young sparrows withdrawn from their mother (the temperature of the atmosphere being 64° Fahr.), fell in one hour from 87° Fahr. to 66°; and, when the external atmosphere was 71·6° Fahr., it fell to 73·4°. The same result is observed in dogs and rabbits. But one thing is remarkable here, especially in reference to its application. It is not the difference of the external covering which is the cause of this: external furs may be put around the young to keep them warm, and yet the loss of temperature is the same. This is not the case with older birds; for in these, even when all their feathers are cut away, they retain their heat. The maternal heat is all that a young bird needs the first day, since

the umbilical vesicle of the egg still supplies it with food. It is interesting to note, however, that these young animals, although they lose skin heat so readily, and become as it were insensible from cold, will yet regain it on being artificially warmed, and recover. This power, however, is lost in proportion as the animal becomes older, and more able to generate heat itself.

The mother's nest, among those animals which are born naked, is both deeper and warmer. This is remarkable with birds; but, even among mammalia, in proportion as the young are born more or less naked or blind, so do the parents take greater or less precautions, and make their beds or nests warm. Less care, however, in this respect, is taken among mammalia which are in the habit of having their young in summer. In some instances, where a nest is not so readily made, the heat is maintained by a persistent connexion between the mother and young. In the kangaroo tribe (the connecting link between the oviparous and viviparous animals), there is a pouch to keep the animal warm attached to the abdomen, where the young kangaroo remains with the mother's nipple persistently in its mouth for seven weeks. But in a higher class, in the *simia rhesus*, this animal, for a fortnight after birth, fixes itself to its mother's nipple, which it never leaves but to take hold of the other. All this indicates, apart from the necessity for food, an equally great necessity for the maternal heat.

The application of these facts to man is most important. The infant is born naked. It is true, his eyes are open; but, according to Burdach, for the first month he is as it were blind, perhaps able to distinguish light, but that indistinctly. Heat is essential only to him at first, and he will rapidly lose it on exposure. The proverb, "Can two lie together, and not have heat?" should be proved in the case of every infant and its mother. Temporary separation may be, and should be, recommended, but it should not be long maintained; for then, owing to the power of the infant of again recovering its heat near the mother, no harm is likely to follow. These remarks apply generally to the young animal at all times, but especially so at meal times. During digestion, there is a continual flow of the blood towards the alimentary canal; and hence that sensation of feeling cold after dinner, which a proverb among us has interpreted as a *sign of a good digestion*. It is only after this is complete, that the blood resumes its position more on the external skin, and the sensation illustrated by another proverb, "The south wind blows after dinner," is brought about. But, as the means of producing heat in the infant itself are very limited, and its meals are frequent, so it requires that the artificial heat from its mother should be often given to it: hence, during meals, a child should be kept warm.

Position of a Child while taking Food. This is not less important to a child brought up by hand. "The child," says Dewees, "should not receive its nourishment while lying. It should be raised, which will not only become a pleasanter position, but it also diminishes the risk of strangulation." (*Diseases of Children*, chap. v, p. 178.) The semi-erect position which the child adopts in sucking is not only favourable, as affording it the readiest means of partaking of its mother's heat, but there is besides an anatomical reason. The stomach is placed more perpendicularly as to position. There is but feeble muscular power in it; and the cardiac opening is less able to contract and retain food taken. Thus, in any other position of the child but the semi-erect, the milk taken is likely to be brought up again, and lost to the child. Strange is it, too, that, in feeding children by the bottle, nurses are usually in the habit of laying the child on his back on their knees, often with the head lower than the trunk, precisely to favour that which it is desirable to avoid. To correct this abuse, with the assistance of a very intelligent chemist, Mr. Cooper, of Oxford Street, I have had a new bottle constructed. To this I have had applied his newly invented stop-cock, which is so constructed as to prevent the child from taking down air with his food, thus avoiding those pains from flatulence, so common in children, and often so distressing. It consists of a female breast-shaped bottle, with two openings in it: one for the use of the child when very young without the stop-cock, but with the tube and a small nipple of India-rubber; the other, with the stop-cock and with its tube, and a larger nipple to be used when the child is older. It may be worn by the female in the position of the breast, or across the chest, and if next the skin, is kept warm, if need be, all night or day. The child, on taking the food out of such a bottle, must be placed in the normal position, and is at the same time kept

warm by the female. Such as it is, I strongly recommend it for trial.

There is another way in which it may prove useful. Mothers often tell us that the child will not take the bottle: and the reason is obvious. It is not likely that a child, accustomed to the semi-erect position and maternal heat, will readily assume the new and recumbent position, at once a less pleasant one from habit, and so much colder. With the mammary bottle, this source of difficulty is at once removed.

I had thought I was the original inventor of this bottle, at least of the glass part of it; but I hear that something like it is in use in America. Be this as it may, as it is founded on *scientific grounds*, and has many advantages, I think it should be used in preference to others.

