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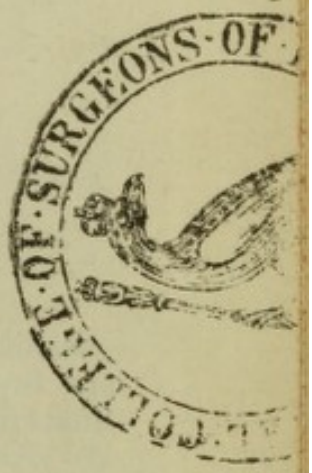
BREAST MILK.



BY

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[*Reprinted from the* BRITISH MEDICAL JOURNAL.]

LONDON:

PRINTED BY

T. RICHARDS, 37, GREAT QUEEN STREET.

M.DCCC.LVIII.

ON THE MORTALITY OF INFANTS,

ETC.

PART I.

THERE is an outcry everywhere against *red tape* and *routine;* yet surely these are very prevalent among ourselves and our medical institutions. Most of the latter, except a few which stand out in honourable contrast, do not give us the benefit of their experience; and thus it is that, in England, much information which might, if regularly published, lead to a just comprehension of subjects in medicine, is lost to the profession. The subject of my paper is in this category. The books and pamphlets that have been written on it are *legion.* De Watteville enumerates a hundred and thirty; yet all this foreign and British experience has, after all, effected but little good. I have, however, been compelled to use chiefly French returns, although of course wishing to make them bear almost exclusively on England and Ireland. Exactitude in the figures given is thus not to be expected. At most, I can only seek to bring out results which shall be *true relatively;* and this I hope I have done. Still, in many cases, my conclusions may be also *true absolutely.* Vital statistics, in the present day, are found to be governed generally by the same common laws; and, although the actual figure of per centage may occasionally vary to a small degree, the difference is not by any means so great as it may appear to be at first, even where populations of different countries are spoken of. Hence it is often allowable to deduce from foreign data, which we do not possess for our country, conclusions which, nevertheless, are perfectly true when applied to ourselves. Take, for instance, Paris and London. The mortality may vary by 1 or 2 per cent., but nevertheless it is still governed in the two cities by the same general laws.

With these few remarks, necessary as an introduction, I proceed at once to the consideration of my subject.

Nearly all writers, who have endeavoured to explain the mortality of foundlings, have usually and chiefly attributed it to want of breast-milk; alluding, as examples, to the hospitals of Paris, Lyons, Rheims, a place called X, and Parthenay. Thus, in Lyons and Parthenay, where the children are suckled at the breast, the mortality is respectively 33·7 and 35; whereas, in Paris, Rheims, and X, where artificial feeding is either extensively or very generally employed, the mortality is respectively 50·3, 63·9, and 80 per cent. Many years ago, Sir Hans Sloane, in a letter to the Vice-President of the Foundling Hospital, quoted at length in Mr. Brownlow's Memoranda of that hospital (pp. 215-16), gives the following results:—

Date of admission.	Total.	To wet nurses.	Deaths.	To dry nurses.	Deaths.
March 5, 1741 ..	30 ..	2 ..	— ..	28 ..	15
April 17, 1741 ..	30 ..	7 ..	1 ..	22 ..	11
May 8, 1741 ..	30 ..	17 ..	4 ..	13 ..	8
	90	26	5	63	34

Six of the latter were taken out. The mortality of the former was 19·2 per cent., against 53·9 of the latter.

Facts like these appear certainly to tell very strongly against dry nursing. It is usual to add the figures of mortality in other hospitals, whose circumstances are often very different; and, these figures being very heavy, the inference is, that these children have died chiefly from want of breast-milk. Thus, the following may be taken as an example:—

Mortality in Foundling Hospitals in different parts of the World.

	Per cent.	Period.
Dublin	91	Close of last century.
Marseilles	90	
St. Petersburgh	40	
Florence	40	
Barcelona	60	
Paris	80	
All France	60	1824
„	75	1818
Dublin	48.7	1750-60
Paris	50	1838
Mean	63.4	

A more recent and succinct account by M. De Watteville, who has very ably treated the whole subject, includes all France, and gives the following results.

Mortality of Foundlings in the Departments of France.

(*a*) Departments shewing the highest rate of mortality.	Per cent.	(*b*) Departments shewing the lowest rate of mortality.	Per cent.
East-Pyrénées	33.3 to 50	Haute-Sâone	0
Seine-Inférieure		Haute-Garonne	2.2 to 2.5
Gironde	25 to 33.3	Haut-Rhin	
Loiret		Jura	2.5 to 3.3
Seine-et-Marne		Hautes-Pyrénées	
Aube	20 to 25	Ardèche	3.3 to 4
Cantal		Finisterre	
Cher		Moselle	
Côte-d'Or		Vosges	
Ile-et-Vilaine		Gers	3.3 to 5
Loire-Inférieure		Lot-et-Garonne	
Seine		Nièvre	
		Basses-Pyrénées	
		Bas-Rhin	
Mean	26.5	Mean	3.6

Mortality of Foundlings in France in regard to the number of Expositions.

Highest.	Per cent.	Lowest.	Per cent.
Basses-Alpes .	83.3	Haute-Saône . .	0
Loire-Inférieure	76.9	Haut-Rhin . . .	5.6
Loiret		Vosges . . .	6.3
Seine-Inférieure		Moselle . . .	11.3
Vaucluse		Ponts	13.
Ardèche	71.4	Finisterre . . .	15.8
Aude		Ariège . . .	15.9
Aveyron		Hautes-Pyrénées .	16.3
Cher		Jura	17.4
Gers		Nièvre . . .	17.5
Gironde		Bas-Rhin . . ,	17.8
Ile-et-Vilaine		Haute-Garonne . .	18.4
Manche	60	Lot-et-Garonne . .	19.2
Seine			
Mean . . .	72.4	Mean	13.4

In comparing the deaths of *enfants trouvés*, whether with the total number or that of the *expositions*, this is the result obtained. One dies out of seven, from 1 to 12 years, or about 78 per cent.; and the mortality of such children in the first year of their existence is 50 per cent.

There is but one foundling exposed in every 39 births in France, while the number of foundlings in institutions is one to every 353 inhabitants. Again, the number of foundlings *exposed* is one-fourth the entire number of foundlings actually existing in institutions, whence it would follow that the mean

duration of life of foundlings is four years. Fortunately, of late years this mortality has been diminishing. Thus, for all France, it was for children from 1 to 12,

Year.	Per cent.	Year.	Per cent.	Year.	Per cent.
1838 ..	14.02	1841 ..	13.30	1844 ..	11.33
1839 ..	13.37	1842 ..	12.60	1845 ..	11.30
1840 ..	13.25	1843 ..	11.35		

These results, albeit the mortality is lessening, are nevertheless bad enough. It is manifest, however, on closer examination, that, although these figures may represent the mortality of foundlings, their difference is too great to be referrible to one cause only, and that cause want of breast-milk; for, however fatal and injurious this want may be, it will appear in the sequel that there are many others, far more fatal and injurious, also co-operating.

But I proceed to speak more particularly of the three hospitals before alluded to; and, in the hope of tracing therefrom that there are several causes in operation, I shall quote at length from M. Villermé's work *On the Mortality of Foundlings* (*Annales d'Hygiène*, vol. xix, p. 47), the same as given in abstract by Dr. West, in his *Diseases of Children*:—

"Lyons is apparently, of the great cities of France, that in which most care is paid to foundlings. I have been witness of this in 1825; and I can certify that nowhere have I seen so much attention, and so wise a care exercised, as in this hospital. So soon as the infant is deposited in the tower, it is taken out, warmed, cleaned, its linen changed; and it is given to a nurse, who always *suckles* the child; or it is sent to a wet nurse by a messenger. By whomsoever, however, the child is taken from the institution (and it is generally by the hospital nurse herself), it never is allowed to pass more than two or three days without suckling at the breast. It is necessary that this hospital nurse herself should see the child put into its basinette at the moment of departure, all precautions being taken to avoid its being chilled in any way. The child's body is almost entirely surrounded by cotton, and hot clothes, always adapted to the season. Finally, the bassinette itself, in which the child is taken away, is surrounded by coverings; and at certain distances, whether the nurse or a messenger carries it, she must stop at some house which has been selected beforehand to accommodate and change the infant. It was not, however, before 1824, or more particularly 1831, that the hospital administration had so far perfected this department.

"The foundlings of Rheims are fed by the bottle and *petit pot* (and never at the breast) by women from the country, who take them away at the end of twenty-four hours or seven days after their deposition in the hospital. Up to the hour of their departure they are very well taken care of, under the direction of the head midwife.

"The children of the Paris Foundling Hospital are kept longer than those of Lyons and Rheims in the house where they are received, and their nurses (a large number of whom live at great distances) bring them up generally at the breast."

Mortality in Foundling Hospitals from 1 *to* 10 *years, to* 1000 *Admissions.*

Place.	Year.	Cases admitted.	1	2	3	4	5	6	7	8	9	10
Rheims	1826	52	596	115			19					
,,	1827	70	585	85	14	28						
,,	1828	90	633	77	11	11	11					
,,	1829	83	747	72	24							
,,	1830	103	640	116	19							
,,	1831	102	607	98	9							
,,	1832	108	676	64	45							
,,	1833	89	663	67		11						
,,	1834	122	662	41								
,,	1835	97	567	31								
,,	1 Total	916	639	714	727	731	733	735				736
,,	2 Total	916		73	13	4	2	1				
Paris ..	1820	5101	515	144	58	20	8	7	4	2	2	0
,,	1821	4963	492	165	4	16	10	6	4	4	1	1
,,	1822	5040	401	128	58	24	8	6	3	2	1	2
,,	1 Total	15104	503	140	54	20	9	6	4	3	1	1
,,	2 Total	15104	503	650	705	725	735	741	745	749	750	751
Lyons..	1820	1580	511	101	45	16	8	3	1	3	2	2
,,	1821	1626	464	157	29	11	5	3	4	2	2	3
,,	1822	1643	373	125	52	17	7	11	4	5	2	0
,,	1823	1669	357	133	50	22	15	7		4	1	6
,,	1 Total	6526	425	129	22	17	9	6	3	4	2	2
,,	2 Total	6526	425	555	599	615	626	632	636	640	642	645
,,	1824	1690	288	157	54	27	13	8	8	3	3	5
,,	1825	1646	288	151	60	26	16	9	7	9	6	
,,	1826	1823	307	144	90	19	17	4	8	4		
,,	1827	1809	366	157	58	17	7	7	7			
,,	1828	1896	394	98	57	19	8	8				
,,	1829	1886	409	154	44	26	8					
,,	1830	1743	358	86	48	22						
,,	1831	1881	303	133	52							
,,	1832	1831	309	151								
,,	1 Total	16205	337	136	49	18	8	41	27	17	0	0
,,	2 Total	16205	337	473	523	542	551	555	557	558	559	560

The arrangements, both in Paris and Rheims, appear, from the above account, to be very defective. To keep children, as

in Paris, a long time in hospitals, is to expose them to much contagion. It is a bad feature to have nurses living at a great distance; and in the difficulty of procuring wet nurses, it is to be feared *bad* selections are made, perhaps of diseased females, whose antecedents are not known. At Rheims the management is even worse. To keep many of these infants as long as seven days on unsuitable diet, and then to send them far up the country, where they may not be carefully looked after (since over these nurses there is no supervision exercised), must be very imprudent. In Lyons, however, the arrangements made appear to be praiseworthy; but even here exposure before reception in the hospital is not prevented.

The first question which presents itself here is the following:—Is there any common law observed in the mortality of these three institutions, and even in the same institutions in different years, which might lead us to determine a common *cause* in operation? Can this cause, by which the march of mortality, its extent, the influence of age in these three hospitals are regulated, be detected. It was in the hope of deducing this that I reduced the mortality of these three institutions to a scale of 1000 for the purpose of *comparison.* (See Table in opposite column.) But, although I annex the table for reference, my expectation in this respect has been belied; whence I conclude that the causes of this mortality are numerous, and vary so much in different institutions, and even in the same institutions at different times, that they require separate consideration. Some of these are doubtless *endemic* to particular institutions; others are often so peculiar and generally misapprehended, as to necessitate separate study. Writers have already specified many of these causes. A few of them have, however, been overlooked; and thus, although I may be guilty of compilation in some respects, I hope also to bring out some original points, the whole to be useful in a practical point of view.

1. *Usual Mortality of Children of Tender Age, distinguishing whether in Town or Country.* First, I think most writers have forgotten in the outset to state what is the actual mortality of infants under ordinary circumstances. As this is essential for comparison, I shall begin by determining this mortality, especially for early ages.

Percentage of Mortality of Children from 0 *to* 1 *year, and from* 0 *to* 10 *years, after Benoiston de Châteauneuf and Quetelet, for all Europe.*

	0 to 1 year.		0 to 10 years.
Switzerland . . .	19.109	..	34.871
Holland . . .	19.642	..	36.214
Geneva . . .	19.507	..	39.329
Paris	21.287	..	52.511
Brussels . . .	21.30	..	42.97
Southern Netherlands .	22.49	..	43.44

France . . .	23.248 ..	44.452
Provence . . .	24.211 ..	47.024
Petersburg . . .	27.897 ..	41.974
Sweden . . .	28.393 ..	50.044
London . . .	36.371 ..	48.453
Berlin	39.538 ..	54.108
Vienna . . .	45.594 ..	55.578

If we take England and Ireland, selecting indifferently different years, the returns obtained betray some most extraordinary results, which will tend to explain, in some measure, the excessive mortality of children in foundlings. The returns, obtained for *all* England and *all* Ireland, are first given; then for some districts of England abounding in manufacturing population, as in towns; others containing an excess of persons occupied in agricultural pursuits, as in known agricultural counties. The same has been done for Ireland; but, as for that country the census returns invariably distinguish between rural and civic districts, advantage has been taken of this distinction to deduce the relative mortality in both districts. Some of the returns here given for Ireland are calculated on the deaths of 1850 with the population of 1851. This introduces a slight error, still one scarcely of much importance for practical deductions; because such returns will be found, as a rule, only to diminish slightly the cypher of mortality; for, from emigration and physical deterioration, the population in the sister island has been steadily on the decrease.

I may be allowed to examine a few of these results *seriatim*.

First, in England and in Ireland, taking districts as well as towns, it may be said that the mortality is greatest in *towns* for all children under one and under five years old. This result may be obtained both from the Irish and some English tables.

Percentage of Deaths to Population of each age in Ireland.

Date.				Under 1 year.		Under 5 years.
1850-1	..	All Ireland.	Civic Districts	15.4	....	8.4
„	..	„	Rural „	8.4	....	4.2
„	..	Ulster.	Civic „	12.3	....	6.9
„	..	„	Rural „	6.9	....	2.6
„	..	Connaught.	Civic „	15.4	....	7.7
„	..	„	Rural „	8.6	....	5.0
„	..	Leinster.	Civic „	15.6	....	9.3
„	..	„	Rural „	9.01	....	4.3
„	..	Munster.	Civic „	15.1	....	8.4
„	..	„	Rural „	11.0	....	5.6
1850	..	All Ireland.		6.0	....	
		Mean.	Civic „	14.7	....	8.1
		„	Rural „	8.8	....	4.3

The returns for England are to be taken in another way, no similar data to those of Ireland being given.

Percentage of Deaths of Infants to all Deaths in England, in 1838-9.

Towns.	Under 1 year.	Under 5 years.
Manchester and Salford	25.7	55.4
London	19.1	40.2
Liverpool	24.1	50.3
Leeds	23.9	52.9
Birmingham	25.6	50.1
Mean	23.7	49.8

Agricultural Counties.	Under 1 year.	Under 5 years.
Norfolk and Suffolk	21.2	34.5
Huntingdon and Cambridge	25.2	40.0
Essex	19.4	34.0
Wales, with Monmouth, etc.	18.6	31.7
Middlesex, exclusive of London, with Herts., Beds., etc.	22.1	34.7
Mean	21.0	34.9
All England and Wales	21.8	39.4

The difference between rural and civic districts is not so clear from the English returns as it is from the Irish. One reason, doubtless, is this: in the English returns, even when a town or civic district is spoken of, the population always includes a small number of families engaged in agricultural pursuits. Again, when rural districts are spoken of, as reference is made to an entire county, the returns necessarily include many engaged in manufacturing pursuits, and town residents. So far there is error, which should not be overlooked; and the conclusion should only be regarded as relatively true.

Hence it becomes very important to distinguish between foundlings living in the country and in towns. Unfortunately, however, after long inquiry, I do not find this distinction made in any work on foundlings I have seen: nevertheless, I have attempted to deduce it from some figures given in the general statistics of foundlings in France, published by authority of the government. But here, as in the former case, the data being insufficient, I am unable to obtain more than an approximative result. The relative mortality, however, between hospital foundlings and those placed in the country thus comes out more strikingly than we might have supposed. Thus, in five years,

Out of 52,883 town hospital foundlings, the mortality was 72.2 per cent.

Out of 122,110 country ditto, the mortality was 11.5 per cent.

Table shewing the Mortality in Ireland from One Month to Ten Years: distinguishing the Rural and the Civic Districts: 1850—51. (*See pp.* 47 *and* 48.)

	Month 1.	Month 2.	Month 3.	Month 4.	Month 5.	Month 6.	Month 7.	Month 8.	Month 9.	Month 10.	Month 11.	Total under 1 year.	Total 1 year and under.	1 year and under.	2 years.	3 years.	4 years.	5 to 10 years.
Ulster: Rural districts.																		
Population in 1851	5072	3331	3875	2494	2116	5571	1957	2431	4402	2436	2109	35874	31368	67242	40904	31927	41365	266480
Deaths in 1850	809	223	233	134	75	209	64	72	215	94	57	2185	1120	3305	710	497	429	1246
Per cent.	15.9	6.9	6.01	5.4	3.07	3.7	3.2	2.9	4.7	3.8	2.7	6.9	3.8	4.9	1.6	1.6	1.3	0.4
Ulster: Civic districts.																		
Population in 1851	1063	684	680	530	500	789	530	571	673	554	427	7001	5229	12230	6374	4915	5367	35306
Deaths in 1850	276	55	82	54	39	60	59	41	86	56	53	861	494	1355	283	180	161	441
Per cent.	24	8.03	12.06	11.3	7.8	7.4	11.1	7.2	12.7	10.1	12.4	12.3	9.4	11	4.4	3.9	3	1.2
Connaught: Rural districts.																		
Population in 1851	2542	1472	2441	1168	809	4610	721	708	3047	753	602	18883	14154	33037	10499	16296	21033	175540
Deaths in 1850	627	166	239	85	40	269	26	28	181	33	30	1624	957	2581	704	470	403	1260
Per cent.	24.9	11.2	9.7	7.2	4.9	5.8	2.1	3.9	5.7	4.3	4.2	8.6	6.7	7.8	6.7	2.8	1.9	0.8
Connaught: Civic districts.																		
Population in 1851	265	166	178	119	90	285	100	121	210	117	79	1730	1270	3000	1746	1320	1381	12212
Deaths in 1850	103	25	26	14	9	32	6	10	22	11	9	267	121	388	93	56	39	138
Per cent.	38.8	15.06	15.02	11.7	10	11.2	6	8.2	10.4	9.3	11.3	15.4	9.5	12.9	5.3	4.2	2.8	1.1
Leinster: Rural districts.																		
Population in 1851	3268	1953	2243	1689	1357	3214	1477	1644	2720	1794	1401	22860	18834	41694	25316	22731	27436	180765
Deaths in 1850	805	170	187	105	81	167	93	98	187	103	79	2075	1139	3214	801	553	573	1713
Per cent.	24.6	8.7	8.3	6.2	5.9	5.1	6.2	5.8	6.8	5.6	5.6	9.07	5.1	7.7	3.1	2.4	2.1	0.9
Leinster: Civic districts.																		
Population in 1851	1654	1074	1240	960	802	1321	914	997	1060	913	656	11591	8990	20581	10056	8560	9335	61419
Deaths in 1850	581	153	134	121	98	151	112	101	163	96	88	1798	966	2764	553	458	381	1119
Per cent.	35.7	14.2	10.8	12.7	12.2	11.4	12.2	10.1	15.9	10.5	13.4	15.6	10.7	13.4	5.5	5.3	4.08	1.8
Munster: Rural districts.																		
Population in 1851	3851	2221	2689	1624	1191	4538	1317	1502	4039	1603	1372	25952	19915	45867	29626	26089	33017	236028
Deaths in 1850	920	373	343	111	86	407	71	76	306	90	73	2856	1660	4516	1352	904	846	2797
Per cent.	24.4	16.8	12.7	6.8	7.2	8.9	5.3	5.06	7.5	5.6	5.3	11	8.3	9.8	4.5	3.5	2.5	1.1
Munster: Civic districts.																		
Population in 1851	1220	767	887	666	551	1112	625	721	952	658	532	8701	6430	15133	8017	6433	7024	53142
Deaths in 1850	435	103	132	78	50	139	63	63	135	72	45	1316	758	2074	504	310	299	880
Per cent.	35.6	13.4	14.8	11.7	9.07	12.5	10	8.7	14.1	10.9	8.4	15.1	11.7	13	6.2	4.8	4.2	1.6
All Ireland: Rural districts.																		
Population in 1851	14643	9082	11248	6975	5573	17933	5472	6386	14298	6476	5484	103569	84271	187840	115445	97043	122571	857304
Deaths in 1850	3167	832	1002	445	282	1052	253	274	889	390	259	8699	4876	13575	3797	2424	2251	7016
Per cent.	21.6	9.1	8.9	6.3	5.06	5.8	4.6	4.2	6.2	4.9	4.3	8.4	5.7	7.2	3.2	2.5	1.9	0.8
All Ireland: Civic districts.																		
Population in 1851	4212	2691	2985	2275	1943	3507	2169	2410	2895	2252	1694	29023	21925	50940	26193	21228	23107	162071
Deaths in 1850	1395	336	774	267	197	382	240	215	406	235	193	4640	2339	6979	1443	1004	880	2588
Per cent.	33.1	12.5	25.9	11.7	10.1	10.8	11.0	8.9	14.0	10.4	11.3	15.6	10.6	11.7	5.5	4.7	3.3	1.5

This conclusion proves that foundling hospitals, if established at all, should always be placed in the country.

