

two glasses of rum-punch, and seemed tolerably comfortable. Next morning, Sunday, Dr. Heysham was found moribund, and before noon passed away in his eighty-first year.

His remains were interred in the burial-ground of St. Mary's, and in the most private manner. In the new Carlisle cemetery has been erected a small pyramid of granite, upon which are inscribed his birth and death, also that of his wife and their deceased sons and daughters. A few years ago Miss Heysham placed a beautiful memorial window in the eastern termination of one of the side aisles of the cathedral, to commemorate her father's character and virtues. The writer would humbly suggest that the admirable bust of Dr. Heysham, done by Mr. Watson the sculptor, and now in the possession of the Rev. John Heysham, the Vicar of Lazonby, should find a place in the Town Hall, or Courts of Justice of Carlisle, that future generations may see the image of a man who contributed largely to the material interests of the city, and by his Bills of Mortality made Carlisle known to the rest of the civilized world.

CHAPTER VII.

REVIEW OF DR. HEYSHAM'S LABOURS ; THEIR APPLICATION TO LIFE INSURANCE—"THE CARLISLE TABLE" COMPARED WITH "THE ENGLISH TABLES"—ESTIMATE FORMED OF DR. HEYSHAM'S SERVICES AT HOME AND ABROAD.

DR. HEYSHAM was a man of broad and vigorous thought, highly discriminative, and sagacious. He belonged to a class of minds that may be characterised as eliminating and suggestive; his readiness in separating the corn from the chaff, and in clearing the ground for correct deductions, was only equalled by his ability to apply patent data to the elucidation of unknown laws. Zealous and painstaking in the solution of all questions submitted to his notice, and an adept at figures and classification, he was well suited to the numerical methods of inquiry, and to achieve success in a field but little trodden—that of Vital Statistics.

Bills of Mortality had engaged other minds than his both at home and abroad, and previous to his time; but no one in England seems to have bestowed the same care in collecting the facts, and notifying the circumstances that necessarily creep in and modify the construction of all formulas resting on the contingencies of life and death. Slovenliness and incorrectness had attended

most inquiries pertaining to health and longevity, and done no small amount of harm; thus the British Government, as will be noted presently, trusting to exaggerated rates of mortality, had unwittingly robbed the national Exchequer, by their grants of annuities and pensions based on false data.

Dr. Heysham first made sure of the number of the population of Carlisle by a method that, in point of accuracy, almost amounted to a personal registration of each individual family. In collating the death-rolls, he recognised the age, sex, and matrimonial relations in the registered forms; nor did he overlook the general questions—the national status, the influence of war and peace, the dearth or abundance of provisions, the state of trade and local interests, the seasons of the year, the meteorological phenomena of the district, the prevalence of epidemics, and all other circumstances bearing upon the health, sickness, and mortality of the city. He kept his eye upon the actual increase of births beyond mere baptismal records; he noted the flow and ebb of Scottish and Irish immigration; the number whose patriotism led them to join the army and navy; and all the fluctuating circumstances surrounding an urban population.

The accuracy which guided Heysham's observations on the rate of mortality in Carlisle proved of the highest significance to the general community of Britain, and, it may be added, to the world at large. Wherever the question of life assurance has been discussed throughout the civilized globe, Heysham's labours have been recog-

nised and extolled for their meritorious application and usefulness. For it need hardly be said that the Life or Mortality Table is the basis upon which the whole science of life assurance rests; it is essential to the vital statistician as the barometer is to the meteorologist, the balance to the physicist, and the test-tube to the chemist.

The value of Dr. Heysham's work in Carlisle can be best instanced by the serious errors that sprang from incorrect observation and records made elsewhere. When Dr. Price was constructing the Northampton tables, a great number of Baptists lived in the town who did not sanction infant baptism, and thereby reducing the ratio of the christenings to the births, led Dr. Price to believe that the population of Northampton was stationary! The average lifetime in Northampton was in reality about 30 years, but Dr. Price, overlooking the Baptists, assumed it to be only 24. It is *now* $37\frac{1}{2}$, or 13 years (*one-third*) more than he took it to be! "And as a curious confirmation of the error, the mortality of the Equitable Society (which first used the Northampton Table) was *one-third less than that Table predicted*. But the most serious part of the business remains yet to be told. The Government adopted these tables as the basis for its annuity schemes. The same error which gave the Equitable and other societies using the Table *one-third too much premium*, induced the Government to grant annuities by *one-third too large* for the price charged; and before the error was rectified, about two millions of money were lost to the country by these annuity transactions."