Substitutes for Human Milk. The simplest substitute for human milk is clearly milk from another animal. Of this fluid three kinds are usually spoken of: *asses' milk*, which is said to come nearest to human milk; *cows' milk*; and *goats' milk*. I will speak of each of these varieties *seriatim*. Before doing so, however, it will be well to set forth in a tabular form the relative quantities of the solid ingredients and the water contained in human milk, at periods of three months for the first year, and of six months for the second year; so as thereby to enable us to judge of the amount up to which each of these ingredients should be brought, and which is best adapted to the age of a child, when we substitute for its mother's milk that of the ass, the cow, or the goat.

Table calculated from one given by Becquerel and Rodier.

	Specific gravity.	Water.	Solid constituents.	Sugar.	Casein with extractive matter.	Butter.	Incinerated salts.
1st quarter...	1032.50	877.33	122.67	42.30	33.39	31.94	1.73
2nd " ..	1031.81	893.14	106.86	43.71	37.95	23.89	1.37
3rd " ..	1033.07	890.83	109.17	43.67	40.89	23.40	1.21
4th " ..	1031.24	892.98	107.03	45.79	36.89	23.03	1.29
12 to 18 mths.	1032.05	891.34	108.66	43.92	36.98	26.44	1.32
18 to 24 " ..	1030.81	876.55	123.45	41.33	37.32	43.47	1.33

Asses' Milk. It has usually been said that asses' milk is the nearest to a woman's milk; but I believe this is an error. It contains, certainly, more water, only about half as much casein and butter, and about twice as much sugar and salts. The following are five analyses of asses' milk, of specific gravity from 1023 to 1039.

	Simon. (Milk 1 year old.)	Peligot. (Mean of several analyses.)	Chevallier and Henri.	Human milk.
Water	907.00	904.7	916.3	
Solid constituents	91.05	95.3	83.5	
Butter	12.10	12.9	1.1	
Caseine	16.74	19.5	18.2	
Sugar with extractive matters and salts	62.31	62.9	—	
Sugar	—	—	60.8	
Salts	—	—	3.4	
	Lehmann.	Vernois and Becquerel.	Human milk.	
Water	795.0 to 789.1	890.12	889.08	
Solid constituents	205.0 to 210.9	109.88	110.92	
Butter	12.1 to 12.9	18.50	34.61	
Caseine	16.0 to 19.0	35.65	39.24	
	(with extractives.)			
Sugar	68.0 to 62.9	50.46	26.66	
Salts	—	5.24	1.38	

To the excess of salts is probably due the purgative effect of asses' milk occasionally noticed in adults who take it. The saline matter amounts as a minimum to twice, as a maximum to four times, as much as in human milk. Now, if it be a fact, as is usually stated in books, that asses' milk is the best substitute for woman's milk, where are the experiments to prove it? Do children fed on it exclusively thrive? Answers to these questions are important desiderata; but, till they are solved, the substitution of asses' milk cannot be urged merely because it contains more sugar than cows' milk, or because it proves wholesome food to invalid adults. To many adults, cows' milk in any quantity produces nausea and vomiting. It is usually well borne on the stomachs of infants, albeit it may disagree otherwise. And indeed, after all, to make up the required quantity of casein and butter needed, twice as much of asses' milk would be required. The quantity of sugar thus taken would be greatly in excess, as well as the *salts*. Would not

scrofula be developed? and what good effect on the brain and bones would the excess of the salts produce? We have before seen that sugar is not of itself capable of supporting life. Besides the debility which supervenes, abscesses form on the cornea, which penetrate internally, so as to let the humours escape. The *post mortem* appearances are, general atrophy of the muscles, contraction of the stomach and intestines, etc. These experiments, chiefly instituted by Magendie, however cruel and revolting, are not without their practical importance. We often meet with a class of cachectic patients, eminently scrofulous, with morbid tastes for sweets and the like: in these, strumous ophthalmia, with ulcers on the cornea, make their appearance. Is not this the result of a diet too exclusively saccharine? and is there not reason to dread something like such a result, if we were to attempt to bring up children too exclusively upon asses' milk?

But more than this: it has been shown by Lehmann and Elsässer, that *fat* exists in most of the fluids secreted by the body, which assists digestion along the whole course of the alimentary canal. The solution of food, although delayed by *excess*, is hastened by a moderate quantity of fat. So also, in early or fatal development, it is the fat globule which attracts, as it were, the albumen or nitrogenous elements around it, acting in the cell-growth as the nucleus around which parts grow. Moreover, the fats of the blood are also deposited in the blood-globule—the portion in the blood generally admitted as most concerned in the nutrition of the body; and this is doubtless one of the reasons why cod-liver oil proves often so useful. To attempt, therefore, to feed a child on food poor in fatty matters, as asses' milk, is evidently unphilosophical.