II. *Mortality in the first Months.* It has been said that the mortality of foundlings is always greatest during the early periods. The data before given for Lyons, Rheims, and Paris, prove this. De Watteville states the mortality during the first year at 50 per cent. The same fact is set forth in the following from Bordeaux and Lyons:—

At Bordeaux, out of 928 foundlings of the same age, the deaths in twelve years, as given by M. De Watteville, were as follows:—

Year.	Deaths.	Per cent.	Remaining.
1	480	51	448
2	112	28	336
3	37	10	299
4	14	5	285
5	13	5	272
6	4	3	268
7	2	1	266
8	7	3	259
9	3	1½	256
10	4	2	252
11	3	1½	249
12	4	2	245
	683		

Thus the average annual percentage of mortality was 10; or 73 per cent. on twelve years.

At Lyons, out of 8053 children from birth to twelve years, the deaths were:—

Year.	Deaths.	Per cent.	Remaining.
1	3098	37.10	4955
2	1114	22.41	3841
3	383	9.47	3458
4	157	4.50	3301
5	84	2.54	3217
6	57	1.77	3160
7	39	1.20	3121
8	23	1.05	3033
9	20	.64	3068
10	26	.84	3042
11	15	.49	3127
12	8	.28	3019
	5031		

Thus the average annual percentage of mortality was 8; or 62 per cent. in twelve years.

This is true also for all children; but, of all the months of the first year, the first is also the most fatal. I do not find the monthly mortality for the first and following months, however, usually stated.

From Quetelet's researches, it appears that in the Southern Netherlands the rate of mortality of children from 0 to 5 years is as follows:—

Years.	Deaths.
0	100,000
1	77,507
2	69,470
3	64,799
4	61,899
5	59,864

Upon this table he remarks that rather less than a quarter of the children born die in the first year following their birth. In Brussels for the first year he found—

1st month	1034	7th month	162
2nd month	890	8th month	152
3rd month	231	9th month	140
4th month	185	10th month	150
5th month	156	11th month	142
6th month	156	12th month	140

So that more children die in the first three months than in all the remaining months of the first year. These numbers are in the proportion of 1665 to 1384. In Paris, and for the year 1823 (*Annuaire du Bureau de Longitudes pour* 1826), the corresponding numbers are in the proportion of 1764 to 693.

There is an excellent table for Ireland, setting forth the mortality in *public institutions* for all ages, and from one to twelve months in particular. From this the exact rate of mortality due to this confinement might be deduced. Unfortunately, however, an analogous table of population for the same years in public institutions is not given; so that the table is, after all, of little use. The only tables which bear at all upon this point apply only to the first month, and are those obtained from lying-in institutions, or from the statistics collected by accoucheurs of large hospitals, under whose care the infants, with their mothers, have remained for the month in hospital. These tables afford us the means of deducing the probable mortality in public institutions for one month. We have such a table given in the summary for all Ireland for ten years, from 1831 to 1841, for the Irish lying-in hospitals.

Total births	35,131
Total deaths	2,258
Mortality per cent.	6.1

Again, from the tables published by different accoucheurs, we may deduce almost the same per centage cypher of mortality.

	No. births.	No. deaths.	Per cent.
Madame Lachapelle . .	22,243 ..	837 ..	3.7
Dr. Ramsbotham . . .	49,528 ..	2723 ..	5.6
Drs. Hardy and McClintock .	6,702 ..	467 ..	6.9
Dr. Arneth (Vienna) . .	6,608 ..	244 ..	3.7
	85,091	5311	6.1

So far both modes of procedure give a similar result. But here a difficulty presents itself. When we come, in the case of Ireland, to measure the mortality in the first month, which the tables for that country enable us to do, we find the mortality is at least five times, sometimes six times, as great. Thus, in Ireland and its four divisions, we have—

Deaths per cent.

	Civic Districts.	Rural Districts.
All Ireland	33.1 ..	21.6
Ulster	24. ..	15.9
Connaught	38.8 ..	24.9
Leinster	35.7 ..	24.6
Munster	35.6 ..	23.9
Mean . . .	31.6 ..	22.2

I can find no tables for England illustrative of the same fact. We have indeed some excellent tables, set forth by the Registrar-General, giving us the deaths in the first, second, third, etc. months of life; but, as we have not corresponding tables of the living population at such periods, the per centage mortality cannot be set down. There is, however, reason, I fear, to believe it is also very high, if not higher, in many parts of England. We have, in these tables before alluded to, the totality of births in the year given. From the Irish tables, by including all one year old and under, we also obtain a number which may represent all the births in one year. Comparing these in both cases with the number of deaths in one month, we may get a number which may express at least the relative mortality in both countries.

Deaths to 100 *Births in First Month of Life.*

	Civic Districts.	Rural Districts.
All Ireland	2.7 ..	1.1
Ulster	3.0 ..	1.2
Connaught	3.4 ..	1.9
Leinster	2.3 ..	1.8
Munster	2.2 ..	2.0
Mean	2.7	1.6

If the number of deaths per cent., compared to the population living, of one month old, in Ireland, bears any relation to these returns, whether taken for Ireland or for England, it would appear that the per centage of mortality to the population of one year old is actually greater in England. But, with the difficulty of isolating rural and civic districts as before stated, and the small difference observed between the two districts here spoken of, it is evident this is not a fair inference. We may, however, conclude this mortality to be at least as high in England as in Ireland; and this result may be brought out another way. Considering all deaths at all ages as 100, the deaths will be, under one month—

	Towns.		Country Districts.
Metropolis	4.0	..	—
Manchester and Salford	5.0	..	—
Liverpool	5.3	..	—
Leeds	7.4	..	—
Birmingham	5.9	..	—
Norfolk and Suffolk	—	..	7.3
Huntingdon and Cambridge	—	..	8.6
Essex	—	..	5.4
England and Wales	—	..	6.4
Wales, with Monmouthshire	—	..	5.3
Middlesex (except Metropolis) Hertford and Bedford	—	..	7.5
Mean	5.5		6.7

The disparity between town and counties is actually in favour of towns, but no doubt referrible to the difficulty of distinguishing the two classes.

Comparing this result with that for Ireland for ten years, 1841-51, considering, as in the case of England, all deaths as 100, the deaths for one month and under will be as follows :—

	Civic Districts.		Rural Districts.
All Ireland	5.	..	3.7
Ulster	5.4	..	3.7
Leinster	5.3	..	3.4
Connaught	4.9	..	3.6
Munster	4.6	..	3.6

Whence I think we may conclude that the mortality of children under one month, great as it is in Ireland, is not much smaller in England, even in ordinary populations; and this out of foundling or other hospitals—a fact, I think, which has been generally overlooked, or, at least, not sufficiently insisted upon.

But this difference of mortality under one month may be set

forth in another way, and one by which we can speak more decidedly to the senses. Taking England and Wales on the same scale, all deaths at all ages been represented by 100, 6·4 deaths take place under one month, and 21·8 under one year; *i. e.*, out of 28·2 deaths, 6·4 die under one month, or 27 per cent. In all Ireland, reckoning all deaths as 100 at all ages, 4·3 die at one month, 13·6 die under one year; *i. e.*, out of 17·9 deaths, 4·3, or 24 per cent., die under one month. This is an appalling mortality. How does it not prove the extent of neglect, mismanagement, and crime, rampant even in a civilised country like this. Indeed, in regard to the latter, I am told by Mr. Wakley, the coroner for Middlesex, whose opportunities of knowing this are only equalled by his untiring zeal in the cause of humanity, that at least 300 children are known to be the victims of infanticide, albeit often returned as still born, or dying from other causes. If this be the case in London, where there is so large a detective police force kept up, and where the opportunities of disposing of a child are so small, what must it be in retired districts and towns, where police authorities are either few and far between, or absent altogether, and in which it is so easy to hide or bury a child out of the way!

Here the cypher of mortality is in favour of Ireland, yet in both it is very high. Can any reason be assigned for this? I think there may be one suggested. Infant foundlings are placed often in very impure air, which, I make no doubt, greatly interferes with nutrition and healthy development; and I believe it has a great deal to do with the great mortality among children. It will be at once and by all recognised that hospital aggregation must necessarily make the children more obnoxious to contagious diseases. Two of these, which produced the highest mortality in the Parisian hospitals, the *endurcissement cellulaire*, and the *muguet* or *diphtheritis*, were particularly contagious, and, as such, highly fatal. But this would apply equally to all diseases, such as scarlet fever, hooping-cough, etc., etc. Even in London alone, taking a year (1849) indiscriminately, from diseases peculiar to infants, including small-pox, measles, scarlatina, pertussis, croup, thrush, diarrhœa, remittent fever, tabes, hydrocephalus, convulsions, bronchitis, laryngitis, pneumonia, teething, inflammation of bowels, want of breast-milk, and premature birth and debility, the deaths were—

	Under 1 year.	Under 5 years.
From the above-named diseases	8,197	16,138
All diseases . .	12,122	24,814

The births amounted to 72,612; so that the gross mortality of children for that year, under one year old, amounted to 11·1 per cent.; for those under five, to 22·5 per cent.; and from all

diseases, in the first case, to 16·6 percent.; in the second, to 34·1 per cent.

Apart from this source of common mortality, which should apply equally in both cases, I think, with all those who have had much to do with infant children, it must be admitted that the hospital atmosphere engendered by children congregated together is peculiarly offensive and injurious. Even the cleanest children have a peculiar faint soapy odour: when this comes to be mixed with that arising from towels drying by the fire, and from foul motions, it is very abominable; while the delicacy of infants, and the easy way in which they catch cold, render a certain degree of closeness imperative; at least, it is always kept up. And herein, I think, lies a fertile source of fatality in bringing up infants in hospitals or foundlings, where, of necessity, they must be congregated together. And in it, too, we may find an explanation of the high mortality of infants in Ireland. The writer of the article in the *Quarterly Review*, on Ireland Past and Present, No. 203, p. 78, thus describes the homes of its inhabitants :—

"Any one who has travelled through Ireland, until within the last few years, must have been struck with the miserable condition of the dwellings of the poorer peasantry. They were built of mud; the roof was sunken, and seldom whole. The thatch was black and rotten; water had saturated it, and grass and weeds grew rank upon it. The window was generally a hole stuffed with hay and rags; and, where glass had been formerly put, there remained scarcely an unbroken pane. The chief access for light or air was the door, which was always open. Close to the door, and generally in front of it, was a fœtid pool, in which foul straw, potato-stalks, dung, and all kinds of abominations, were fermenting and macerating; while half-naked and squalid children enjoyed themselves around it. Inside there was as much dirt and discomfort as without; the floor was broken and uneven; the walls were dark from smoke; there was but one room common to the family, their poultry, and their pig. Something like a bed, in which all sexes and ages slept, an iron pot, an old tub, a stool or two, a rude table, and a dresser, with some broken plates, constituted the furniture and all the family possessions."

No wonder, then, if, under such circumstances, an atmosphere was generated, even in rural districts, peculiarly fatal to the children, and not better than hospital air.

A strange nurse's milk, not the child's mother, is of itself a source of mortality. M. Benoiston de Chateauneuf has shown that the mere substitution of a hired wet nurse's for a mother's milk increases the mortality 10·64 per cent. per annum. *i. e.*, from 18·36 to 29 per cent. I know of no facts on any large scale to verify this statement, although, from the high character of the observer, I cannot doubt it. One fact has

been communicated to me, however, by my friend Dr. Wright, who had it from a lady correspondent. It is so far confirmatory. It applies to six twins, *i. e.*, twelve children. Six were fed by their mothers, and all did well. Six were entrusted to hired wet nurses ; three died ; and of the remaining three, two at twelve months were looking puny and delicate, as if they could not long live ; the sixth was quite healthy. No doubt can be entertained that even hired wet nurses, although well paid, and with all their preference for their sucklings, if not well looked to, will often, when failing in their milk, or from other causes, sacrifice their sucklings to their interest. I have seen this, and know it to be the case. It may be perhaps in measure due to ignorance, but in other cases it is wilful injury—in my mind, as much wilful murder as a more glaring attack, albeit the law does not acknowledge it. Hence another influence at work to increase the mortality of foundlings, and children generally. I shall, however, again recur to this subject.

So far, then, we have certain causes in operation which are not exclusively confined to foundling institutions, which may explain some of the mortality, viz.—

Residence in town will account for from 5·07 to 6·1 per cent. for children under one year old. During the first month, if the number of inmates die only in proportion to the number which die out of hospital in civic districts, the mortality may be as high as 33 per cent. Of this amount, under the most favourable circumstances, 6·1 per cent. must take place in the first month. At least, from 16·6 to 34·1 per cent., or the mean of 25·3 per cent., should be put down for the effect of contagious diseases. To absence of the *mother's* breast-milk, 10 per cent. per annum may at least be referred : in all, 47 per cent., at least, for children under five, from causes not peculiar to foundlings—a large per centage to be deducted from the usual mortality of foundlings. It should also not be lost sight of that, as the mortality of children is generally greatest in the earlier years, and as, in a given population of foundlings, there is a higher per centage of children of early than of later years, so necessarily the whole per centage mortality must be greater.

Passing on from these general causes of mortality, but which affect more severely foundlings, I proceed to speak of some of those to which children of this class are particularly exposed : and here, in the first place, I should premise that such children are by their very constitution particularly obnoxious to disease. Thus remarks M. De Watteville : " These unfortunate children in general have already been injured while yet in their mothers' wombs ; a very large proportion suffering, from their birth, from defects of body which, later in life, quite unfit them for labour. And then, it should be added, want of

care in infancy, whether in a hospital or when put out at nurse, contributes a great deal to make them weakly and obnoxious to disease."

1. *Effect of Removal.* Under this head we have conflicting opinions. From Mr. Wakefield's tables, it appears that 57 per cent. of all infants who had been brought from a distance of more than fifty miles died in the hospital, whereas the mortality among other children did not exceed 48 per cent.—a difference of 11 per cent. from this cause alone. M. Gaillard brings out the same point by comparing the mortality of foundlings deposited in the town and hospice of Poitiers, as compared with that of infants who were merely removed there from the Maternité. During six warm months, seven of the former died to six of the latter; during six winter months, nineteen of the former died to ten of the latter. At Poitiers most came from a distance, whereas at Lyons they were mostly supplied by the city itself. This appears natural. A child brought a long way very soon after its birth, the mother probably too ill to accompany it, fed in the interim in a very improper manner, weakened by hunger and fatigue, is placed, no doubt, under very unnatural and unfavourable circumstances; yet it is a question how far, in practice, this rule applies. We learn from M. De Watteville's book (*Statistique des Etablissemens et Services de Bienfaisance*, p. 23), that this mortality cannot be due to the transport, since in other cases, where the children are not very ill, and not exposed, the mortality is actually decreased. Thus—

Out of	8879	children, aged from	1 day	to	2 years.	
„	12110	„	2 years	to	6	„
„	7661	„	6	„	9	„
„	3958	„	9	„	12	„
	32608					

Exclusive of 8,000 who were taken out of these institutions by their parents, only 13 died during the journey, and 209 only in the month following their removal—a cypher of mortality positively below that which obtains in such institutions. No doubt, want of care, and neglect of infants in removal, will increase the mortality; and in this way we may perhaps explain the differences of opinion. This is best considered, however, under the next head.

2. *Effect of Exposure.* This is a great cause of mortality in foundling institutions. On comparing the French returns before given, the percentage mortality of exposed children, as compared to that of the ordinary foundlings, was as follows :—

Exposed Children.

In the Departments.	Highest.		Lowest.
Where it was highest . . .	83.3	to	60.
Where it was lowest . . .	19.2	to	0
Mean	72.4	to	13.4

Foundlings.

Where it was highest . . .	50.	to	20.
Where it was lowest . . .	5.	to	0
Mean	26.5	to	3.6

(See this table in full, at page 46.

Upon this point Mr. Brownlow speaks admirably in his very interesting work (*Memoranda of the Foundling Hospital*) of the great mortality in the building. He says: "This practice of transporting children from remote towns was condemned by a distinct resolution of the House of Commons, and a Bill was ordered to be brought in to prevent it; but this Bill was never presented; so that parish officers and others still continued to carry on their illicit trade, by delivering children to vagrants, who, for a small sum of money, undertook the task of conveying them to the hospital, although they were in no condition to take care of them, whereby numbers perished for want, or were otherwise destroyed; and, even in cases where children were left at the hospital, the barbarous wretches who had the conveyance of them, not content with the gratuity they received, stripped the poor infants of their clothing into the bargain, leaving them naked in the basket at the hospital." (p. 173.) Indeed, Mr. Wrottesley, in his report to the House of Commons, states what is almost too horrible to believe—"that parents brought their children in a dying state, for the purpose of having them buried at the expense of the hospital." (*Report* of 1836.)

Mr. Brownlow makes, a little further on, the following very pertinent remarks: "It has been truly said, that the frail tenure by which an infant holds its life will not allow of a remitted attention even for a few hours. Who, therefore, will be surprised, after hearing under what circumstances most of these poor children were left at the hospital gates, that, instead of being a protection to the living, the institution became as it were a charnel-house for the dead? It is a notorious fact, that many of the infants received at the gate did not live to be carried into the wards of the building; and, from the impossibility of procuring a sufficient number of proper nurses, the emaciated and diseased state in which many of these children were brought to the hospital, and the cruel conduct of some of

those to whom they were committed (notwithstanding these nurses were under the superintendence of certain ladies, sisters of charity), the deaths amongst them were so frequent that out of the 14,934 received, only 4,400 lived to be apprenticed out, being a mortality of more than 70 per cent." (p. 175.) These children were doubtless deprived of breast milk. To attribute their death, however, to this cause, would be manifestly unjust.