Guided by Dr. Heysham's published observations, and the explanations elicited by his lengthened correspondence (set forth for the first time in the appendix to this volume) with the author of the Bills of Mortality, Mr. Joshua Milne constructed his famed "Carlisle Table." From the date of the publication of Mr. Milne's table in 1816, a new era in the life assurance world sprang up. Conjecture, occasionally wild if not chaotic, had to give way to a healthful reasoning upon legitimate data and sober facts.

Mr. Milne, whose experience as actuary to the Sun Life Assurance Society and high sagacity entitled his considerations to the fullest attention, was of opinion, that although the Carlisle Table had been constructed from the mortality of two parishes only, the results it exhibited would probably vary very little "from the general law that obtains throughout the kingdom, taking town and country together, if we except the children under five years of age, or at most under ten." "In other respects," says the editor of the *Insurance Guide*, "it has undoubtedly been the best guide to healthy life" in England, from the date of its publication at least up to the completion of Dr. Farr's tables. It gave the expectation of life for males at 30 in Carlisle at $34\frac{1}{4}$ years. The average duration throughout England at the same age is $33\frac{3}{4}$ years; and in Sweden and Finland, $32\frac{3}{4}$." Though the table showed results slightly too favourable for the whole country at all ages, the great fact remains, "that all properly conducted

offices, based upon the Carlisle Table, have met their engagements, and for the most part had very large surpluses to spare."

Benjamin Gompertz, F.R.S., in his calculations by logarithmic formulas* of the value of life at certain ages, shows the striking accuracy of Milne's tables formed on the Carlisle Bills of Mortality. Thus he found the value of the joint lives for ages from 20 to 30, at 3 per cent and Carlisle mortality, to be 16.745, which, according to Milne's tables, should be 16.749; an "insignificant difference," as Gompertz very truly observes.

It is a matter of fact, that the Carlisle Table, founded by Joshua Milne on the Carlisle Bills of Mortality, is used by a majority of the existing insurance offices. "The English Tables" based on 30 years' observation, and on data obtained from the records of mortality over the whole kingdom, will probably receive the attention of offices now forming, yet the two tables differ comparatively little; as is evidenced on the following pages 124 and 125. The Carlisle shows the lightest mortality, except at the extreme ages, namely from 0 to 5 years, and from 74 years down to the end of the Table, with the exception of one or two years. The minimum mortality in the Carlisle Tables occurs at the age of 10; in the English Table at 12.

* "On the Nature of the Functions expressive of the Laws of Human Mortality, and on a New Mode of Determining the Value of Life Contingencies:" in a letter to Francis Baily, F.R.S.; by Benjamin Gompertz, F.R.S. (*Lond. Philos. Trans.*, vol. cxv. p. 513). Gompertz had previously written on the same subject (*loc. cit.* A.D. 1820).

CARLISLE TABLE, MALE AND FEMALE.			ENGLISH LIFE TABLE No. 1. MALE AND FEMALE.		
AGE.	Number who complete that year.	Number who died during the next year.	AGE.	Number who complete that year.	Number who died during the next year.
0	10,000	1539	53	4211	68
1	8,461	682	54	4143	70
2	7,779	505	55	4070	73
3	7,274	276	56	4000	76
4	6,998	201	57	3924	82
5	6,797	121	58	3842	93
6	6,676	82	59	3749	106
7	6,594	58	60	3643	122
8	6,536	43	61	3521	126
9	6,493	33	62	3395	127
10	6,460	29	63	3268	125
11	6,431	31	64	3143	125
12	6,400	32	65	3018	124
13	6,368	33	66	2894	123
14	6,335	35	67	2771	123
15	6,300	39	68	2648	123
16	6,261	42	69	2525	124
17	6,219	43	70	2401	124
18	6,176	43	71	2277	134
19	6,133	43	72	2143	146
20	6,090	43	73	1997	156
21	6,047	42	74	1841	166