It has been stated by Mr. Lobb, that, by adding two and a half per cent. of *cream* to asses' milk, a very good substitute for human milk would be procured with great ease. "The expense of asses' milk," remarks Mr. Lobb, "would put it out of the reach of the poor." He might have added, the expense of *cream* also. The suggestion, however, is a good one, because, in the country, these might be easily procured. In many parts of Great Britain, asses are to be obtained at a very cheap rate. I am told five shillings are in some places, in winter, gladly accepted; and I believe thirty shillings to be the usual price. To a founding hospital, a herd of these animals would prove most useful, not only in providing milk for the infants, but in affording a ready method of exercise; while, as beasts of burden, they would prove valuable in the neighbourhood, particularly if situated in the country, or by the seaside. To determine, therefore, the practical usefulness of asses' milk, is no small matter, and would be fraught with immense advantages; but as, when singly given, and on scientific grounds, theory condemns the practice, I for one, till its usefulness is proved, must oppose the popular prejudice.

Goats' Milk. In many parts of the world, the goat is the substitute for the cow as the provider of milk to the population. The objection usually made to it is its disagreeable odour, from the presence of hircic acid. Observers differ greatly as to its composition, as may be seen from the subjoined table, partly given by Simon (*Animal Chemistry*, vol. ii, p. 65.)

The analysis by Boysson is not unlike that which would obtain from the examination of a woman's milk. Mayer, indeed, says that goats' milk is preferable to cow's milk, as resembling more than any other milk that of a woman; and this

is doubtless true, if we compare with it particularly the milk of very young women. It is without doubt that many children do thrive very well on it in Ireland, Switzerland, and other mountainous countries. One advantage which the goat possesses over other animals that yield milk, is the greater impunity with which it sustains the various vicissitudes of the weather. She will sleep readily under a powerful sun, without suffering; she will remain unaffected, if exposed to rain or storm; she will bear a great amount of cold, although to this last she is more susceptible. Like the cow, however, experience has proved that the goat will yield a larger flow of milk if fed in stables upon proper fodder; but, as with the former, if kept in these, great attention should be paid to the cleanliness of the stable, and the removal of all offensive matters. The best milk afforded by the goat is that which it yields about two months after kidding. The peculiar odour of goats' milk, from the presence of hircic acid, and which is not always very agreeable to those who taste it for the first time, is an objection; but persons soon get accustomed to it, and come to like it. This smell, indeed, is not essential to goats' milk, being chiefly present, and then most strongly, when the ram has had any relations with the goat; and is greatly diminished if the animals are kept clean, and especially if washed from time to time. It is also far less marked in those goats who have no horns, in which there is little more odour than in the milk of the cow. (Parmentier.)

It is interesting to notice here a fact established by Becquerel and Vernois; that is, that the character of the goat's milk, as that of the cow, may be regulated by the quality of the food supplied. If a highly nourishing and rich milk is desired, it is best fed on straw and trefoil; but if a light milk is required, beet-root is preferable. This difference is set forth in the following table, to which I have also appended the composition of human milk, for comparison.

	GOAT'S MILK.			HUMAN MILK (normal).
	Fed on straw and trefoil.	Fed on beet-root.	Normal (mean).	
Specific gravity . . .	1031.10	1026.85	1033.53	1032.67
Water	858.68	888.77	844.90	889.08
Solid constituents . .	141.32	111.23	155.10	110.92
Butter	52.54	33.68	56.87	34.61
Casein and extractive matters . .	47.38	33.81	55.14	39.24
Sugar	35.47	38.02	36.90	26.66
Salts	5.93	5.72	6.18	1.38

This table shows that the milk from a goat, if she has been fed upon beet-root, is very near to that of a woman, only that it is richer in sugar and salts. Still it comes much nearer to human milk than asses' milk. Indeed, as evidence that practice confirms theory in this instance, I may cite the experience in Ireland. In that country, I am informed, the foundlings of Dublin were formerly sent to the mountains of Wicklow, to feed upon the goats' milk. As the children grow older, the goats come to know them, and become very tame; so that the infant goes to the goat, and suckles it as he would a human wet nurse. These children thrive, I am told, remarkably well.

Analyses of Goat's Milk.

	Chevallier and Henri.	Clenm.	Boysson.	John.	Paycn.	Stipriaan, Liuscus, and Bondt.	Lehmann.	Donné.	Vernois and Becquerel.	Human milk.
Water	868.0	865.175	892.8	849.3	855.0	744.0	886 to 884	819.4	844.90	889.08
Butter	33.2	42.507	29.9	11.7	40.8	45.6	33.2 to 42.5	48.6	56.87	34.61
Casein	40.2	60.321	52.9	105.4	45.2	91.2	40.2 to 60.3	43.8	58.14	39.24
Sugar	52.8	44.065	20.7	23.4	—	43.8	40 to 53	91.2	36.91	26.66
Salts	5.8		—	—	—	—	—	—	6.18	1.38
Residue of whey	—		—	—	58.6	—	—	—	—	—
Cream	—	—	—	—	—	7.5	—	—	—	—

[To be continued.]