3. *Influence of Season.* The mortality of children is usually believed to be greater in winter than at other seasons, because the weather is so much colder. .The Abbé Gaillard pointed out this contingency in the case of the Foundling Institution at X. Thus, in November and December 1829, out of 29 children, 19 died in the first month after admission; whereas, in July and August of the same year, there died only 11 out of 25 admitted. We all know, also, from the Registrar-General's return, how the mortality is increased by a cold week, the very young and old suffering under its baneful influence. The conclusion, however, which I am bound to come to is, that, in *public institutions*, the greater number of deaths take place in *spring*, the least in autumn. It appears that, the deaths being 100 in all seasons, 30·8 will take place in spring; in summer and winter, it will be about the same—27·1; while in autumn it will be least, only 14·3. The effect may be somewhat varied out of public institutions; but in these, extending over a period of ten years, the results must be admitted as true. (See Table on next page.)

4. *Influence of the Recumbent Position and Want of Exercise.* In the *Union Médicale*, November 2nd and 23rd, 1852, are two very able papers by M. Hervieux, on the abuse of the horizontal position at the Hospice des Enfans Trouvés, and its influence on the mortality of the newly born infants. The following is an abstract.

The *nursery* of this hospital is sixty feet long by twenty wide, and from twenty to twenty-five feet high. Light is introduced by eight windows, besides a painted one. The temperature is kept up by a large fireplace in the centre, around which persons can sit at ease, besides two large stoves at each extremity; so that the heat is equally diffused. Dry oak boards, covered by carpets, constitute the flooring; and the walls always appear most dry.

The *linen* is very clean and white; altogether, everything that could be desired, in the way of neatness and cleanliness, is carried into effect.

In this room are eighty-four cots to receive infants. Nine women are engaged in feeding and cleaning these little creatures, which is done four times a day, 6 A.M., 9 A.M., 12, and 4 P.M. The food is given in the *spoon*. Besides these nine day nurses, there are two night nurses employed in the same

Mortality in Ireland from June 6th, 1841, to March 30th, 1851, in Public Institutions.

Age.	Spring.	Summer.	Winter.	Autumn.	All Seasons.	Per Cent.			
						Spring.	Summer.	Winter.	Autumn.
One month and under . . .	15,106	13,128	13,506	7009	48,569	31.	27.2	27.7	14.4
Two months	3694	3443	3409	1806	12,452	29.5	27.5	27.2	15.8
Three months	4619	4810	4607	2636	16,672	27.6	28.2	27.5	16.7
Four months	2163	2187	2199	1032	7781	27.	27.1	27.1	18.8
Five months	1300	1174	1349	738	4561	28.4	25.4	29.1	17.1
Six months	5684	4895	4514	2692	18,785	30.2	26.	24.	10.2
Seven months	1428	1252	1428	796	4804	29.7	26.	29.7	14.6
Eight months	1388	1235	1352	1078	4653	29.5	26.2	28.7	15.6
Nine months	4815	4088	4219	2067	15,189	31.6	26.8	27.7	13.9
Ten months	1654	1342	1426	677	5099	32.4	26.3	27.9	13.3
Eleven months	1346	1103	1075	614	4238	32.	26.2	25.6	16.2
One year	25,716	22,484	21,841	10,886	80,926	31.9	27.8	26.9	13.4
Two years	22,759	18,639	18,113	8748	67,259	33.7	27.6	26.9	11.8
Three years	15,837	13,500	12,558	6074	47,969	32.9	28.1	26.1	12.9
Four years	13,381	11,327	10,140	5048	39,926	33.5	28.1	27.9	10.5
Five to ten years	44,161	36,954	29,667	15,823	126,605	34.7	29.	23.4	13.9
Mean						30.8	27.1	27.	14.3

way all night. Thus, including the most restless and the quietest children together, it may be assumed, on an average, that each child is taken up six times a day. To clean and feed a child would occupy about twenty-five minutes in the hands of inexperienced nurses, ten or fifteen in the hands of those more experienced. Thus, the children, on an average, are held twenty minutes—6 × 20 = 120; so that each child has only two out of twenty-four hours exercise or movement. Now, what is the effect of this? A child, under natural circumstances, even if fed, generally lies upon the bosom of its mother or nurse; here he obtains artificial heat; and, in the hands of others, through the shaking, petting, etc., he obtains ample exercise. Thus his heat is maintained. But, short of this exercise, the temperature of the child's body will fall, the extremities will cool; the circulation become slower; the respiration will be embarrassed; all the major functions will fail; the cellular tissue will harden; the visceral organs will become congested; some will die by "sclerema", others by passive pneumonia (which is, after all, only proof of congestion of the lungs), some of serous effusion or hæmorrhage in head or spinal cord. These are simply the results of cold superadded to those of starvation.

Now, in order to prove that these children are starved, M. Hervieux proceeds to speak against the system of feeding infants only at regular hours. Looking at the case of many infants who keep sucking thirty to forty times a day, very often kept constantly to the breast, MM. Natalis Guilliot and Lamperière, of Versailles, have shown that infants absorb in the twenty-four hours from 48·1 to 60·4 oz. Such children thrive wonderfully; and hence to stint and feed a child so precisely by rule—a child who, in the earlier two or three years of life, gains half the height and weight he will acquire in all his life, is little less than absurd.

This large amount of food has been objected to, as giving rise to gastritic derangement; but if no such diseases are be found in towns, among the rich and those poor who, when they can do so, almost always overfeed their children, this objection cannot be correct. It is true, part of the mortality of such infants may be attributed to the hereditary taint from diseased parents, to the close aggregation of the infants in the hospital, and often to the injurious artificial food which has been supplied. But there must be something more than this; many poor diseased parents inhabiting filthy localities, and even often in want (although, to their credit be it said, the milk will often be provided for the child, though the parents want the common necessaries), have children who thrive. A child wants good food and air; but this will not suffice; he requires to be moved about; should go out in the open air and sun; and should be properly attended, in a hygienic as well as a dietetic manner. M. Hervieux therefore recommends that,

instead of nine, there should be at least thirty-six nurses to tend the children.

5. *Want of Breast-Milk.* It is to the deprivation of this kind of food that the mortality is usually assigned. Now, I believe this is only one of several causes—a powerful one, no doubt, but still, I believe, in its effects much exaggerated. This becomes manifest if we look to the actual number of deaths attributable to want of breast-milk, as occurring in a general population, and irrespective of foundling institutions altogether. I have selected the Registrar-General's tables for London. In the quarterly returns, however, under this head, we are referred to cold, atrophy, and privation, as, no doubt, under these heads many cases are included which, properly speaking, should be returned under the head of death from want of breast-milk. Perhaps we should include some others, as, for instance, diarrhœa; albeit I make no doubt, though diarrhœa may have been present in most of these cases, as a symptom, death has been referred to the cause want of breast-milk. This is, however, only a supposition; and hence, in the impossibility to measure the amount due to diarrhœa, I am obliged to neglect it. I have, however, to make amends, included all cases of *premature death and debility* under one year old, which is a large number, and which must needs include many who are not thriving under the poor breast-milk given, or the food substituted. Taking the six years, 1849 to 1854 inclusive, I have the following table:—

Mortality of Infants from various causes.

	1849.	1850.	1851.	1852.	1853.	1854.	Total.
From all causes under one year old.....	12208	10349	11631	12272	12981	13896	73227
Privation.....	5	2	—	2	1	1	11
Cold.....	3	1	3	3	4	2	16
Want of breast-milk.....	174	178	229	240	255	337	1413
Neglect	8	4	—	—	9	3	24
Premature birth and debility under one year old	1232	1241	1470	1537	1475	1518	8473
Atrophy, ditto ..	874	757	784	827	971	1091	5304
Total	2296	2183	2481	2609	2715	2952	15241
All births	72612	74564	78300	81250	82254	84885	473865

Therefore, out of 473,865 births in six years, 15,241, or 3·2 per cent., died from want of breast-milk in its widest sense; or, out of 73,227 deaths from all causes, occurring to children under one year old, 20·8 per cent. might be referred to deprivation of this kind of diet.

My own experience completely bears out these conclusions. I am connected with two institutions which, each in their way, have satisfied me that the congregation of foundlings or children whom we sought to bring up by hand in this town was almost invariably fatal; so that their distribution, even in circumstances of poverty, was almost always less injurious, often their salvation.

An attempt was made in connexion with one of these—an infant nursery, where children are received during the day, in the absence of their working parents, cared for, and fed—to take in boarders, that is to say, the infants of mothers who were engaged as wet nurses. A large nursery, well aired, scrupulously clean, temperature uniform, 70° usually, in which an experienced nurse, directing four or five young women in the arrangement of the children, was placed,—was selected. The most approved system of diet was enforced; and yet none of these children throve. The mortality was certainly 4 out of 5, if not more. The diseases that prevailed were—diarrhœa, which resisted all treatment, the *post mortem* appearances in such cases being usually null, or consisting of a simple thickening of Peyer's glands, similar to what we see among some cases of Asiatic cholera; aphthæ or diphtherite, with or without diarrhœa. In these cases, solution of nitrate of silver, in minute doses, or as a lotion to the mouth, was the only remedy which seemed ever to do good. This disease was fearfully contagious, and no measures of precaution could prevent its extension: indeed, to such a degree was it so, that, on one occasion, two of the big girls in attendance were seized with a kind of ulceration in the conjunctiva, having much the appearance of scrofulous ophthalmia, only the ulcers were more lengthened, and there was no photophobia. These cases did not recover till after the application of nitrate of silver in substance. Chloride of lime was largely used in the rooms; the whole walls were washed with a solution of it. The same spoon was never used to another child, and always washed after use in a solution of chloride of lime. A separate nipple was kept for each child. Still the disease often recurred, and proved equally contagious. Lastly, atrophy prevailed largely; it often succeeded the cases of diphtheritis which recovered. Sometimes, however, it was the only symptom present. These children ate enormously, but got thinner and thinner, till at last they died, with all the symptoms of inanition. Usually, a removal from the institution led to a recovery; except, however, in those cases of atrophy. This disease, once induced, generally persisted, and proved fatal.

The other institution was a penitentiary for females of a better class, but who, having fallen *once*, were taken in to be confined and reclaimed. Many of these went out as wet nurses. Some of the infants came to the nursery before spoken of; others were brought up by the hand, by *friends* of the patients. Among the latter I did not trace one case of death. Although this statement should be taken with reservation, as, after some months, the children were lost sight of, still there is no doubt that, although these infants were brought up in circumstances of poverty, and that those who cared for them were often in penury and want, yet they throve better and proved longer lived than our nursery infants. I have no doubt that the causes enumerated by M. Hervieux, the hospital atmosphere, the insufficiency of external exercise, contributed greatly to these results. I might perhaps add another—the inaptitude of the assistants to the head nurse, and their inexperience of children. I am sure I have seen this in private practice. I have seen a child under the care of a nurse, and that nurse exact, too, in her duties, but not a mother, or having had much experience in the handling of children; that child has pined away, and become weak and thin. An experienced mother has now taken the child in hand; and, albeit the same food has been given, and apparently, in as far as regarded external circumstances, the child has been placed exactly as before, it has now thriven well, and recovered health and strength speedily. I cannot measure the extent of this influence by figures, but of its existence and powerful operation I have no doubt.

These are a few of the reflections which I have ventured to commit to paper, which, I hope, may prove of interest to the Society, and calculated to elicit discussion. I had hoped to have entered upon the subject of the effect of diet on the mortality of children, and foundlings in particular. The length, however, to which this paper has already extended, precludes this. On a future occasion, if the Society will allow me, I shall return to the subject. I think, however, enough has been said to show that, however injurious the want of breast-milk may be, it is somewhat exaggerated, more especially taking in connexion the fact observed by M. Benoiston de Chateauneuf, that the mere substitution of a hired wet nurse for a mother increases, as before seen, the mortality 10·64 per cent.

To recapitulate, therefore, I have shown—

1. That, for the ages one year and under five, the mortality, even under ordinary circumstances, is in towns nearly double what it is in country; but this difference in the mortality according to residence is nearly seven times as great for foundlings: therefore, foundlings should never be maintained in towns.

2. That in Ireland, while it is doubtless very high in the first month, for those under one year it is only 30 per cent. in towns, to 22 per cent. in country; the worst mortality with foundlings being 50 per cent.

3. That travelling in fair seasons is not dangerous to foundlings.

4. That the mortality is greatest in spring, and least in autumn, with children in public institutions.

5. That a chief cause in the mortality of foundlings is want of exercise, and the abuse of the recumbent position.

6. That want of breast-milk will only account for a mortality of 3.4 per cent. additional.

7. That a depraved hospital atmosphere and certain endemic contagious disorders are the chief cause of the mortality in foundling hospitals.

From which results we are justified in concluding—(*a*) That if foundling hospitals are to be maintained at all, they should be always built in the country. (*b*) That large open single wards should be converted into small well ventilated rooms, capable of containing from three to four cots, with one nurse at least to each small ward so constructed. (*c*) That, where it can be done, and wet nurses can be supplied, preference, if possible, should be given to the children's mothers. (*d*) That means should be taken to ensure the proper exercise of the infants.

52, Montagu Square, London, November 1857.

PART II.

ON THE ADVANTAGES AND DANGERS OF WET-NURSING.

In a former paper which I had the honour of reading before the Medical Society, I spoke of the causes of mortality in foundling hospitals, as opposed to those which obtain in a general population, and dwelt in particular on one—want of breast-milk. My remarks tended to show that the evil influence of this cause had been greatly exaggerated; the mortality being, in fact, rather due to other contingencies which I then enumerated. I purpose now to consider the mortality of children as influenced by the diet selected, and to treat it especially under three heads.

I. As influenced by the kind of breast-milk supplied.
II. As influenced by the quality of any other animal's milk or compound given as a substitute.
III. As influenced by the vegetable food which is usually employed.

On the last occasion I had to allude to the little advantage usually derived from hospital experience to the profession. I have now to allude to one of the honourable exceptions, viz., the first and second Reports of the Clinical Hospital for the Diseases of Children, in Stevenson Square, Manchester, prepared by Drs. Merei and Whitehead, and kindly sent to me by the former gentleman. These are most able and philosophical documents, not a fact being asserted which is not substantiated by accurate statistical researches—documents like those which might be yearly produced by every hospital, and confer endless good to thousands. I shall first, in a short summary, quote a few of those results which bear upon this portion of my subject.

1. In regard to age, seizures, and deaths, taking the two years together.

Children.	Seized.	Died.	Per cent.
Under 6 months . .	256 ..	42 ..	16.1
6 months and under 12	271 ..	25 ..	9.2
1 to 2 years . .	450 ..	57 ..	12.6
2 to 3 years . .	285 ..	13 ..	4.5
3 to 4 years . .	655 ..	14 ..	2.1
Total . .	1917	151	7.8

From this it will be seen that mortality is greatest under six months, and that under two years the preponderance of deaths is very great.

2. From the first report there were treated—

	Cases.
Developmental disorders, viz.:—	
Feeble and retarded development, including complication, with anæmia and slight degrees of rickets	59
Rachitis of decided forms	28
Constitutional debility, including slight complications, with anæmia, but no disorders of development	27
Diseases of the abdominal organs:—	
Disordered digestion (loss of appetite, sickness, costiveness, diarrhœa)	76
Diarrhœa (mucous, serous, bilious)	85
Dysentery	18
Sporadic cholera	2
Enteritis	2
Rheumatism of stomach	1
Habitual constipation (severe)	3
Mesenteric disease	4
Chronic enlargement of liver	4
Hepatitis	1
Making a total of cases of disease of development and of abdominal organs in 530 patients	310
Or per cent.	58.4
Deaths from all causes	34

Taking, however, the 34 deaths from various causes, 10 happened to children with bad development; diarrhœa was present, either as principal ailment or as a complication, in 20, *i. e.*, 60 per cent. In 24 of the 34 fatal cases, *i. e.*, 70 per cent., there was morbid localisation in the abdominal cavity.

From the second year's report, of 1548 patients, there were affected with—

Digestive disorders	249
Atrophy	116
Developmental debility	256
Rickets	74
Total	695
Or per cent.	44.9

The greater number were dismissed cured; 93, however, died.

Of 117 deaths from all causes, 93 deaths, or 79 per cent., were from diseases arising from defective or faulty nutrition, which was partly the direct and partly the co-operative cause of the fatal issue.

Of these 93, 11 had a full supply of breast-milk up to nine months; but seven of the respective mothers had been delicate or sick, and only four healthy: 19 children had had a more or less sufficient supply of breast-milk, and bread food along with it, and from earliest infancy; 59 were brought up from birth or earliest infancy on bread food, in addition to scanty breast-milk; and 4 had no breast at all. Consequently, only a very small proportion of those who died (a little above 4 per cent.) had enjoyed a fully favourable alimentation.

The breast-milk of feeble or sickly women, and scantily secreted, judged according to its effects upon the respective nurselings and its chemical examination, is, in the great majority of cases, decidedly of unwholesome quality.

Altogether, about 60 per cent. of the children treated in this institution were brought up in an unfavourable manner.

From these statements will at once be perceived the extensive operation of two noxious agents—insufficient and unwholesome breast-milk, and early bread-feeding.

The direct and baneful agency of want of good breast-milk may be inferred from the next table.

Results observed in 1041 *Children.*

			Per cent.
1. Children having had breast-milk alone to ninth month or longer. Some to fifteenth, eighteenth, or twenty-fourth months.	Well developed	94	62.6
	Medium „	35	23.3
	Badly „	21	14
	Total	150	
2. Those who had breast-milk up to sixth, eighth, and ninth months; after which they were partially weaned; about 20 per cent. of them partially receiving for some months longer other food beside the breast.	Well developed	65	57.4
	Medium „	29	25.6
	Badly „	18	15.9
	Total	113	
3. Those having breast-milk moderately abundant and bread-food along with it from birth or early ages.	Well developed	110	51
	Medium „	54	25
	Badly „	52	24
	Total	216	
4. Children who from birth or the age of two or three months, besides an abundance of breast-milk (as stated by mothers), had received additional food, generally boiled bread and milk, or merely with water, sugar, and arrowroot.	Well developed	55	52
	Medium „	29	28.6
	Badly „	21	20
	Total	105	

5. Children who have had from the earliest infancy a moderate or small supply of breast-milk; some for a few months only, others up to nine, twelve, fifteen, or eighteen months, or longer, with other food from birth.	Well developed	109 or 26.8
	Medium „	107 or 26.3
	Badly „	191 or 45.9
	Total	407
6. Children fed entirely by hand, and with no breast-milk at all.	Well developed	5 or 10
	Medium „	13 or 26
	Badly „	32 or 64
	Total	50

Among those noted as being of very good development—*i. e.*, those most rapidly advanced in dentition, ossification of the skull, and facility of walking (most of these having commenced to walk before twelve, many at ten and eleven)—we find 59, of whom 43 had breast-milk alone to nine months and upwards, to twelve, fifteen, eighteen months, a few of them even longer; 8 had breast-milk alone to between six and nine months; eight only received, besides the breast, other kinds of food before the sixth month. It may be added, that the respective 59 mothers were at most not only healthy, but of strong constitutions, and had great abundance of milk.

Of the 1548 children treated in the second year, there were—

		Per cent.
Well developed . . .	585 ..	37.1
Medium „ . . .	462 ..	29.1
Badly „ . . .	451 ..	29.1
Not noted . . .	50 ..	3.2

Of these, 27 per cent. had a full supply of breast-milk, or at least for upwards of six months; 29 per cent. had a medium supply, with bread or other food; 38 per cent. had scanty breast-milk and some farinaceous food from birth or earliest infancy; 3 of them had no breast at all from birth or earliest infancy.

From these facts, we cannot otherwise than conclude that bringing up a child on its mother's breast-milk is, without doubt, the best method where the mother's milk is abundant. The worst is to bring up a child exclusively by hand; *at least, in the way in which it is usually done.*

These conclusions, however, it should be insisted on, valuable as they are, apply to *towns* only, and those in which the artificial food supplied is not good. Of this last point, more anon. I think, however, sufficient evidence is now before us to justify the conclusion that, if a mother be healthy and have sufficient milk, it is her duty to suckle her child.