22	6,005	42	75	1675	160	154
23	5,963	42	76	1515	156	151
24	5,921	42	77	1359	146	146
25	5,879	43	78	1213	132	140
26	5,836	43	79	1081	128	134
27	5,793	45	80	953	116	126
28	5,748	50	81	837	112	117
29	5,698	56	82	725	102	108
30	5,642	57	83	623	94	98
31	5,585	57	84	529	84	87
32	5,528	56	85	445	78	77
33	5,472	55	86	367	71	67
34	5,417	55	87	296	64	57
35	5,362	55	88	232	51	47
36	5,307	56	89	181	39	38
37	5,251	57	90	142	37	31
38	5,194	58	91	105	30	24
39	5,136	61	92	75	21	18
40	5,075	66	93	54	14	13
41	5,009	69	94	40	10	9
42	4,940	71	95	30	7	6
43	4,869	71	96	23	5	4
44	4,798	71	97	18	4	2
45	4,727	70	98	14	3	1
46	4,657	69	99	11	2	
47	4,588	67	100	9	2	
48	4,521	63	101	7	2	
49	4,458	61	102	5	2	
50	4,397	59	103	3	2	
51	4,338	62	104	1	1	
52	4,276	65				

TABLE X.—POPULATION OF ST. MARY'S and ST. CUTHBERT'S in 1780, 1788, and 1796.

TOWNSHIPS OF QUARTERS.	1780.				1788.				1796.				Between 1780 and 1796.		
	Houses.	Families.	Males.	Females.	Total.	Males.	Females.	Total.	Houses.	Families.	Males.	Females.	Total.	Increase.	Decrease.
	English Street	208	319	639	732	1371	801	1030	1831	213	482	738	892	1,630	259
Scotch Street,	122	197	354	437	791	423	530	953	140	290	411	504	915	124	..
Fisher Street	53	82	130	194	324	143	222	365	52	75	134	183	317	..	7
Castle Street	81	143	220	307	527	320	411	731	162	260	379	496	875	348	..
Abbey St. and Annetwell St.	77	121	173	270	443	340	521	861	78	124	205	276	481	38	..
The Abbey	8	8	17	31	48	20	24	44	8	8	18	25	43	..	5
Total within the walls	549	870	1533	1971	3504	2047	2758	4805	675	1239	1885	2376	4,261	757	..
Botcheigate	95	202	385	457	842	259	329	588	172	330	689	762	1,451	609	..
Rickerigate	82	177	307	356	663	319	367	686	124	204	366	445	811	148	..
Caldewgate	165	356	592	698	1290	576	705	1281	322	541	1010	1183	2,193	903	..
Total Suburbs	342	735	1284	1511	2795	1154	1401	2555	618	1075	2065	2390	4,455	1660	..
Newtown	16	19	40	52	92	..	26	52	23	23	56	58	114	22	..
Haraby	9	10	31	41	72	..	31	72	8	8	19	32	51	..	21
Carlton	30	30	66	67	133	60	54	114	34	34	99	88	187	54	..
Wreay Chapelry	17	18	56	58	114	60	54	114	21	21	60	54	114	..	..
Brisco	32	34	107	85	192	95	59	154	34	35	97	94	191	..	..
Botcherby	21	22	46	52	98	43	46	89	19	19	38	40	78	..	..
Upperby	20	21	35	54	89	44	48	92	22	22	44	49	93	..	..
Blackhall	63	64	176	178	354	169	151	320	70	73	193	185	378	24	..
Cummersdale	22	22	60	50	110	105	123	228	33	36	112	110	222	112	..
Morton Head and Newby	27	27	57	67	124	..	..	..	30	31	75	70	145	21	..
Total in Country District	257	267	674	704	1378	633	618	1251	294	302	793	780	1,573	195	..
Omitted in parts of the City	..	..	..	..	..	30	36	66	..	..	..	..	..	..	..
Grand Total	1148	1872	3591	4186	7677	3864	4813	8677	1587	2616	4743	5546	10,289	2612	..

N.B.—The Population of Newtown, Morton, and Newby, in 1788, was most probably included in the Returns for Caldewgate and Cummersdale.

TABLE XI.
Number of CHRISTENINGS and DEATHS in both Parishes.