But, supposing a mother cannot do so, should a wet nurse be selected or not? I think myself justified, in this view of the case, to lay it down as a rule never to decide at once upon the employment of a wet nurse, until the attempt has been made, at least for a few days, *under medical supervision, and with proper care*, to bring up the child by hand, and it has been found to fail. And this because—

(*a*) The employment of wet nurses frequently entails the death of the children deserted by them, certainly in towns. Their development is at least almost always retarded, if not prevented altogether.

(*b*) It is attended with an increase of mortality in the children confided to these wet nurses.

(*c*) There is a risk of physically, as well as morally, injuring the children so confided.

(*a*) In Dr. Merei's and Whitehead's cases of the 40 children under treatment which had been brought up by hand, in the second year's report, 4 died, or 10 per cent. But, out of the 40, only 4, or 10 per cent., were well developed; 10, or 25 per cent., medium developed; and 26, or 65 per cent., badly developed. The figures above given on the two reports combined tell the same tale. It must always be so if children are in circumstances of poverty and want, combined with injudicious management. And here the mortality is even lower than might have been suspected; but probably this was due to the judicious treatment employed.

(*b*) The mere substitution of a hired wet nurse increases the mortality; for it should be borne in mind that the chances of life, precarious as they always are in a young infant, are rendered still more so by transferring a child to a wet nurse other than its mother. From a reference to the *Annuaires* of Mortality in Paris, Quetelet obtained nearly everywhere the same result,—that, in the first three months after birth, twice or three times as many children die as in the other months of the first year. Other authors, he says, have made the same observations; and from their inquiries they have thought to find the cause of this disproportion in the mortality in the habit which mothers have either of suckling their own children or of abandoning them to hired wet nurses. Here is what M. Benoiston de Chateauneuf, in his excellent work on the *Enfans Trouvés*, says on this subject:—"It is true that, to preserve the life of a child, care does everything, and climate nothing, or very little; and Switzerland and Holland are the countries where the smallest number die. Is the explanation of this fact, already offered by Muret, to be found in the habit which all the mothers, at the foot of the Alps as on the borders of the Amstel, have of suckling their children themselves? We cannot say; but we shall only add, that, having been curious to compare the mortality of children at nurse

with that of children brought up in Paris, we obtained the following results. Of 100 children suckled by their mothers, 18 die in the first year; of the same number at nurse, 29 die." (*Recherches sur la Population, Décès, etc., du Royaume des Pays Bas.* Par A. Quetelet. F. 18, p. 142-3.)

The following facts, for which I am indebted to the kindness of Mr. Brownlow, the efficient Secretary to the Foundling Hospital, direct to a conclusion similar to that arrived at by Benoiston de Chateauneuf. From some parish registers given in the Report of the Special Committee to the Governors of the Foundling Hospital, it appears, also, the mortality is much greater among those children nursed by strange women, as compared to those nursed by their mothers. Thus, between the years 1762 and 1770, the annual mortality was as follows from children of and under four years old.

Admitted :—

Foundlings	877
Illegitimate	5283
Casual	1821
Legitimate	19562
Total	27543

Died :—

Nursed by their mothers	1229
Nursed by workhouse nurses	2698
Total	3927

Removed :—

To the Foundling Hospital	525
To their mothers	3623
To friends	2961
Total	7109

This gives a gross mortality of 14·2 per cent. upon admissions; or, out of 100 deaths, 31·2 will occur among those nursed by their own mothers, while 68·8 will occur among those nursed by the workhouse nurses. These numbers have, of course, no absolute value, as it is not stated how many children were nursed by their mothers, and how many by workhouse nurses. Still as, out of this number, only 877 were foundlings, and as many as 7109 were removed to the Foundling Hospital, mothers, or friends, we may presume this number only were not nursed by their own mothers at the workhouse. Deducting, also, those children who, as sent to the Foundling Hospital, were probably among the number previously included

among foundlings admitted, we shall have about 7461 children who were probably nursed by the workhouse nurses, giving a mortality of 36·1 per cent. for such children to 6·1 per cent. for those nourished by their mothers. These numbers are doubtless exaggerated on both sides; but I think the reasoning adopted will justify our concluding that the risk of substituting a hired wet nurse for a mother is *great*, and that it will certainly increase the mortality.

The above reasons should be sufficiently powerful to induce parents to put off the adoption of a hired wet nurse as long as possible. But, more than this, it is better, if it can be in any way accomplished, to put off the day for other reasons. First, there is often great difficulty to procure a fitting wet nurse. It sometimes happens that a suitable one for a given child cannot be found. I have known as many as seven wet nurses successively tried before one was obtained to suit; and this no doubt because, as Burdach states, the milk only of that child's mother would have agreed with it; and, *vice versâ*, that child's mother's milk would not have proved useful to another child. Secondly, the later the employment of a wet nurse is put off (unless, indeed, it is so manifestly necessary and indicated that the child's death appears exceedingly probable), the better chance there is of the child living through it, since the chances of life increase with the age of the child. This I showed in my former paper; but the following table from Burdach is confirmatory of it.

Mortality in different quarters of the first year (Burdach, *Physiologie*, vol. iv, s. 523, p. 387.)

	Brussels.	Broeck.	Berlin.	Hamburg.	Paris.	Mean.
	1 in	1 in	1 in	1 in	1 in	
Mean term....	17 ..	10 ..	16 ..	21 ..	24 ..	17.6
First 3 months	8 ..	3 ..	7 ..	11 ..	8 ..	7.4
Second „	23 ..	13 ..	19 ..	27 ..	51 ..	26.6
Third „	25.07..	21 ..	23 ..	30 ..	..	31.8
Fourth „	25.12..	41 ..	21 ..	26 ..	..	28.

(*c*) But there may be a state of health present in the mother which renders this change essential. If she is weak or pale, hysterical to a degree; if there be copious leucorrhœa, but particularly if there be headache and a sensation of sinking at the epigastrium; if the sight become impaired,—the mother should desist. This defect in the sight will become blindness if the nursing be prolonged—a blindness often persistent, and the least curable. Moreover, as shown by Drs. Merei and Whitehead, such milk is not only injurious to the child at the time, but is insufficient for its proper development. As such, it is noxious. Then, again, the child's mother may be dead. Or, lastly, the child whom an attempt has been made to bring up by hand is in a state of dangerous atrophy,

diarrhœa, etc. In such a case, there must be a change; and a wet nurse must be selected. In this choice, we must have regard, lest we injure the child to be nursed, to—

1. Her moral qualifications.
2. Her physical qualifications.

Moral Qualifications. The lesser mortality among children suckled by their own mothers is no doubt due to the greater care and assiduity with which women will tend their own children. But there is another: it is want of experience in the wet nurse. And the question here suggests itself, Is it not due in great measure to the selection made? It is usual in our profession to recommend as a nurse an unmarried woman who has fallen; and the reason assigned is, that her milk is less likely to suffer, because she has no husband or children to fret after; or, if she has fallen more than once, she is less likely to fret after a child left behind, her habits having inured her to this separation. Now, is this a moral act on the part of those who make such selections? Is vice to be recommended by the preference so given, and the child of the unfortunate mother almost certainly sacrificed? It is a cruel alternative; and, although circumstances of necessity may arise to justify the adoption of such a course, still I think we are bound to set our faces against a system so pregnant with mischief to society.

But, apart from the moral act, I must say that the use of a nurse who has fallen for the first time is very dangerous. She is quite inexperienced; and the child entrusted to her care is, therefore, very likely to suffer. If such a woman is selected, she should be used rather as the animal which feeds the child, and the supervision of the infant entirely taken away from her. When one who has fallen more than once is selected, it is true, the objection of inexperience does not apply; but the moral objection is greater. Her conduct betokens a depraved and passionate nature; and, like a species of insanity, it may be conveyed to the infant, to his permanent injury in life. I am sure I have noticed this. Upon this point Burdach states: "The organism of a child is not passive to the impressions that act upon him. He developes in the direction of the first influence submitted to him, and hence does not suck out in consequence a character opposed to that of the milk on which he feeds. The thing is manifest in itself, and, moreover, well exemplified by the thousands of infants which are fed on cow or goat's milk. If the popular opinion leads us to believe in a moral assimilation of character; if it be permitted, in speaking figuratively, to say of a cruel man, that he was suckled by a tigress,—all that is true at the bottom is, that the mode of animal life of those beings who are suckled determines the quality of the milk; and that this in like manner influences on the mode of animal life of the suckling child."

(Burdach, iv, 384.) And surely, if we look at the subject philosophically; if the child, while in the womb, has an independent life, yet derives much of his nourishment from the mother during the nine months he exists in that womb,—is the infant less influenced by the woman he suckles during the nine months or year in which he continues to derive his nourishment, and that almost exclusively, from her milk? But further still; if those psychologists are right who, in the present day, ascribe much of the criminal tendencies of some minds to *hereditary taint*, whereby, as if it were spiritually as materially, the sins of the fathers are visited on the children; if there be anything in blood, as conveying good or bad inclinations,—shall we say that a vicious wet nurse will not be a material link in contaminating the child who feeds on milk extracted from her blood? Doubtless it must be so.

It may not be inopportune here to repeat a story which refers to the queen of one of the then reigning monarchs of Sweden, who, contrary to royal etiquette, would give nourishment to her own infant, preferring to follow Nature's rule and dictum to that of courts or modes. Her example, it would seem, was followed by the ladies of the court; for, at the time the story refers to, one of the ladies in waiting upon her majesty was a suckling mother too. The queen one day was absent longer than usual from the royal babe, who began to cry from hunger. The lady before referred to, taking compassion upon the infant, took it to her bosom, and gave it nourishment from her own breast. The queen, coming in soon after, and learning what had been taking place, with great indignation seized the child, and, putting her finger in its mouth, forced it to be sick, and to reject the milk it had just taken, exclaiming the while that "her infant should have none but royal blood flow in its veins". This is a good lesson, if not to queens, to mothers of lesser degree.

Let us beware how far we advise the selection of a fallen woman as a wet nurse. I would not, however, in regard to the former class, wish my words to be misconstrued. Woman is to me always an object of interest; and, even in her most degraded state, she is an object for Christian pity and reformation. Many are rather sinned against than sinning—the victim of some villain, who has deceived a too confiding love. If we are assured of this, if the woman be one of a class not previously depraved, and such as may be admitted in the Female Penitentiary, New Road, I think I should give her the preference to a married woman. If she is carefully watched in tending on the child, and her own child is carefully looked to, we are giving that woman an opportunity of gaining an honest livelihood, and once more reclaiming a lost position in society; but if she be a harlot in taste and habit, a virtuous household is not her proper domicile.

Physical Qualifications. The physical qualifications of a wet nurse may be summed up under the following heads:—

1. That she has good milk.
2. Hereditary predisposition good.
3. Age not to exceed 30.
4. She should not have been confined many months before the child's mother.
5. She should be of the melancholic temperament.
6. She should have not only good quality, but a sufficient quantity, of milk.
7. When a wet nurse cannot be given to a child exclusively, a married woman suckling another child, may be employed as an adjuvant to assist the artificial feeding.

1. *She should have good milk.* This point is best treated in the consideration of what are the characters of good human milk. One of the best evidences of a wet nurse's good physical constitution, is the secretion of an *abundance* of healthy and nutritious milk. Good human milk has an average specific gravity of 1032, varying from 1030 to 1034. It is always strongly alkaline; this alkalinity it usually retains from five to six days, when it becomes acid. To the taste it is sweet, much more so than cow's milk. When allowed to stand, it will be seen to separate into two portions. The superficial very white substance, known familiarly as *cream*, is chiefly the oil-globules which, being of a lower specific gravity than the other portions of the milk, rise to the surface. The more transparent subjacent liquid is the *casein*, sugar, and milk. The agitation of the cream breaks asunder the oil-globules, which in this state constitutes *butter*. If the milk, after the cream has separated from it, be kept any time, the sugar contained in it becomes converted into lactic acid, which gradually precipitates the casein as a curd. Rennet, or the mucous membrane of the stomach, and most acids, have the same effect. The fluid which now remains, technically called whey, contains, still in solution, a large quantity of sugar and the salts of milk, which are readily separated by evaporation. When looked at through the microscope, milk is found to consist of a colourless fluid, in which are floating a number of bodies—(*a*) Oil-globules similar to those found in all parts of the body. (*b*) The proper milk-globules, smaller in size, varying from 1-95,000th to 1-7,000th of an inch. These also appear to be oil-globules, from the fact that they reflect light strongly; but they are evidently covered with something else as a layer, from the difficulty of dissolving them in ether. (*c*) There are a great multitude of small granules, or granulated corpuscles, floating in amongst the milk of globules most abundant in milk secreted at a very early period. The *liquor lactis* holds in solution the casein, though some observers be-

lieve that the external layer of the milk-globules is made up of casein.

According to the latest analyses by Becquerel and Rodier, the composition of human milk may be stated as follows :—

	Mean.	Maximum.	Minimum.
Specific gravity . . .	1032.67 ..	1046.48 ..	1025.61
Water	889.08 ..	999.98 ..	832.30
Solid constituents .	110.92 ..	147.70 ..	83.33
Sugar	43.64 ..	59.55 ..	25.22
Casein and extractive matters . .	39.24 ..	70.92 ..	19.32
Butter	24.66 ..	56.42 ..	6.66
Salts by incineration	1.38 ..	3.38 ..	.55
	1000.00	1000.00	1000.00

It will be seen that the extreme limits exhibit a very marked difference, and thus point at the difficulty of always accurately making a good selection of a wet nurse.

2. *Hereditary Predisposition.* In the inquiry made as to the hereditary predisposition of a wet nurse, the greatest care is required. It is usually the custom to reject those affected with taint of consumption or tubercular disease, and syphilis. The great extent to which the former of these diseases prevails may be gathered from the fact that the proportion of deaths from it, to 1000 deaths from all diseases, is 154·5 for males, 172·3 for females, and 163·4 for all persons. Syphilis is not generally fatal, but, in its consequences upon the life of a child, is very deplorable. It is known that a woman thus tainted will consecutively bring forth still-born children, or be constantly miscarrying ; but it is not generally known, or at least enforced, that even the healthiest children will, if they partake of this milk, gradually become atrophied, and die. Simon mentions a case of a young woman who contracted this disease after the birth of her first child, and who, in consequence of improper medical treatment, carried the disease about her for years. Her children continued pretty well till they reached the age of six months, then became highly scrofulous, and died in a state of general marasmus; and yet this woman's milk, when analysed, appeared to be quite healthy, and even rich. Donné, from several examinations of the milk of syphilitic women, concluded that no difference could be found in either the chemical or microscopical characters of such milk. Meggenhofen, however, found that it was *acid* in reaction.

I think, however, that sufficient caution is not usually given in the case of cancer. It has been said, that of late years cancer has been on the increase. Thus, the deaths amount to 14·3 for all persons per 1000 annually; but the proportion of women singly is greater than that of men, being 20·5 for the former, against 8·5 for the latter. The disease is known to be hereditary; and therefore is it necessary to be doubly cautious in making a selection, where any blood relative of the patient has laboured under the malady. What is true of cancer I would equally apply to insanity. This is also an hereditary disease, and one which, even if not actually transmitted as insanity, is so in analogous, albeit milder, affections. Extraordinary peculiarities, eccentricities, strong dispositions to crime or sexual indulgences, more frequently a deficiency in intellectual power, are apt to follow—evils greatly to be deplored, and, if practicable, to be avoided.

3. *The age of a nurse should not exceed thirty.* I would further venture to state that it should not be much under twenty-five. I have already shown elsewhere that the age of the highest sexual development in a female is twenty-six, at which age she is in the best condition to fulfil her maternal duties. After thirty this power deteriorates; and before twenty-five she can scarcely be said to have completely recovered that physical health, which has been weakened during the progress of puberty and the changed position which she has been made to occupy in society. It is but right to add, however, that we do not find the milk itself very much altered, chemically or microscopically, between the ages of fifteen and forty. Still, at the extremities of the scale, the differences are obvious. In the very young, the butter, casein, and solid matters generally, are on the increase; excepting the sugar, which exists in diminished quantity. In the older women, there is a larger proportion of water and sugar; the amount of butter and casein is diminished, although the latter is still in excess, as compared with the normal condition;—from which it may be inferred, that the milk of a very young person is less digestible, and therefore less to be recommended for a delicate infant.

4. It is usually said that *the wet nurse selected should have been confined as nearly as possible about the same time as the mother of the child for whom the milk is required.* Too much stress, however, should not be laid on this contingency; for it should not be forgotten that the constituents of milk not only vary in relative quantities in different, but in the same animals. So liable are they to vary, that the different circumstances of life may materially affect them in the same individual. Indeed, Parmentier and Deyeux have shown that the milk of women of the same age, confined at the same time,

and submitted to the same influences, was always different—in fact, that the milk of the same animal, obtained at different times, varied greatly. (Burdach, *Physiology*, s. 520, p. 356.) All that we should look to is, that the milk is good, and that the age of it should not be too far removed from what the child's mother's milk was; for milk materially changes in its composition as the period of lactation is prolonged; and the female thus, although possessing very excellent milk, may yet supply a fluid which will prove injurious to the suckling. The results of age, as applied to the milk, are summed up as follows by Becquerel and Rodier. The specific gravity varies much. The proportion of water increases from the fifth to the sixth month, and from the eleventh to the twelfth; it diminishes from the first to the second, and from the eighteenth to the twenty-fourth. The solid matters increase in a marked degree from the first to the third. The sugar decreases during the first month, but increases from the eighth to the tenth month. The butter increases considerably up to the sixth month, and then considerably decreases from the fifth to sixth, and from the tenth to eleventh month. The salts undergo a slight increase in quantity from the first to the fifth month, then correspondingly decrease. These changes are really most important to trace, as they are an index as to the substitute which, bearing a proper proportion to the amount and quality of nutritive matter required, is best fitted for a child whom it is obligatory to wean, or for whom another diet is imperatively called for. It must be confessed, however, that the constituents of milk vary so much, that it is very difficult readily to estimate its goodness from their present quantity. Its composition varies also within the limits of health, so much that we have often no better method of testing it than trial with the child; when, if it agrees with it, we may conclude it is good. I think, however, it may be stated as a rule, that if the butter in it is in excess, the milk is poor in quality, excepting in syphilis and phthisis, particularly when the latter is accompanied with diarrhœa, and in mental disturbance. In the former, it may fall to 9·12; in the second, to 12·7 per cent.; in the latter, to 5·14; the normal proportion being 26·6. Thus, in acute diseases, the mean is 29·8; in chronic, 32·6; in acute enteritis, 31·5; in acute pleurisy, 54·2; in acute colitis, 54·2. In nurses of feeble constitution, it is 28·78, as compared to 25·96 in those of robust constitution. In very young nurses, it is 15 to 20, 37·8, and so on.

5. *A wet nurse of a melancholic temperament should be preferred.* The milk of a brunette is generally richer in solid constituents than that of a blonde; for which reason the former are preferred as wet nurses. The following analyses, quoted from Simon, were made by L'Heritier:—

	Blonde, aged 22.		Brunette, aged 22.	
	1	2	1	
Water	892. ..	881.5 ..	853.3 ..	853.
Solid constituents .	108. ..	118.5 ..	146.7 ..	147.
Butter	35.5 ..	40.5 ..	54.8 ..	56.3
Casein	10. ..	9.5 ..	16.2 ..	17.
Sugar of milk .	58.5 ..	64. ..	71.2 ..	70.
Salts	4.0 ..	4.5 ..	4.5 ..	4.5
	1000.00	1000.00	1000.00	1000.00

These are extreme cases; but the average ratio of solid constituents lies from 120 for a blonde to 130 for a brunette. There is yet another reason why a brunette is to be preferred. Blondes usually belong to the sanguine or scrofulous temperament. A fair skin, with brilliant colour, light blue eyes, very light or red hair, are usually present in such cases. The whole digestive powers are weak, and an unusually irritable state of manner is a frequent accompaniment. As a consequence of this sanguine and more passionate character, the milk of blondes is very apt to become altered under mental excitement. In extreme cases, it has been known to produce the death of the infant; but it almost always leads to and generally produces serious results. In the case of a recently delivered woman, whose milk was examined by Simon, who was in a state of considerable fever, induced by a fit of passion, the child was seized with vomiting, diarrhœa, and convulsions. The milk had an alkaline reaction, and a strong animal odour, when boiled. After twelve hours, it developed a large quantity of sulphuretted hydrogen; and yet the casein, sugar, and butter, had not undergone any change in quantity or quality. Indeed, it may be stated here, that most of those peculiar changes which render milk so detrimental do not occur so much in these ingredients as in the *extractive matters*, of which (to our regret, it must be added, in the emphatic words of Lehmann, so aptly used by Becquerel and Vernois) "we know absolutely nothing".

Brunettes usually belong to the bilious or melancholic temperament. In disposition, they are more gloomy and dull. The milk is richer; and the precocious child is, as it were, restrained by this milk from over-excitement in its mental manifestations. Its body has time to be formed and to develope itself before exhausted by undue psychical excitement, and a stronger child is the result.

Intermediate between the sanguine and melancholic is the lymphatic or phlegmatic temperament. It is the reverse of the sanguine. It is accompanied with weak pulse, languid circulation, cold extremities, and pallid skin. There is deficiency of red blood, of vascular action, of tone; and the pro-

clivity is to watery fluxes, and other chronic affections. Such persons are not calculated to make good nurses, and should therefore be scrupulously avoided.

Among the brunettes there is to be found another variety, closely connected with the sanguine. The eyes may be very dark, even black; and so also the complexion. But with this there is a transparency in the look; the eye is unusually bright; the veins appear vividly blue through the skin. Such persons have all the vivacity of character common to the sanguine, and are to be avoided for similar reasons.

Lastly, the nervous temperament is to be rejected, characterised by agitation and trepidation of manner. There is an exaltation in the nervous phenomena, and a general tendency to nervous and hysterical diseases. (Druitt, Williams.) When we remember that a child is eminently impressionable, and has to go through an excitable period in teething, to exalt a nervous tendency cannot be wise. Deyeux examined the milk of a woman who was liable to frequent nervous attacks. He found that, simultaneously with these attacks, the milk became transparent and viscid, like albumen, and did not resume its normal condition till some time afterwards. To expose a child to such variations is most injudicious.

6. *She should have not only good milk, but it should be in sufficient quantity.* This is very important; for upon no point do I think we are so liable to be deceived as upon the quantity of milk supplied. Hervieux, whom I before quoted, states the amount consumed by a child in twenty four hours to be sixty ounces. This may be exaggerated; but still, when we consider that a child has in the first year of its life to acquire not far from one-third of its full growth and size, we must consider that it requires, at the same time as it has to supply waste and wear, a large quantity of food to meet the emergency. Quetelet, from his calculations, considers that, as a mean, a child grows in length, in the first year of life, from 20 inches to 26 with boys, and from 19 to 26¼ inches with girls; the weight in the former increasing from 6 lbs. 13 oz. in boys to 20 lbs. 7 oz., and from 6 lbs. 3 oz. in girls to 18 lbs. 14 oz. These data do not, however, clearly set forth the extent of food required. We may, however, infer this from experiments made upon animals. The philosophical Boussingault has shown that a calf increases—

	lbs. per diem.
During the period of suckling	2.4
Under 3 years old	1.5
Above 3 years old	.2

From this we may conclude that the greatest amount of growth and consumption of food takes place at the suckling

period. This increase of weight, however, bears a direct ratio to the quantity and quality of food supplied. Boussingault has admitted what might be presumed at first sight, that an animal of great size, *cæteris paribus*, will require a larger amount of forage. Again, in regard to the quality: in winter, usually, cattle which are not set aside to fatten are stinted in their food, and fed almost exclusively on straw. Straw is an aliment which, compared to hay or other kinds of fodder, is deficient in both combustible and incombustible aliment. Hence, towards spring, the cattle are thin, and yield but little milk, and have lost much strength. If these results happen to a full grown, they will *à fortiori* occur to a growing animal. The following table from Boussingault gives this statement. It will appear that, for every hundred pounds of living weight, neat cattle require—

	lbs. of hay.
For simple sustenance	0.7
When labouring (Pulsh)	2.0
When in milk (Pulsh)	3.0
Ditto (Perrault)	3.12
Ditto, large cows (Boussingault) . . .	2.73
Growing rapidly (Boussingault) . . .	3.08

Strange to say, farmers, generally supposed deficient in intellect, have found out this truth, unknown to many of our juvenile tiger keepers in London, and always, if they can help it, refuse to employ growing lads when grown men are to be had, having found out that, although their wages are lower, they more than compensate for this advantage by the larger quantity of food they consume.

An infant, therefore, requires proportionally a much larger quantity of food than an older child, or a man. I believe that one of the disadvantages of a wet nurse is this. The breast often appears large and full of milk. Whether this is owing to an increase of adipose tissue between the lacteal ducts, or to the peculiar conformation of the breast in some women, I do not know; but I am sure that many wet nurses, apparently with a full breast, have milk which, although it is found, when examined chemically or microscopically, to be particularly rich and good, is often *insufficient in quantity*. Such nurses are often so anxious to keep their situations, and so devoid of honest principle, that they will keep their fatal secret, and, if it be not discovered, the child will die. Yet it is a fraud which can be easily detected. The child cries frequently; his sleep is disturbed; he becomes thin, and generally pines away. Let the child be watched; and, the moment he has had the breast, and the nurse has left the room, offer it artificial food. The zeal with which he will attack this, and the quantity he will consume, the sleep of quiet and comfort which will almost instantly succeed, will reveal the tale, and oftentimes save the child.

7. *Where a wet nurse to tend a child exclusively cannot be met with, and it is conceived that the circumstances of a child's case still need that human milk should be given, we must act otherwise.* There are, fortunately, some women who have both milk which is good in quality and excessive in quantity. This fortunate peculiarity is usually found in very young women. As before stated, it contains a larger quantity of solid matters; and hence, conjoined with a poorer milk or artificial food, it may so far suit the child. I know it is a common opinion that no one woman can nourish at the same time two children. I believe this is not always correct. Certainly, in the vast majority of cases, where children are artificially assisted by other milk as supplementary, she will be able to do so. I know it is, again, a popular prejudice, that two milks must not be mixed, as they will be sure to disagree. This is, I believe, the opinion also of many well informed accoucheurs; yet I venture to disbelieve it. In the Foundling Hospital, where children are sent into the country to wet nurses, for the most part married women, with a baby of their own to suckle besides, the following is the mortality, as given us in Mr. Brownlow's book before referred to.

Out of 100 children under 5 years of age, received at two separate periods, viz., from May 1835 to May 1837, and from May 1837 to March 1839, Mr. Brownlow shows the following was the mortality at the Foundling Hospital.

	1st period.	2nd period.
Deaths in first year of their age	12	9
Deaths in second year of their age	5	10
Deaths in third year of their age	2	2
Deaths in fourth year of their age	0	0
Deaths in fifth year of their age	1	0
	20	21

The causes of death were—convulsions in 9; diseases of membrani glandia, 5; water on brain, 4; inflammation of bowels, 4; inflammation of lungs in 3; malformation of chest, 3; diarrhœa in 3; croup, 2; scarlet fever, 2; hydrocele, atrophy, bilious vomiting, scrofula, hooping-cough, teething, and breaking a blood-vessel, of each 1. This is the mortality in the country. The usual mortality is higher: for the first year above 15.

This result I think sufficiently favourable to justify our adoption of the plan. I am happy to learn that the celebrated Manchester accoucheur, Mr. Roberton, is in the habit of carrying out the same plan in that city. Where breast-milk is needed, and the mother of an infant cannot supply it, he employs a married woman, who, although suckling her own child, calls twice a day to feed the other.

There is but one more point I wish to allude to here, and it is on the choice of country nurses for town children. I cannot help speaking in strong terms of reprobation of this custom. It almost invariably fails. A nurse accustomed to a country life, open air, and exercise, is scarcely likely to thrive in a close town, where she leads that sedentary life at home so necessary in London and other great towns. *Vice versâ*, the more exposed condition of life may not agree with a town nurse. Both will be likely to suffer. A town nurse, if healthy, should therefore be preferred for a town child, a country nurse for a child in the country. If the town child, however, is removed into the country, he comes under the second category, and will thrive better with a country nurse.

The full discussion of this point more properly belongs to the third and fourth parts of this paper, when we come to speak of other animal and vegetable substitutes for human milk. So much, however, may be said—that the ill success attendant on the combination of other kinds of food, as shown by Drs. Merei's and Whitehead's tables, affords no criterion, seeing that that food was bread food, and seldom, if ever, judiciously given. The following valuable notice of deaths occurring at Brighton, and kindly forwarded to me by a lady correspondent, and one of the Committee of the Society for Improving the Sanitary Condition among the Lower Classes, can be relied upon, and emphatically illustrates this fact. It relates to the—

Infant Mortality in Brighton.

Fifty cases taken from the books of the registrars of the several districts, shewing the age of each child, the cause of death as *certified*, with additional information obtained by personal inquiry into the method of feeding, etc.

1. Girl; aged 4 months. Died suddenly in a fit. Coroner's inquest.	Fed on boiled French roll, given with a spoon; very little breast-milk. Fed freely.
2. Boy; aged 9 months. Died of bronchitis and convulsions.	Fed on boiled rice and sago, and the breast. A fat heavy child.
3. Boy; aged 8 months. Died in a convulsive fit. Coroner's inquest. Alleged cause, teething.	Fed upon tea and *muffin* heartily the night before it died. Always ate heartily, and had also breast-milk. Was a very thin and puny child.
4. Girl; aged 7 months. Died of diarrhœa (during dentition).	Fed partly from breast, partly with boiled milk.
5. Boy; aged 5 weeks. Died of diarrhœa.	Fed partly from breast, partly with boiled milk.

6. Boy; aged 8 months. Died of hooping-cough.	Fed entirely from mother's breast.
7. Girl; aged 2 months. Died from want of breast-milk.	The mother died when the child was five weeks old. It was weakly from birth, and did not thrive upon the food given. The bottle was not tried.
8. Girl; aged 6 weeks. Died of bronchitis and convulsions. Death sudden.	The mother says it had nothing but the breast as food; and no drug or medicine, except given by a medical man.
9. Boy; aged 6 months. Died of hooping-cough and convulsions.	Had breast-milk the first four months; then bread and water food sweetened.
10. Girl; aged 3 months. Died of marasmus.	The mother, not having sufficient breast-milk, tried bread and milk, and then milk and water, without success.
11. Boy; aged 9 months. Died of mesenteric disease.	The child was weaned suddenly, and fed without judgment.
12. Girl; aged 3 months. Died of convulsions.	Fed entirely from mother's breast.
13. Boy; aged 5 weeks. Died of bronchitis.	Had boiled bread food, and the mother's breast.
14. Boy; aged 9 months. Died of diarrhœa and convulsions.	Was suckled by its mother till three months old; then put out to dry nurse, and fed with milk sop, arrow-root, beef-tea, mutton-broth, etc.
15. Child; aged 3 months. Died of convulsions.	Fed entirely from mother's breast.
16. Girl; aged 4 months. Died of marasmus.	Fed entirely from mother's breast.
17. Girl; aged 4 months. Died of diarrhœa and convulsions.	Partly fed from breast; also with all kinds of food, which the stomach rejected. "Delicate from birth".
18. Boy; aged 3 months. Died of diarrhœa.	Partly suckled; also had boiled French roll.
19. Boy; aged 5 months. Died of atrophy.	Had arrow-root—probably insufficient in quality.
20. Girl; aged 4 weeks. Died of convulsions.	Fed on mother's breast and arrow-root. Mother says it was an "eight months' child".
21. Boy; aged 10 months. Died of convulsions.	Mother's breast, and boiled French roll.
22. Child; aged 9 months. Died of convulsions.	Weaned at three months: then fed chiefly on gruel. Ailing from birth. Mother sickly.

23. Girl; aged 10 months. Died during dentition.	Nursed entirely from mother's breast.
24. Girl; aged 3 months. Coroner's inquest: verdict "affection of brain from overloading the stomach".	Two cups of arrow-root, milk, and water, in addition to breast-milk, within a very short time.
25. Girl; aged 6 months. Coroner's inquest: verdict "accidental death". No blame attached to nurse!	Suffocated by being overlaid by the wet nurse, a heavy sleeper. She was questioned as to taking any extra drink herself, or giving any narcotic to the child, who was often very restless.
26. Girl; aged 4 months. Died of marasmus.	Weaned at eight weeks; then fed on arrow-root and boiled bread. "Pined to a skeleton".
27. Boy; aged 8 months. Died of diarrhœa.	Born a fine healthy child; lost its mother in the first month; was put out to dry nurse, and shockingly neglected; removed to care of another person when 7½ months old; lived 13 days in a state resulting from starvation and disease. No coroner's inquest.
28. Boy; aged 4 months. Died of phthisis.	Partly suckled; partly fed. Constitutionally delicate.
29. Boy; aged 1 year. Died of phthisis and convulsions.	Ditto, ditto. The father of these two children (28 and 29) died of consumption; all three deaths occurred within a week or two.
30. Girl; aged 11 months. Died (as alleged) of constitutional debility. Died in a fit of convulsions.	Partly suckled by mother, partly fed, for six months: a pint of thick food three or four times a day. After six months, was put out to dry nurse; fed with bun and milk and gruel a few minutes before it died. Probably a case of overfeeding.
31. Child; aged 9 months. Died of bronchitis.	Suckled entirely by the mother.
32. Girl; aged 1 year. Died of hooping-cough.	Weaned at ten days old; fed on arrow-root and gruel.
33. Child; aged 6 months. Died of choleraic dysentery.	Weaned *suddenly* three weeks before death; fed on bread and milk.
34. Boy; aged 3 weeks. Died of "exhaustion of vital powers".	Suckled by a wet nurse; but fed also on rolls and cow's milk.

35. Girl; aged 9 months. Died of hooping-cough and pneumonia.	Suckled entirely by the mother.
36. Boy; aged 6 months. Died of convulsions.	One of twins; suckled by the mother; also fed on prepared barley. Ailing from birth.
37. Boy; aged 3 months. Died of hooping-cough.	Suckled by the mother.
38. Child; aged 1 month. Died of "constitutional weakness".	Suckled entirely by the mother.
39. Boy; aged 1 month. Died of "diseased stomach".	Fed on cow's milk and water.
40. Girl; aged 8 months. Died in dentition.	Fed on the mother's breast.
41. Child; aged 9 months. Died of bronchitis.	Brought up by hand, on new milk and tops and bottoms.
42. Girl; aged 6 months. Died of pneumonia.	Fed partly from breast; partly with biscuit-powder and cow's milk.
43. Girl; aged 7 months. Died of convulsions during dentition.	Fed entirely on cow's milk and water. Dentition unusually early; ten or twelve teeth in seven months.
44. Boy; aged 5 months. Died of hooping-cough and convulsions.	Fed partly from mother's breast; also on bread-sop.
45. Child; aged 1 year. Died of hydrocephalus.	Always fed a great deal (the mother having difficulty in suckling). When weaned, had anything (*i.e.*, everything). Convulsions came on with teething. Treatment consisted of blister to top of head, mustard to the back of the legs and neck, and leeches to the temples.
46. Boy; aged 1 year. Died of convulsions.	Partly fed from mother's breast; also with boiled bread.
47. Girl; aged 2 months. Died of diarrhœa.	Very little breast-milk; had baked flour and biscuits boiled.
48. Child; aged 5 months. Coroner's inquest: verdict "overfeeding".	These cases happened together in the same house. The child of a wet nurse, and her nurseling, were fed on a hearty supper of bread food; and were found dead at 4 A.M.
49. Child; aged 7 months. Coroner's inquest: verdict "overfeeding".	
50. Child; aged 4 months. Coroner's inquest: verdict "overfeeding".	A similar case to the preceding two.

These 50 cases may be thus classified:—

Convulsions (in 7 coroner's inquests, verdicts "overfeeding": several not investigated) .	22
Diarrhœa and other disorders of stomach and bowels	12
Total cases traceable to overfeeding and injudicious feeding	34
Or per cent.	68

The other cases (16 in number) were affected with hereditary, structural, developmental, and epidemic diseases: most probably in these cases death was wholly independent of *diet*. At least, it is remarkable that in these last named 16 cases, the children were in general either fed from the mother's breast entirely, or if brought up by hand, were fed with more judgment than is commonly observed.

The cases of convulsions (Nos. 12 and 15), I have been unable to trace to any cause. They were not hand-fed at all; and probably the attack in each might have been induced by some irregularity in the health or diet of the mothers.

Fed on bread food without the bottle: some having the breast in addition to bread food; some having other food, as sago, arrow-root, etc.: dying of convulsions, or of diarrhœa	24
Fed entirely from mother's breast	11
Fed from the bottle	1
Fed entirely on cow's milk and water	2

Clearly, therefore, no conclusion can be drawn from the above facts that admixture of food, if *judiciously* combined with the mother's milk, is injurious. Indeed, the conclusion would be rather that death was less likely to occur in those fed on cow's milk and water than in those fed exclusively on their mother's milk. To do this, however, where so few cases so fed are given, would be unphilosophical.

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 *Palmipedes* 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 which are obliged to remain in the nest a long time, and 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 to a child. It is not the *difference of the external covering which is the cause of this fall:* 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 at meal times. During digestion, there is a continual flow of the blood towards the alimentary canal; and hence the sensation we experience 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: therefore, 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. Yet is it strange 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 that we may be enabled thereby 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	34.94	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 mhs.	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, but 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.
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 (with extractives.)	35.65	39.24
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, and 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 fœtal 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 foundling 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 its use, I for one, till its usefulness is proved by practice, 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 re-

Analyses of Goat's Milk.

	Chevallier and Henri.	Clemm.	Boysson.	John.	Payen.	Stipriaan, Liuscius, 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 with ext.	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	— —	—	—	—

sembling 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 she 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.

Cows' Milk. This is the substitute for human milk best known in these regions. The absence of odour and its more general diffusion, are advantages in its favour. In appearance, it is of a bluish white colour, almost tasteless, specific gravity varying from 1030 to 1035. Its microscopical characters are about the same as those of human milk, excepting that the milk-globules are more abundant.

Now, it is clear, comparing this with woman's milk, that—1. The quantity of water is less in the cow; 2. The solid matters are in greater quantity; 4. The sugar is less in amount; 5. There is more casein; 6. And more butter; 7. The salts are also in excess.

It is quite manifest that, if the above analyses are to be depended upon, a simple dilution of this milk will not suffice. Water may be added to diminish the relative quantity of casein and butter to the normal figure it attains in human milk; but it will only reduce unduly also the amount of sugar; and thus, at the outset, we meet with a difficulty in its employment. But there are other difficulties, more serious and difficult to contend with, and which tend to affect materially its quality. A few of these I will consider *seriatim*. They are—

1. Adulteration of cows' milk.
2. Its acidity dependent upon stall feeding.
3. The effect produced upon the milk by feeding cows in a proper manner.
4. The effect upon milk of keeping cows in unhealthy sheds.

1. *Adulteration.* The most painful part of our experience in towns is, that pure milk cannot be procured; it is almost always adulterated. In the excellent work of Becquerel and Vernois, the *Annales d'Hygiène* (and in this respect Dr. Hassall confirms their results), it appears to be adulterated in Paris by the following substances: water, glucose, flour, starch, dextrine, infusion of amylaceous matters (rice, barley, bran), grumous matters, yolk of egg, and white of egg; sugar, gelatine, liquorice, boiled carrots, broken down calves' brains,

Analyses of Cow's Milk.

	Simon.			Herberger.		Lecanu.	Boussingault.	Chevallier and Henri.	Poggiale (10 cows).	Playfair (9 cows).	Vernois and Becquerel (30 cows).
Water	857	861	823	853.0	862.0	868	874.0	870.2	862.8	—	864.06
Butter	40	38	55	38.9	37.5	36	39.0	31.3	43.8	49.0	36.12
Casein	72	68	67	69.8	67.0	56	34.0	44.8	38.0	41.6	—
Ditto, and extractive matter	—	—	—	—	—	—	—	—	—	—	38.03
Sugar	—	—	—	—	—	—	—	—	52.7	—	55.15
Sugar, and extractive matter	28	29	51	31.3	26.3	40	53.0	47.7	—	—	—
Fixed salts	62	61	13	7.0	7.2		—	6.0	2.7	—	6.64
Earthy salts	—	—	—	—	—	—	2.2	—		—	—

serum of blood, several salts, bicarbonate of soda, chalk, turmeric, emulsion of hemp or almond seeds, etc. We do not, however, find that in England these are commonly employed, but adulteration by water is extensively practised. Dr. Hassall, out of 26 samples of milk, found that 11 were adulterated with water in the proportions of from 10 to 50 per cent.

Dr. Sanderson, the medical officer of health for Paddington, found in thirty-two specimens of the milk examined by himself and Mr. Alfred Bernays of St. Mary's Hospital, that all, except one, the quantity of water was greater than it was in pure milk. In twelve instances, the quantity of solid constituents was only half as great as it should be, in a few only one-fourth; many specimens contained less than 6·5 or 5·8 per cent., a few, 3·5 instead of 12·98 as in pure healthy milk.

Dr. Hillier, the medical officer of St. Pancras, examined twenty specimens of milk, and found that the quantity of water added varied from 25 to 50 per cent. That supplied to the workhouse was one of the poorest. Instead of a gallon containing nearly 9,000 grains of *solid* matter, it contained only 5,425 grains, or two thirds the proper quantity. Dr. R. D. Thompson found in Marylebone, that the gallon of milk, in 7 samples, weighed as a mean 71,680 instead of 72,415 grains, which amounts to the withdrawal of 1·44 oz. of solid matter, well calculated to nourish the body, and substituting for it water. Dr. Hyde Salter and Mr. Hunt, from the confessions made to them by milkwomen, their patients, state the quantity of water usually added is one gallon of water to two of milk. What sort of food can this be for an infant, especially if diluted as it almost invariably is by the purchaser, and often afterwards by medical direction? Is it to be wondered at that children fed on such weak milk do not thrive?

2. *Acidity.* Cows' milk, except the animal has been fed upon grass exclusively, is almost always *acid* in stall-fed cows; human milk is always alkaline: hence another reason why cow's milk disagrees with many children.

The experiments of Dr. Mayer of Berlin are particularly conclusive upon this point. He says that for a considerable time he had been in the habit of examining the milk of every householder in Berlin, and testing it by litmus paper, according as the cows were fed from brewery slops or brandy lees, gardeners' produce, or in the country. In every instance, except one, he had found the milk decidedly sour. *a.* Of cows fed with brewers' lees, red potatoes, rye bran, and wild hay, in five instances the milk was slightly sour, in one very much so. *b.* Of forty cows fed with potato mash, barley husk, and clover and barley straw, in ten which

were examined, the milk was sour, in three very sour. *c.* From among fifty cows, fed on potato husks, barley husks, and wild hay, five were examined, and in all the fresh milk was sour. *d.* From fifty-two cows, fed on potato mash, husks, wild hay, rye straw, out of twelve selected for examination, the fresh milk of all was sour. *e.* From six cows, fed by a chief gardener on coarse beet-root, red potato, bran mash and hay, the fresh milk was faintly sour. *f.* From five cows, fed by a cow-feeder on lukewarm bran mash, and hay, in four the fresh milk was quite neutral, in one it was decidedly alkaline. The whole of these experiments were made in the winter season, when cows were necessarily stall-fed, and confirm the truth of the general opinion, that the fresh milk of stall-fed cows is almost invariably acid. Dr. Mayer does not believe that this acidity is due to want of exercise, so much as to the unscientific manner in which the cows are fed; and he particularly objects to the potato mash, which he considers the cause of this acidity. The milk of the cows of gardeners and cow-feeders is usually praised by the Berlin women as being particularly good. But Dr. Mayer has observed that it often gives rise to diarrhœa and cutaneous eruptions in children; which, he supposes, is due to the cows being fed with the cabbage, turnip, and potato refuse. The very worst milk is that supplied by cows fed on potato refuse from brandy distillers, as opposed to that obtained from the cows of cow fatteners, which feed on hay and grass in stalls. By substituting the milk of the latter for the former, he was often enabled to arrest at once the intestinal derangements previously referred to.

3. (*a*) *Effect upon Cows' Milk of various Kinds of Food.* It must be admitted that a great deal depends upon the manner in which cows are fed. Generally this is done in the cheapest possible way, because milching cows so deteriorate in value after eight or nine months use as such. I am told that a cow purchased for £18 to £20 at the beginning of a season, will sell at a loss of £6 or £8 at the end of it; they look so small and meagre. But this may be easily prevented. A very intelligent gentleman in Nottinghamshire has informed me that if the cows are fed upon a steamed food composed of chopped hay, bran, malt calms and rape-cake, not only will they produce an extra quantity of milk, but keep throughout the milching period in first rate condition; in fact, they will at the end of the six or nine months look as well as they ever did.

(*b*) *Country Milk and Town Milk.* The former is stated to be preferable to the latter. The reason is, no doubt, that the cows are less crowded together, and the milk is less watered.

Becquerel and Vernois have also proved the truth of this popular opinion from their experiments. (The mean figures only are here given.)

	Paris.		Country.
Specific gravity . . .	1033.10	....	1033.72
Water	869.78	....	857.80
Solid constituents . .	130.42	....	142.20
Butter	33.66	....	38.85
Casein and extractive matters . . .	53.66	....	57.00
Sugar	37.07	....	38.99
Salts	6.03	....	7.36

This is not, however, due to the mere exposure to country air, because experiments have been made, and when the cows are fed on hay, with oats or barley-straw, or the ordinary culinary roots with a certain quantity of wet bran, a similar result is obtained in towns.

(c) Summer and Winter Milk. Owing to the difference of nutriment given, the composition of these two milks is not the same. The principal difference observed in winter is a diminution of the water, and among the solid constituents, an increase of the butter only; both the casein and sugar are slightly diminished. In summer there is more water; but what is remarkable is, that among the solid constituents the casein, sugar, and salts are diminished, and the butter is considerably increased.

(d) Results obtained by various kinds of Food, and Beet-Root in particular. Dr. Playfair adduces an example of a cow fed on much nitrogenous matter, in which not only was the amount of nitrogenous matter or casein in the milk increased, but also the butter. Certainly the yield of milk is increased by much of that stimulant diet which is occasionally given to cows, such as refuse slop from whiskey distillers, which is known to be given largely in America, and for which cows acquire so depraved an appetite, that they will not take afterwards their ordinary food. (Hassall.) Other less exciting food has the same result. Thus, Parmentier and Deyeux found that cows fed on the leaves and stalks of maize yielded more milk than when fed on ordinary fodder. Moreover, the milk was extremely sweet. The milk obtained from cows fed on potatoes and common grass was much more serous and insipid. That from cows fed on cabbage was much more disagreeable to the taste. Hermanstadt found also that fresh aliments caused a larger quantity of sugar to appear in the milk than dry food.

Among the most approved fodders for cows are sainfoin, Spanish, and ordinary trefoil; but there are a vast number of other annual plants chosen from among the graminaceæ or leguminosæ, which, if cultivated and given to the cows, would prove exceedingly useful. Indeed, Anderson assures us that he had seen cows fed upon trefoil and grass which yielded

a superior kind of butter to that afforded by cows fed upon famed old pasture. The ancient faculty of medicine in Paris appointed a commission in 1771 to trace the effects of various roots on the milk of cows. These reported the potato to be particularly useful in increasing the quality and the flow of milk; also, that its administration to mothers of thin weakly children had led to the rapid improvement of these latter in every respect.

The effect of several varieties of food is set forth in figures in the following table, compiled from one quoted by Dr. Hassall from Chevallier and Henri, and from another given by Becquerel and Vernois. Chevallier and Henri's cows were fed on ordinary fodder—beet-root and carrots. The winter food of those referred to by Becquerel and Vernois was one bundle and a half of trefoil or lucern, weighing from 12 to 13 pounds; half a bundle of oat-straw to eat, weighing from 9 to 10 pounds; and 25 *kilogrammes* of beet-root, half in the morning and half at night, with two buckets of water by way of drink. The summer food was green trefoil and lucern, Indian corn, barley, grass, in no fixed quantity, in amount, however, estimated at 45 to 50 *kilogrammes*. At night, in returning from the field, the cows were given in the stable from 5 to 6 *kilogrammes* of grass. Drink as in winter.

After Chevallier and Henri.

	Ordinary fodder.	Beet.	Carrots.
Water	870.2	868.8	866.7
Casein	44.8	37.5	42.1
Sugar of milk	31.3	27.5	30.8
Butter.....	47.7	59.5	53.0
Salts	6.0	6.8	7.5

After Vernois and Becquerel.

	Summer food.	Winter food.	Normal Human milk.
Water	859.56	871.26	889.
Casein and extractive matters	54.7	47.81	39.24
Sugar of milk	36.38	33.47	26.66
Butter	42.76	42.07	34.61
Salts	6.80	5.34	1.38

The effect of feeding cows on carrots is slightly to diminish the casein and butter, but to increase the sugar; whereas, if fed on beet-root, both the casein and butter are much more diminished, and the sugar is much increased. Here, as in the case of the goat, a milk is produced, which, except in the case of the salts, is very like woman's milk.

3. *Effect on Milk of keeping Cows in unhealthy Sheds.* The supply of good and selected food is, however, only one part

of the management needed to ensure good milk from milk-bearing animals. Excessive cleanliness should in every way be enforced. Upon the subject of the cleansing of cow-sheds, Messrs. Parmentier and Deyeux remark:—Nothing contributes more to maintain the good quality and quantity of cow's milk than scrupulous cleanliness in the shed. If the fæcal matters are left about and removed only at long intervals, the cows lying amid all this mess are always weak; the udders are hot; and the milk, so susceptible of acquiring a bad odour, soon contracts the bad taste, from which it is with difficulty again deprived. The great reputation of the cows of the Prevalaye is due to the remarkable cleanliness in which they are kept, which also enables them to yield an abundance of milk, and to be particularly innocuous to disease.

A very slight glance of what is revealed to us in Dr. Hassall's book as to the unhealthy localities and ill-ventilated sheds in which cows are kept in London, will convince any right thinking man that the cows in such localities cannot be healthy, and that their milk must also prove occasionally very detrimental.

I have, in the course of a large dispensary practice, visited some of the wretched inmates either in the immediate neighbourhood, or living over these sheds. On one occasion I remember having to cross through the shed to get to the small upper room above it to see a child infected with fever. The puddles of liquid and fæcal matters through which I was forced to pass, the abominable odour pervading the apartment, I have not yet forgotten; and yet from this cow-shed nearly the whole neighbourhood was supplied.

The character of disease affecting the wretched inmates of the small close cottages just around it was always low, if not typhoid. Many examples are given in Dr. Hassall's book of the wretched, filthy, and offensive sheds in which cows are kept. A common sewer would be in many cases equally serviceable. These facts are well known to most medical and to many general readers of the *Lancet*. I shall, however, content myself with a quotation from the *Lancet*, which retails Dr. Normandy's experience, and from some of the reports of the Officers of Health of later date.

In the Report of the Commission on adulterations (quoted by the *Lancet*, ii, 1855, p. 551), Dr. Normandy states he was lately in the neighbourhood of Clerkenwell for the purpose of examining a well in that locality, when he met with a sight which prevented him from tasting milk for six months afterwards. Dr. Normandy saw from thirty to forty cows in a most disgusting condition, full of ulcers, their teats diseased, and their legs full of tumours and abscesses; in fact, quite horrible to look at; and a fellow was milking them in the midst of all this abomination. This was by no means an exceptional case,

a great many dairies being in the same condition. The milk in consequence provided was really *diseased milk*. This state of the poor animals must have been produced by the manner in which they were kept.

In speaking of cowsheds, Dr. Hillier says of St. Pancras, that there are ninety-two such establishments, some well placed, with good drainage; twenty-two are not near inhabited dwellings; others quite underground; twenty with inhabited rooms above them; some surrounded by noxious exhalations. Their size is often very insufficient; the cubic space for each cow is sometimes as low as 230 feet; 1000 to 1500 being not at all more than cows require. The drainage is very bad in twenty or thirty. Very few are efficiently ventilated; whilst from forty to fifty are as bad as they can be in this respect. Forty of the sheds are kept in a most filthy condition. Seven sheds are without water supply. The manure is kept too long in seventy-six cases; in sixty-three, there is no suitable pit for it; in scarcely any is the place covered over. Occasionally the manure heap is immediately under the windows of dwelling-houses, and in some instances the receptacle for the contents of a privy. The grains on which the cows are fed are usually kept until they are sour, and give out an offensive smell. In seventeen sheds, the cows drank distillers' wash, which is kept in uncovered receptacles, and is very stinking. In addition, there is often vegetable matter lying about the yard, in a rotten state. In fifteen of the sheds, pigs are kept as companions to the cows. Some of the animals are kept very clean, being curried and attended to in the same way as horses. In many instances, on the contrary, they are fearfully neglected, and their coats are either one entangled mass of filth, or else are free from hair, owing to a diseased state of the skin. The deaths from diseases of cows are enormous. One gentleman, out of a large number, lost in one year ninety; another, who keeps fifty cows, lost three hundred in six years; another, with four hundred to five hundred cows, considered it not bad luck to part with two cows weekly from disease. Insurance prices tell a tale. *Country* dairy cows are insured at sixpence to sevenpence halfpenny in the pound; *London* dairy cows, at eighteen pence to two shillings in the pound; so that they consider the risk on town cows three times as great as on country cows. Dr. Sanderson, medical officer for Paddington, in his report, says the mortality of cows in Paddington was three hundred and four in 1856. In a large proportion, the drainage and ventilation were deficient, and fatal disease had prevailed to a frightful extent among the animals kept. No less than 19 per cent. of the whole number of cows had died in three months; in one case, all the cows died.

So much for a few dainty spots in this great town. But is it better in other parts of England, or in other great towns? When

diseased cows, many of which are, to use a common term, in consumption, or one mass of ulcers and abscesses, is it wonderful that so many children brought up by hand die in towns, while so few comparatively die in the country. No wonder, then, as Dr. Merei says, is it that cows' milk is so depreciated among the working classes. That gentleman states that, of all children fed on other articles besides bread (and the number, from another table, appears to be 602 out of 722), only seven, or 1·1 per cent., received cows' milk without bread or other admixture; twenty-seven, or 4·4 per cent., used it with arrow-root or sago, partly with flour.

There can be no doubt, from the general foregoing remarks, that if the subject were more closely studied, cows and goats might be so cared for and so fed as to yield a quality of milk which would be found most serviceable to children brought up by hand. The milk obtained from cows fed upon beet-root, with a very small dilution of water, might be brought so closely to resemble human milk as in all respects to perform the same services. But every day's experience proves that nothing but the most stringent measures can effectually remedy the abuses that prevail. Parliament must interfere: and in what better cause could it do so than by compelling all cowkeepers to sell good milk, to strengthen the bone and sinew of its people, and preserve the lives of thousands of helpless babes? Till this is done, our best efforts, it is feared, will prove nugatory.

Cream as a Substitute. I have before said that there are some cases in which no wet nurse can be found to suit a child; and in these, moreover, milk in its several forms may be tried, but the efforts to bring up that child upon milk will fail altogether. In many of these cases, it is observed that there is a great quantity of acid produced upon the stomach of the child, and the same effect results when that child takes saccharine matters. It is in such instances that the mixture of one part of cream to three of water proves often very beneficial. I have known a child reduced almost to a state of complete atrophy, gradually recover its good looks and strength on this change of diet. Cream in composition contains pretty nearly the same ingredients as milk, except that the casein is diminished, and the fatty matters considerably increased. In this manner, the absence of sugar is compensated for by the excess of fatty matters; and thus the fluid produced is sufficiently rich both as a nutritive and as a calorifiant aliment. The addition of water diminishes the density, and makes the mixture more digestible. If to every half-pint of this half an ounce of lime-water be added, the tendency to the formation of acid is removed, the solubility of the casein and the emulsion of the fatty matters are insured, and both these last become more assimilable.

What has been said will suffice on the use of the various

kinds of milk in their natural condition. But here I must take up two other points—1. The correction of inferior milks, so as to adapt them for infant purposes; 2. The preparation from strong and rich milk of a compound resembling human milk.

1. *Correction of Inferior Kinds of Milk.* Here I am especially indebted to Dr. Merei of Manchester for the information he has given me, which I have in this paper in great measure incorporated. If we take a tube nine inches long by half an inch wide, graduated in sixteenth parts of an inch, and put into it about two ounces of milk and the same quantity of water, and expose it to a temperature of 50° to 60° Fahr. for about eighteen or twenty-four hours, the cream will be found to have separated, and will be observed as a whiter, more opaque substance, floating on the surface of the milk. If this stratum above the milk amount to seven or eight of the graduated degrees, that milk is essentially good and rich, and contains about six and a half to seven and a half of butter. Medium milk will contain only five or six degrees; the worst kinds, only three degrees; and the inferior qualities supplied to the poor (skim milk), only two degrees. Here, then, is a ready means of measuring quality.

Now, experience has shown that such poor milk causes more gastric disorders than rich milk: nay more, that, to obviate this result, it requires a greater dilution than rich milk, notwithstanding its poverty. Dr. Merei attributes this to the preponderance of casein, which is one of the chief causes of gastric disorder. This casein, it is observed, is both *harder* and *coarser* in cows' than in human milk. This is, no doubt, one cause; but there is another which, I think, applies, and which is mainly due to the dishonesty of milk-dealers. The cowkeeper has already watered his milk, to separate a certain amount of cream from it. The retail milk-keeper has done the same very frequently. The butter has thus been already taken out. Lactic acid has formed, and what butter remains in the milk is scarcely now contained in perfect combination as an emulsion, but is disintegrated, or, as it were, in imperfect mechanical suspension only. The casein is perhaps in the same state.

Dr. Merei's experience in the method he adopts to improve inferior milks seems to point also to this view of the case.

In case of feeble children, with bowels previously deranged, he recommends that, instead of diluting the milk with water, we should add a decoction of arrowroot, made with one teaspoonful of this substance to three-quarters of a pint of water, this quantity to serve for the admixture of the whole day's supply. In more severe cases, the arrowroot may be increased to two teaspoonfuls. This arrowroot is not given as an aliment, but as a softish substance to soothe by its mechanical pressure the irritation of the intestinal mucous membrane.

Langenbeck, indeed, believes that, in such cases, the granules of starch intersperse themselves between the particles of casein, and thus in great measure prevent the formation of hard indigestible curds. The mixture Dr. Merei gives consists of three or four pints of this thin decoction of arrowroot to one part of new milk slightly boiled, and in the twenty-four hours amount of food thus prepared he adds about one to two tablespoonfuls of *cream*. Children will digest well from a pint to a pint and a half of this mixture in twenty-four hours, according to age. As they grow older, he increases the proportion of milk, but not of the cream. If an infant be tolerably strong and regular in his bowels, and has to be bottle-fed, under four months of age, a mixture of first rate quality of milk simply with water, in equal proportions, or, after three to four months, one part of water to two of milk, agrees well, if given at a temperature of 90°. For children liable to diarrhœa, a very thin and weak infusion of aniseed tea, instead of water, may be substituted. Where the gripings and diarrhœa are severe, it is well to combine a teaspoonful, three or four times a day, of dill or peppermint water and water in equal parts, with lime water and a trace of opium to allay the irritation. (Extract of private letter.)

The above has been very generally the plan upon which I have acted in these cases, with two exceptions. The ease now-a-days of giving cod-liver oil to infants, and its cheapness as compared with cream, have led me usually to prefer the former, which doubtless acts in the same way as cream in supplying an oily but highly assimilable combustive aliment. Also, I have usually combined sugar, because existing in cows' milk in smaller quantity than in human milk.

2. *Preparation from Rich or Strong Milk of a Compound resembling Human Milk.* My attention has been called to this possibility by Mr. Harry W. Lobb, a gentleman who for some time past has closely studied the subject. In page 133 in his little work on *Hygiene*, he gives us the following method of preparing Professor Falkland's milk for infants. I subjoin it here in full.

One-third of a pint of new milk is allowed to stand until the cream has settled; the latter is removed, and to the blue milk thus obtained about a square inch of rennet is to be added, and the milk vessel placed in warm water. In about five minutes, the curd will have separated; and the rennet, which may again be repeatedly used, being removed, the whey is carefully poured off, and immediately heated to boiling, to prevent its becoming sour. A further quantity of curd separates, and must be removed by straining through calico. In one-quarter of a pint of this hot whey is to be dissolved three-eighths of an ounce of milk sugar; and this solution, along with the cream removed from the one-third of a pint of milk,

must be added to half a pint of new milk. This will constitute the food for an infant of from five to eight months old for twelve hours; or, more correctly speaking, it will be one-half of the quantity required for twenty-four hours. It is absolutely necessary that a fresh quantity should be prepared every twelve hours; and it is scarcely necessary to add, that the strictest cleanliness in all the vessels used is indispensable.

The above is a very ingenious process, but it is open to objection in one or two particulars.

a. Messrs. Parmentier and Deyeux have shown that there is a disadvantage in boiling milk. When eight pounds of milk obtained from cows fed on grass, cabbage, potatoes, and maize, respectively, were distilled, eight ounces of a colourless fluid were obtained. That from those fed on grass was aromatic; on cabbage, offensive; on maize and potatoes, quite inodorous. Hence they infer that, if this volatile principle constitutes in any way one of milk's constituent parts, it must be wrong to deprive milk of it, or to expose it to those circumstances which favour its separation. Experience with infants has also shown me, that boiled milk is seldom so well borne as milk simply warmed by the addition of hot water.

b. The objection has been made by Mr. Lobb, that in Dr. Falkland's process scarcely enough casein is removed. That gentleman has another method of preparing this artificial human milk, which he calls *mincasea*, which I here subjoin.

"Half a pint of new milk is set aside for the cream to separate, which latter is removed; and to the blue milk half a teaspoonful of prepared rennet is added; this is placed over the fire, and heated until the curd has separated, when it is broken up with a spoon, and the whey poured off. In winter, three drachms of powdered sugar of milk are added to this warm whey; and the whole is mixed with half a pint of new milk. In summer three drachms and a half of sugar of milk are added, and with the new milk are all boiled together."

There is another formula given by Mr. Turner, a homœopathic chemist, of Manchester. Although I disbelieve the dogma of homœopathy, I am not above taking a lesson from an adversary. His formula is very simple. "Dissolve one ounce of sugar of milk in three-quarters of a pint of boiling water, and mix with an equal quantity of good fresh cows' milk." This process is simpler than Professor Falkland's and Mr. Lobb's, and, as such, I prefer it, and would fain recommend it, except that I should prefer water of a temperature of 160° Fahr. to the boiling water. The most ignorant nurse might prepare it easily in any part of the country where good milk can be procured.

The disadvantage which applies to this process in towns, as

I before stated, is the difficulty which attends the procuring of good milk. The same objection applies to many other places, as on board a ship. Something like a substitute may be found, however, in the employment of desiccated milks, to which if water in proper proportions is added, a milk presenting all the peculiarities of good rich milk is produced. Two of these kinds are known in London—Moore's Patent Concentrated Milk, and Grimsdale's Patent Desiccated Milk. In a communication received from Mr. Moore, through a late friend, that gentleman stated that his milk could be manufactured at 1*s.* 4*d.* per lb., which would be equal to one gallon of pure milk. The milk is, I understand, merely evaporated at a temperature under the boiling point. It appears to possess many advantages.

The other preparation, Grimsdale's Desiccated Milk, is not in the form of extract, but rather of powder, of the same bluish white colour as milk. This has rather a gritty feel to the finger, and, when put on the tongue, a strong milky taste; and it mixes readily with boiling water. It is then acid or alkaline. From calculation, one ounce of the powder requires 6·4 oz. of boiling water to make it of the same strength as milk. I have no experience of its uses or advantages. The objection to it seems to be, that it needs boiling water for its solution; nor am I aware if it is in its preparation evaporated to the consistence of an extract by heat, above or under 212° Fahr.

Other Substitutes for Milk. Eggs. It would appear natural, from the lessons comparative anatomy and chemistry give us, that where milk could not be procured, *eggs* would afford us a good substitute. Indeed, the egg presents several points of analogy to milk. It is true, we have albumen in the place of casein; but these two substances, for all practical purposes, may be considered as similar. The white of the egg is albumen in a very pure state, with about 22 per cent. of water, and 0·65 per cent. of salts. The yolk, with 52 per cent. of water and 1·52 per cent. of salts, contains as its albuminous compound a substance called *vitelline*, very like albumen in composition, but coloured by an oil containing phosphoric acid, and in its ultimate composition being a little richer in hydrogen and oxygen. Moreover, Barreswill has determined the presence of sugar in the white of egg. It has an alkaline reaction, which is due to the presence of carbonate of soda. The yolk, on the contrary, contains little or no alkali, and its emulsive character is to be ascribed to the presence of a substance very like pancreatic juice. The proportion of white of egg to yolk may be stated as 60·6 to 39·4, and 58·4 to 41·6.

The composition of the white and yolk of egg has been tabulated as follows :—

Composition of Egg (Gobley).

		Yolk.
Water		51.5
Vitelline		15.7
Margarine and Oleine		21.3
Cholesterine		0.4
Phosphorous body	7.2	
Oleic acid	1.2	8.4
Phosphoglyceric acid		
Cerebric substance		0.3
Salts		2.3
		White.
Water		77.15
Albumen		22.2
Salts		0.65

The salts raised to 100 parts contain according to Polack—

	Yolk.	White.
Chloride of potassium	—	42.17
Chloride of sodium	—	14.07
Potass	6.57	16.09
Soda	8.05	1.15
Lime	13.28	2.79
Magnesia	2.11	3.17
Sesquioxide of iron	1.19	.55
Phosphoric acid	66.70	5.79
Carbonic acid	—	11.52
Sulphuric acid	—	1.32
Silica	1.4	2.04

It will at once be seen that, in the quantity of phosphoric acid, and of chloride of potassium only to a larger extent, egg resembles milk and flesh, and, as such, must possess similar properties in nourishing a child.

I have already alluded to some of the uses of phosphoric acid. The excess of potash salts, of chloride of potassium especially, which, as in muscular flesh and milk, so greatly exceeds in quantity the chloride of sodium, is very remarkable. My friend Dr. Andrew Clark has also informed me that potash salts are always in excess in cell-developments, even when the growths are morbid—a fact of great importance, although often overlooked, as showing that those animal foods which contain an excess of potash salts should be preferred as aliments for growing children.

The white of egg, however, if given, should be given as nearly as possible raw, or, if warm, only heated to 130° Fahr. Beyond this temperature, it coagulates, and then becomes much more difficult of digestion. If the egg be put in boiling water

for two minutes only, except a thin external layer of albumen which will have been coagulated, it will be warmed throughout. Cows' milk contains, however, 5·5 of casein, and white of egg 7·7, or with the yolk 4·6. It should, therefore, be diluted; and, with a little sugar of milk added, it would form a very fair substitute for milk.

Bone Soups and Jellies have been recommended as aliments for children. The opinion at present almost universally entertained is, that gelatine, the chief ingredient in such soups, etc., although a nitrogenous substance, is, like hair, innutritious. It is unassimilable in children, as well as in older persons; and it only overloads the blood with nitrogenous products, which render this fluid impure and unfit for the purposes for which it is required. Still, as an emulcent in cases of irritation of the bowels, or for the exhibition of wine or particular remedies, jellies may be useful occasionally, just as we spoke of arrowroot in cases of intestinal irritation.

The last animal preparations to which I shall allude, as substitutes for milk, are beef-teas; and, of these, I shall speak of two kinds only—Liebig's Beef-Tea, and Hogarth's Essence of Beef. Meat possesses this advantage over vegetable food—in a given weight, it contains more nutritious matter. An essence or extract of meat thus contains, in a still smaller weight, all the nutritive properties essential to the maintenance of life, and, if mixed with a little fat, all the nutritive and combustible properties to be desired. Unfortunately, a complete extract of meat, which could be entirely soluble in water, cannot be made, owing to the insolubility of fibrine.

Liebig's Beef-Tea. When flesh is finely lixiviated with cold water, all its soluble matters are removed, and a perfectly tasteless, inodorous residue is left, which, in every case, is white like fish. The solution remaining consists of lactic and inosinic acids, creatine, creatinine, a nitrogenous organic acid, which forms a pellicle on the surface like casein, though differing from it in many other respects. There are several other ingredients not very clearly made out, besides tartrate of potash, phosphates, especially of the alkalies, a little lime, and more magnesia.

It is this solution which is to be evaporated to dryness, and constitutes the best extract of meat. In doing so, however, as the albumen in it coagulates at 133° Fah., and the colouring matter at 158° Fah., and would above this temperature be precipitated, it is advisable to evaporate it in a sand bath, at 120°; in this manner all the nutritive, combustible, and mineral matter will be retained. To this extract more or less water may be added, according as the strength of the tea is required. It is well to use on these occasions young animals in preference to old. In the former case the albu-

men will vary from 1 to 2 per cent., while in young it will be as high as from 12 to 14 per cent. The extract prepared by Mr. Roberton, of Manchester, obtained in the form of a dry powder, is the best I am acquainted with. However, except in cases where haste is required, there is scarcely any need of using this extract, since the beef-tea itself, prepared by lixiviation in water over night, is more easily obtained. This, also, should not be heated above 120° to 130°; never boiled. If more body is required in it, a little flour or fine oatmeal may be added to the tea, so as to thicken it; also finely divided meat may be suspended in it. A little lime water added to it will remove any acidity, if this be present in excess.

Hogarth's Extract of Meat Of the composition of this material, I can say nothing; I only speak from experience of its use. I have seen children, who have been reduced to a state of great weakness by feeding them by hand on improper diet, recover almost marvellously under its influence. That which I have used principally is the essence of beef. Its taste is much liked; and five or six teaspoonfuls by day, with a very little water, are well borne by children. Indeed, it is often borne in children affected with exhaustive diarrhœa from weaning, when milk and farinaceous food disagree.

This result may probably explain the success obtained by the administration occasionally in exhaustive diarrhœa, of raw meat, which is but a step further in this direction. "In these circumstances", says Dr. West (*Dis. of Children*, p. 498), "there is still one article of food—raw meat—which, strange as it may seem, is often eagerly taken, and always perfectly well digested." Professor Meisse, of St. Petersburg (*Journal für Kinderkrankheiten*, vol. iv, 1845, p. 99), first recommended its employment in children suffering from diarrhœa after weaning; and it has been since then frequently given by other physicians in Germany in cases of long standing diarrhœa. The lean either of beef or mutton very finely shred may be given in quantities at first of not more than two teaspoonfuls four times a-day to children of a year old, and afterwards, if they crave for more, a larger quantity may be allowed. I have seldom found any difficulty in getting children to take it; often, indeed, they are clamorous for it; it does not nauseate if given in small quantities, nor does it ever aggravate the diarrhœa; while, in some instances, it has appeared to have been the only means by which the life of the child has been preserved. With returning convalescence the desire for this food subsides, and the child can without difficulty be replaced on its ordinary diet.

From the foregoing remarks, we may conclude:

1. That maternal warmth and the semi-erect position are essential to a child while it is taking its food. Hence the need of *the mammary bottle.*

2. That asses' milk does not appear from its composition calculated to do good to a child, if persisted in for any length of time.

3. That goats' milk is proved, from experience, to be even in its normal state most efficacious to a child; and that if the goat be properly dieted, it will yield a milk closely resembling human milk.

4. That as in the case of the goats' milk, so in regard to the cow, if the milk be pure and the animal be properly dieted, the same results obtain in both cases; but that *in towns* cows are so shamefully kept and fed, and the milk is so watered, that cows' milk cannot be considered, as a rule, wholesome food.

5. That to remedy these abuses, stringent laws are imperatively called for.

6. That artificial milks closely resembling human milk may be readily prepared from pure cows' milk; and that these, together with beef-tea and eggs, may occasionally be safely substituted for breast milk.

52, Montagu Square, London, February 1858.

LONDON: T. RICHARDS, 37, GREAT QUEEN STREET.

PART IV.

VEGETABLE SUBSTITUTES FOR HUMAN MILK.

Food, as has been before stated, to be capable of supporting life, must contain three substances in due proportion—1. Plastic or nitrogenous matters, to nourish the fleshy parts of the body. 2. Calorifiant or combustible matters, *i. e.* hydro-carbons, to supply the respiratory process, to keep up animal heat, and to provide fat for the body. 3. Mineral matters or salts, to supply the bones, and hold in chemical union, combination and action the solids and liquids of the body. Among the first class are fibrine, albumen, or casein; among the second, fats and oils, sugar and starch; among the third, lime, potash, soda, magnesia, in union with phosphoric, sulphuric, hydrochloric acids, and many others. Some one or more of these are contained in all aliments in beautiful combination, and so these aliments are capable of supporting life. Singly, however, or as a simple substance, these plastic, fatty, or mineral matters cannot do this; starvation, in modified forms, being always observed to follow their employment when given alone.

Milk contains these elements in combination. There are casein, the plastic ingredient, fat and sugar, two combustible substances, and the several mineral matters needed. As such, if given in sufficient quantity, it will support life for any length of time. The proportions in which these elements are contained in other aliments vary; but it should at least be of 10 of plastic to 30 or 40 combustible, and the mineral should vary from 1·5 to 6 or 7 per cent. We have here to consider two questions as preliminary—1. Does analogy in animals, encourage or condemn the use of vegetable food for infants? 2. Is the chemical constitution of vegetable food such that (*a*) we can safely employ it as a substitute for animal food; and if so, (*b*) at what period should it be given?

1. The whole analogy of comparative anatomy proves that all young animals require animal food for some time after birth, because (*a*) this is generally supplied by the parent, or some adventitious animal structure. (*b*) The infant itself is so anatomically and physiologically made as to be capable only of digesting animal food.

(*a*) In many species of mollusca, and especially in gasteropoda, in many insect and among the batrachian reptiles, the mother produces, together with the egg, what is called a nidamentum, which nourishes it for some time after its birth.

Certain insects even feed upon the external envelopes which surround them, as in the case of the stratismys chameleon.

The yellow substance which surrounds the abdominal parietes in some animals, or which is inclosed in the central abdominal cavity, is an auxiliary of this kind. Its presence explains the fact that spiders and snakes, for instance, remain some time after birth without requiring any other kind of food. The raw food which the greater number of birds give to their young is exclusively animal, hence the more readily obtainable and digestible. The northern ducks and the petrels, with their nests situated on high rocks near the sea, easily procure this food, and they always return to their nests richly laden with fish. The sparrows nourish their young with insects and worms, which they find everywhere in abundance; and hence certain rapacious birds, which require a greater amount of animal food for their young, become at the breeding season particularly audacious in order to procure it.

Some of the sparrow and crow tribe bring the nourishment in their beaks, emptying it in those of their young. The rapacious birds, on the contrary, bring it in their claws, place it before their young, and tear it in small pieces for them. The heron and the pelican bring the fish in the pharynx, which is dilated to a large pouch below the bill; and the pelican applying its lower jaw against its own breast, allows its young to eat out of this pocket as out of a plate. Among some species of vultures and dark-winged eagles, the crop seems to serve as a reservoir for the food intended for the young. Approximating to a higher degree of maternal co-operation, the female does not give nourishment to her young till she has in part digested and assimilated it. The bees and wasps are of this class, and swallow some pollen, and then disgorge it mixed with honey. Among pigeons, the greater number of grallatores, some palmipedes, and many sparrows, the mucous membrane of the œsophagus is dilated in a crop, well supplied with vessels, into which the grain which is difficult to digest is first conveyed and then softened under the chemical influence of a fluid analogous to the gastric juice of the stomach. When half-digested, and converted into a kind of chyme, it is subsequently disgorged into the beak of its young. The male assists in this operation as well as the female. Finally, in mammalia we arrive at the production exclusively by the mother, of milk, which bears in its composition considerable resemblance to the diluted yolk of egg, and in some respects to the nidamentum. It will be seen from the preceding review that the food which is required by the young is essentially animal; and in those cases even where the birds themselves are granivorous or vegetable feeders, they either supply their young with animal food exclusively, or else with vegetable food so semi-digested in, or so intermixed with, the animal

fluids, that for all purposes it may be regarded as animal food. Gradually as the young animal becomes older, this exclusive dependence upon the maternal supply ceases. Among pigeons, for instance, after three days the young bird begins to partake of other food also.

The reindeer at the end of some days begins to eat grass and lichens, and the calf in about three weeks can no longer live exclusively on its mother's milk, but requires other food. Still the dependence of young animals upon the food which they directly obtain from the mother in the natural state, is very close. In the case of the simia rhesus, that animal attaches itself to its mother's nipple, and remains in this position for fifteen days, in sleeping as well as in waking, never leaving one breast, but to attach itself to the other. To endeavour, therefore, to nourish any young animal exclusively on vegetable food, is contrary to the entire law of nature, and especially so in man, where the parental relations are so much closer, and maintained for so much longer a period.

(*b*) The infant itself is so anatomically and physiologically constructed, as to be capable only of digesting *animal* food.

One would have thought that a very little reflection would have convinced any observer, that if among *herbivorous* mammalia the young require animal food, this is, *à priori*, a strong argument against the use of vegetable food in *omnivorous* or *carnivorous* animals; yet even upon this point our medical authorities are not agreed; many vegetable compounds are both recommended and taken. Apart from this commonsense view of the question, let us look to the physiological construction and anatomical arrangement of the alimentary canal of a child. Upon these points, Burdach in his *Physiology*, and West in his *Diseases of Children*, speak graphically. It is remarkable that suction is the only faculty for the prehension of food which the child possesses on birth, and even this is soon lost if not practised. The jaws are not so constructed as to permit active movements, nor the gums to bear pressure. The hard palate is, moreover, but little developed: albeit the cavity of the mouth is sufficiently wide. There is, moreover, no saliva secreted for the first two months, so that no species of preparatory change can take place in it, as in the conversion of starchy matters into sugar, through the agency of this fluid (saliva). The mouth is, therefore, merely an organ of transmission and suction. The lips are large, and the tongue and pharynx, uvula, soft palate, well developed, to secure these ends. (Burdach, p. 434.) The stomach in infants is a small tube-shaped membrane, dilated in the centre, one extremity ending in the œsophagus, and the other in the pylorus, resembling in this character that found in carnivora through life. In position, also, it lies more parallel to the trunk; the large and small curvatures and muscular structures being but

very little developed. The liver at birth is unusually large, the pancreas perhaps not more developed than the salivary glands; the intestinal tube is much shorter, and the large intestine approaches more nearly in its length to the small. The cæcum (in which, moreover, it is believed a sort of additional digestion occasionally occurs,) is very small. The peristaltic motion is more rapid. All these are evidences that food taken will be kept for a shorter time in the canal, and, therefore, should be in the condition most favourable for digestion. (West, pp. 402, 403.) In no other of the mammalia, lastly, is there, in the first periods of life, such a complete absence of teeth. In man they appear latest, and are longest in obtaining their complement. Comparing these appearances with those observed in herbivorous animals. Well developed salivary glands, compound stomachs, sometimes four in number, muscular gizzards, as in some birds, long intestines, large cæcum, etc., etc., are the exact opposites to what we find in young infants. As the child grows, the peculiarities which are permanent in herbivorous animals gradually present themselves. The stomach assumes a more horizontal position, the valvulæ conniventes become well developed, the peristaltic motion of the intestines becomes slower; in fact, all the changes calculated to retard the food in its progress, and thus to expose it more completely to the solvent juices for digestion, occur. All this, the reverse of what we find in infants, proves indubitably that animal, not vegetable food, is the proper diet for an infant; for it is evident that if among granivora and herbivora the food essential to their preservation when very young is animal, *à fortiori*, is it the case with the omnivora and carnivora.

2. Is the chemical constitution of vegetable food such that (*a*) we may safely employ it as a substitute for animal food; and if so, (*b*) at what period should it be given?

(*a*) As I have elsewhere said, animal food is, as it were, the essence of vegetable food, and far more digestible. But there is another peculiarity possessed by animal food. Liebig has shown that the blood in the body is preserved alkaline in carnivorous animals through the agency of the *subphosphate of soda;* whereas, in the case of herbivorous animals the salt which maintains the alkalinity of the blood is the *subcarbonate of soda*. This last result, however, only applies in the case where the food consists exclusively of the lowest grains, roots, green vegetables, and fruits, the ashes of which contain carbonates; because if lentils and the higher cerealia, as wheat, oats, etc., be employed, since their salts are nearly the same as the salts of blood, the subphosphate of soda is also found in the blood. But more than this; in meat, and the higher cerealia, not only have we a large quantity of mineral ingredient, but we have also a large quantity of plastic or nitrogenous element. The hydrocarbonaceous, calorifiant, or combustible element con-

tained is also in fair proportion, so that any of them may then be safely used. Still there is a very great disparity between these vegetable substances among themselves, and as compared with animal compounds. In order to make this clear, I have annexed the following table, compiled from Liebig and R. D. Thompson, in which the amount of nitrogenous or plastic matter being expressed by 10 in all cases, the relative amount of combustible or respiratory material is given for purposes of comparison.

Proportion of ten plastic to the following quantities of respiratory matters in the following articles of consumption :—

Veal	1	Rye flour	57
Hare	2	Barley	57
Beef	17	Maize	70
Lentils	21	Potatoes, white	86
Beans	22	East Indian rice	100
Peas	23	Dry Swedish turnips	110
Fat mutton	27	Potatoes, blue	115
Cow's milk	30	Rice	123
Linseed	30	Buckwheat flour	130
Fat pork	30	Arrowroot	260
Human milk	40	Tapioca	260
Wheat flour	46	Sago	260
Oatmeal	50	Wheat starch	400

The respiratory ingredient in these vegetable substances with large figures being chiefly starch (such as if digested at all becomes converted into sugar), would, as proved by Majendie's experiments, lead to the development of scrofula, from deficiency of plastic or nutritive ingredient. But from the non-development of saliva at an early period, it is to be feared even this change would not occur. And this seems, often at least, to be the case. In a paper published on the "Diet of Infants," Dr. Stewart, of New York, in speaking of the Parisian hospitals, says, "It is the custom at these and similar institutions, whenever an infant is sick, to withdraw him altogether from the breast, and to substitute for the milk some farinaceous substance, made fluid by boiling—arrowroot, gum, and rice water, or a thickened preparation of rice, known as 'crême de riz,' and other preparations of a similar kind, forming the diet of a sick infant. In the reported cases of the Foundling Hospital, and those for the reception of sick children, prescriptions of this nature form a very important part of the treatment, as will be seen by referring to the different treatises in French on the diseases of children." "The attention of M. Guillot having been directed to the changes which the food given to children underwent, and to the excessive mortality among them, he instituted a series of investigations in a number of cases of death, with special reference to the state of the contents of the

bowels. He was struck with the uniform similarity,—a jelly-like substance being present in the bowels, and in some instances lining both the small and great intestines. This was subjected to the test of the tincture of iodine, which produced an intensely blue colour, thus proving it to be starch." (Dr. Stewart on "Diet of Infants," *Dublin Journal*, 1845, pp. 141, 2.) This jelly-like substance is sometimes tinged with blood. Its presence, however, in the bowels of a child proves that starch is not digestible, at least in the early periods of life, which is, in fact, what we might have anticipated. In adults, it is converted into sugar; but if this change is not effected in the child, in whom two of the principal organs that bring about this change do not act at all, or at least very imperfectly, the presence of starch in the bowels in any excess must be detrimental and injurious. Yet how frequently, even by medical men, is arrowroot ordered in cases of diarrhœa as the exclusive diet!

I cannot conceive anything more injurious than this popular arrowroot feeding. I believe it is a cause of the death of many infants. The following example, one out of many, received from an authentic source, will suffice to prove this. A poor woman had had five children; all had been brought up artificially on arrowroot, and all had died. A sixth in due time was born, and she was strongly urged by a kind friend to try nourishing food, such as milk, beef-tea, etc., instead of the arrowroot. This she agreed to do. Meeting her accidentally some time afterwards, this friend inquired about the infant. The reply was, "Oh! it is dead; but it is no fault of mine, as I fed it on the best arrowroot that could be procured." So strongly rooted is the popular prejudice in favour of this starchy ingredient, which contains only 10 parts of plastic matter in 260 of combustible matter, instead of 10 in 40, as in human milk (see above table), and therefore never can suffice to nourish a child, especially a weakly one.

A favourite substitute, also, for human milk is barley—or patent barley, more properly. Here, again, we have a flour comparatively poor in nitrogenous material. But, besides this, it contains *dextrine*, a substance which even in the adult is difficult of digestion, and, *à fortiori*, must be so in a little infant. Its starch corpuscles are less soluble in the gastric juice, the milk is slightly acrid, and it is somewhat laxative. (Hassall.) When barley paste is washed, the milky fluid deposits, as well as the starch, a protein matter, supposed to be *insoluble* casein.

Next in esteem with the public is pap. Now pap is given very early. I have seen it given to a child from birth. It seemed to thrive upon it at first; but in about a month's time the child, which was enormous for size, sickened, and recovered only after much difficulty. Now, here the popular pre-

judice in favour of white bread proves often *a cause of death.* To show this distinctly, however, it will be necessary to recur to some of the saline constituents of wheat, as compared with those of milk; the comparative disadvantage of wheat-flour, as given in bread, being the decomposition of the phosphates into insoluble, and therefore useless, salts to the economy, and also to a marked deficiency in chloride of potassium.

The salts of milk are not the least important of its constituents. They are stated in the annexed table for human and cow's milk:—

Mean of two experiments.

COW'S MILK.		HUMAN MILK.	
Phosphate of lime	2·84		0·706
Phosphate of magnesia	1·06	Carbonate of lime	0·069
Phosphate of peroxyde of iron	·07		
Chloride of potassium	1·63	Other salts	0·053
Chloride of sodium	·29		0·098
Soda	·43	Sulphate of soda	0·074
	1000		1000

Schwartz in his *Journal* (vol. viii, p. 270) mentions as contained in 100 parts of human milk the following enumerated salts:—Soda, resulting from the decomposition of lactate of soda, 0·03; chloride of potassium, 0·07; phosphate of soda, 0·04; phosphate of lime, 0·25; phosphate of magnesia, 0·05; phosphate of iron, 0·001.

I pass on to speak particularly of the phosphate of lime. This salt, especially when combined with carbonate of lime, is most useful in the process of alimentation. It is to their combined agency that the solidity of the skeleton depends. Moreover, the peculiar property of phosphate of lime in making carbonic acid more soluble in the blood, is not one of the least interesting of its uses. Its administration, whether in a separate form or in aliment to a growing animal, is thus peculiarly indicated. Deformity of every kind in the skeleton may depend on an insufficient quantity of this salt in the blood; for it should be remarked, that firstly, not only is it useful because it is itself appropriated to the system; but secondly, it enables the blood by its peculiar property to take up more carbonic acid in solution; and thirdly, inasmuch as carbonate of lime being soluble in an excess of carbonic acid, so the quantity of carbonate of lime held in solution in the blood is thereby made greater, and is in this way from time to time more easily and largely deposited in bone. Chalk, or carbonate of lime, is insoluble in distilled water; but in proportion as this becomes saturated with carbonic acid, so it takes up a larger quantity of this chalk,—a property never to be lost sight

of, when it is wished to strengthen a growing child. Again, the phosphate of soda has an alkaline taste and reaction like the carbonate, and its solution in the presence of free carbonic acid takes up as much of that acid as carbonate of soda does; and, like it, only more easily, gives it off by agitation *in vacuo*, or by evaporation, without losing its power of again absorbing carbonic acid. Hence it follows that the change of acid combined with alkali by phosphoric acid has no pernicious influence, and *vice versâ*, because it gives rise to no alteration in the essential properties of the blood. The processes of sanguinification, of the production of heat and secretion, are carried on alike under the influence of the predominating alkali, as before stated. (Liebig's *Letters.*)

But phosphate of soda seems to possess another useful property in the economy. The fatty acids, stearic and margaric, are converted into emulsions in the chyle through its agency, so as to allow of their easy assimilation in the system. This peculiar property, discovered by Dr. Marcet, and lately exemplified by Dr. Thudichum before the Medical Society, is of immense importance in the explanation of the digestion of fatty matters, and is another reason for supplying food rich in phosphoric acid and soda, which is especially the case with animal aliments, to growing and weakly children; fat, it being well known, being the nucleus around which albuminous matters are deposited.

Of phosphoric acid in particular as an acid, and viewed in its regard to alimentation, there are several very interesting points of view. The blood is alkaline, and, as opposed to this flesh, is acid, this acidity being due to phosphoric acid. In vegetables, also, the excess is on the side of the alkali, except in the case of the more nutritious kinds of grain, which are rich in phosphoric acid.

There is one peculiarity in the solid portions of animal food, flesh, muscle, especially. These contain excess of phosphoric acid; but in muscle, and in soup made from muscle, we have also excess of chloride of potassium in lieu of chloride of sodium. Now there is considerable analogy in this respect in milk which contains an excess of chloride of potassium, although it also contains some chloride of sodium. The following table will show this:—

Composition of ashes of flesh. (Keller.)		When boiled there enter into the soup.	*Composition of ashes of milk.* (Com.)	
Phosphoric acid . . .	36·60	26·24	Phosphate of lime . .	50·7
Potash	40·20	35·42	Phosphate of magnesia	9·5
Earths and oxide of iron	5.69	3·15	Phosphate peroxide of iron	1·0
Sulphuric acid	2·95	4·95	Chloride of sodium . .	5·0
Chloride of potassium .	14·81	14·81	Chloride of potassium .	27·1
(Liebig's *Letters*, p. 428.)			Soda	6·7
	100	100		100

No doubt its large excess in the milk answers many of the purposes of the chloride of sodium in the economy. Chloride of potassium enjoys the peculiar property, however, in common with carbonic acid, of dissolving carbonate of lime or chalk. The use, therefore, of giving to the infant this salt for the purposes of the skeleton and the muscular system, is at once obvious.

To return, however, to pap,—and the first remark applies, if we except the pea and bean tribes, to most of the grains, which are all deficient in the same way. *There is no chloride of potassium in wheat, etc., and, necessarily, in bread. But more than this, the phosphoric acid is completety neutralised in its effects.* Englishmen like to use white bread, which, independently of containing less nutritive matter than brown bread, as I have fully shown elsewhere, contains alum. This adulteration is known to make inferior flour, and flour of a bad colour, white, and equal in appearance to flour of superior quality; and secondly, it enables flour to retain a larger quantity of water, by which means the loaf is made to weigh heavier.—(Hassall.) The bread is also less liable to crumble as it gets stale. Accum, quoted by Hassall, states the smallest quantity of alum that can be employed to produce this white appearance is 4 ounces to a sack of 240 lbs. Dr. P. Markham states 8 ounces to be the usual quantity employed, and Mitchell found in the 4 lb. loaves he examined the amount of alum varied from 34½ to 116 grains in each. 114 grains would amount to 20 ounces to the sack. (Hassall.) Out of 28 samples of bread in London examined by Dr. Hassall, in all alum was found, in smaller or larger quantities. The injurious effects of alum cannot be too strongly urged. Alum forms with phosphoric acid, as Liebig has shown, an *insoluble salt*, and so prevents the phosphoric acid from being appropriated to the economy. The blood becomes incapable of performing its duty, and hence children fed on it deteriorate, and in the end will die. And herein is the explanation of the frightful amount of disease observed in pap-fed babies. The phosphoric acid, so essential to them, is lost altogether. The brain and nervous system, the bones are arrested in their development; and hence also one reason for the great comparative success in bringing up children by hand in the country on home-baked bread, which contains no alum, and which, although of darker colour, provides phosphoric acid in an assimilable state to the child. But there is another way in which pap proves injurious. It more often, perhaps, than is recognised, is the *cause* of death. It has long been known that bread and milk, if given to canaries, in any quantity, swells in their stomachs, and thus, pressing against the heart, impedes its action, and often causes their death. The same result sometimes occurs in the infant. At pp. 44 and 46, *vide supra*, I have enumerated several

fatal cases in which the coroner's verdict assigned over-feeding with pap as the cause of death.

Another fraud extensively practised in London is the large admixture of *rice-flour* in bread. This, I believe, is not generally known; its great whiteness; its great power of absorbing water, are properties peculiarly well known to bakers, and not only ordinary bakers, but many of our hypocritical workhouse-poor feeders. I have been informed by a wholesale corn and flour merchant, that there is a species of rice-flour which is expressly kept for the purpose of adulterating bread, and which is largely employed by our London bakers, and in workhouses. In this way the nutritive power of the bread is considerably diminished, although the calorifiant power is increased, the proportion of the former to the latter being, instead of 1 to 7, as it ought to be in wheat flour, increased to 1 in 10 or 11, producing precisely the same results in the human frame as those which follow the employment of a diet too exclusively saccharine, viz., scrofula, atrophy, and all its dependencies.

Among the vegetable substances, that which comes closest to milk in its composition is, without doubt, *lentil powder*, or, as it is called for the purposes of obtaining a better sale, Revalenta Arabica, containing both phosphoric acid in abundance, and chloride of potassium; it also includes casein, the same principle which is found in milk. Moreover, its nutritive matter is to its calorifiant matter in the proportion of 1 to 2½, milk being in that of 1 to 2. No wonder, therefore, that under its influence many children affected with atrophy and marked debility have completely recovered. I have given it with the very greatest advantage in such cases, and, so far as I may judge from my own experience, I should conclude that practice fully carries out what theory, from a knowledge of the composition of lentil powder, would have led us to anticipate. Lentils have also a slightly laxative effect, and therefore, in many instances, where the child is of a constipated habit, they are to be recommended. Peas and bean meal in this respect resemble lentils; the former, however, is objectionable, because it produces flatulency. The latter is not generally obtainable; still the bakers take advantage of this fact in regard to the beans, and usually, where wheat by partial germination has lost some of its nitrogenous aliment, or where the flour used is poor in quality, add a proportionate quantity of white bean flour, to restore it to its proper nutritive value.

The only advantage which another popular ingredient seems to have (I allude to what is called *baked flour*), is that it contains a smaller quantity of water, which has been expelled during the heating process, and in this respect it comes to resemble more closely, because more concentrated, an animal compound. Moreover, from its greater capacity to absorb

moisture, it is somewhat more astringent, and less likely to produce diarrhœa, which indeed it often checks; but the absence of chloride of potassium and fatty matters in it, both so essential in growth and all development, is, I think, a fatal objection to it. Indian corn flour, which contains much oily matter, is preferable to it for this last reason. Hence, if either be given, they should, to supply fat and chloride of potassium, be mixed with milk.

Flour enters into the composition of many of the ordinary foods for children. The best combination which I have seen, and heard most favourably spoken of, is that prepared by Mrs. Wells, of the Laurels, New Hampton, in which it is mixed with sugar, and flavoured with a little spice, forming a most agreeable food for infants: so far as I have tried it, I am satisfied as to its effects being beneficial. One advantage it possesses, common however to all properly contrived mixtures, when these are already mixed in due proportions. Nothing is left to the discretion or the whim of nurses, often too careless when not too disposed to spoil the child's food by excess of sugar, so that in the hands of the most ignorant it may be safely used.

Among the best bread compounds made out of wheat flour, that which my own experience (because I have seen it frequently attended with beneficial results to children, who were evidently losing flesh and strength under other ordinary foods), are Robb's biscuits. I doubt not there are many more; but it is no part of my intention to make an examination of each of these. I lay down general rules, which I believe founded on a scientific basis. The application of these rules I leave to others.

6. At what period may vegetable food be given? *My reply is, not before the eighth month:* and for these reasons. True, man belongs to the omnivorous class; there must, therefore, be a time when vegetable food may be safely given. There is no doubt a relation between the period of time occupied in incubation or gestation, and the time when an animal is so far developed and grown to partake of herbivorous food without danger. Thus, if a granivorous bird occupy three weeks in incubation, a mammal one month in gestation, we should, *à priori*, expect the offspring of the former would be sooner capable of maintaining life independently of its parent than the latter. Again, the same thing would apply to an herbivorous animal provided with a stomach fitted for digestion of vegetables, *i. e.*, a compound stomach, as compared to a carnivorous animal, with only a membranous stomach, even though the period of gestation were the same in both. Thus, in the cow and in a woman, gestation has the same duration; but in the one case, the calf, we have the compound stomach; in the child, the simple membranous tube, and so the former depends

less upon its parent, and attains independent existence and maturity soonest. But the best test of capability of independent life in man is the dental apparatus. The appearance of the teeth is the only guide that a child is maturing rapidly, or the reverse; or whether it is or it is not in that condition when vegetable food may be safely administered. It was formerly stated in books that the following was the order of appearance:—

Ant. incisors	7th month
Lateral do.	9th „
Anterior molars	12th „
Canine	18th „
Post molars	2 years

Drs. Merei and Whitehead have shewn however that there are some important modifications to this rule. From their results, excluding those cases with only medium development, and reckoning those only with a favourable and those with unfavourable development, they conclude that in the former case, *i. e.* in 128 out of 161 children (or 79 per cent.), the first teeth appeared before the 8th month was past, in 38 at 8 to 9 months, in 12 after the 9th, and in 3 after the 12th; while in the great majority of children with unfavourable development, namely, in 71 out of 119 children (60 per cent.), the first teeth were cut at 8 months and upwards, in 46 from 9 to 12 months, and in 16 even after 12 months, and only in 48 (44 per cent.) before 8 months.

Upon these data, it would appear that the eighth month is about the earliest period that vegetable food may be borne. The teeth which appear are not of value as capable of mastication, but simply as indices that changes have occurred in the organs of digestion, which have progressed *pari passu*, and that the salivary and pancreatic glands, intestines, etc., the glands of the membranous stomach are in full development, and capable of doing duty. Then, and only then, therefore as a rule may vegetable food be given, and consequently weaning may be tried, if necessary. But even in this case the most easily-digestible vegetable aliment only should be administered, and it is best to continue also, in great measure, the animal milks in combination.

Individual cases may, of course, form exceptions. I have alluded to some of these before; and it is clear if development is earlier in some, so we may conclude that these could bear vegetable food at an earlier date.

The conclusions to which the present paper lead me, are:—

1. The analogy of comparative anatomy of warm-blooded animals, and the special anatomy of a child's alimentary canal, indicate that its food should be *animal.*

2. The vegetable aliment selected, should contain chloride of potassium and phosphoric acid among its mineral ingredients, and a due proportion of plastic as compared with calorifiant matters; excess of starch is very difficult of digestion.

3. If pap be given, it should be made with milk, so as to include fat and chloride of potassium in the compound, and not given in large quantities; above all, it should not be made with white town-made bread, which contains alum, and is nothing better than a slow poison.

4. The child should not be weaned, as a rule, or given vegetable food, if it can be avoided, before the *eighth month*. At this period it may be allowable to give vegetable food, yet even then it is well to combine it with milk.

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