Years.	CHRISTENINGS.				DEATHS.				
	Males.	Females.	Total.	Dissenters.	Males.	Females.	Total.	Increase.	Decrease.
1779	102	109	211	?	133	125	258	..	47
1780	132	120	252	?	108	117	225	27	..
1781	136	130	266	?	103	101	204	62	..
1782	118	139	257	38	84	122	206	51	..
1783	139	123	262	35	85	96	181	81	..
1784	121	153	274	36	73	85	158	116	..
1785	148	119	267	28	94	110	204	63	..
1786	123	103	226	43	100	105	205	21	..
1787	145	122	267	51	101	98	199	68	..
1788	144	118	262	44	81	106	187	75	..
1789	131	109	240	53	107	106	213	27	..
1790	107	118	225	49	105	130	235	..	10
1791	129	127	256	67	171	173	344	..	88
1792	148	137	285	54	109	117	226	59	..
1793	141	139	280	48	107	109	216	64	..
1794	145	134	279	39	129	130	259	20	..
1795	144	122	266	30	131	157	288	..	22
1796	147	149	296	39	141	132	273	23	..

TOTAL BETWEEN 1779 AND 1796.

Christenings.

Males 2410 }
Females 2271 } 4681

Increase in Males 139

Deaths.

Males 1962 }
Females 2119 } 4081

Males — 157

Births + Deaths = 600

The Christenings of the Dissenters were not obtained for the years 1779-80-81. They are in the following years included in the columns of the Males and Females.

TABLE XII.

VIEW of the ANNUAL AVERAGE MORTALITY at different
Periods in CARLISLE.

Term.	Commencing with the Year	Ending with the Year	Mean Population.	Died Yearly on an Average.	
				Persons.	One of
9 Years.	1779	1787	8,177	204	40.00
8 Years.	1788	1795	9,458	246	38.45
5 Years.	1796	1800	10,667	249.2	42.80
22 Years.	1779	1800	9,209	229.73	40.09
10 Years.	1801	1810	12,660	285.8	44.30

The author of the article "Human Mortality" (*Encyclop. Britan.*, 8th ed., vol. xv. p. 638), after specifying the observations hitherto published from which the laws of mortality may be correctly determined—namely, those of M. Deparcieux in France, the Swedish, Dr. Heysham's at Carlisle, Dr. Cleland's at Glasgow, Mr. Finlaison's on the nominees of life annuities granted by Government in this country, and Mr. Morgan's on the lives insured in the Equitable Assurance Society—goes on to say:—"Those of Deparcieux, Finlaison, and Morgan, were made only on select classes of people; the Swedish are incomparably the most numerous and extensive; and whilst Dr. Cleland's exhibit the mortality in a large manufacturing town, Dr. Heysham's will, we believe, be found to be the best authenticated and most correct."

TABLE XIII.

A TABLE exhibiting the POPULATION and MORTALITY at CARLISLE for 35 Years, ending with 1813.

Year.	Population.	Deaths.	One of	Year.	Population.	Deaths.	One of
1779	7,677	258	29.76	1797	10,487	284	36.93
1780	7,739	225	34.40	1798	10,658	195	54.66
1781	7,864	204	38.55	1799	10,829	176	61.53
1782	7,989	206	38.78	1800	11,000	318	34.59
1783	8,114	181	44.83	1801	11,300	236	47.88
1784	8,239	158	52.15	1802	11,600	245	47.35
1785	8,364	204	41.00	1803	11,900	241	49.38
1786	8,489	205	41.41	1804	12,200	287	42.51
1787	8,614	199	43.29	1805	12,500	208	60.10
1788	8,805	187	47.09	1806	12,800	298	42.95
1789	8,996	213	42.24	1807	13,100	345	37.97
1790	9,187	235	39.09	1808	13,400	321	41.75
1791	9,378	344	27.26	1809	13,800	374	36.90
1792	9,569	226	42.34	1810	14,060	303	46.40
1793	9,760	216	45.19	1811	13,680	259	52.82
1794	9,951	259	38.42	1812	13,957	338	41.29
1795	10,145	288	35.23	1813	14,257	377	37.64
1796	10,316	273	37.79				

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The great increase in the rate of Mortality in 1800 was evidently owing to the great dearth, which produced the same effect all over the Kingdom. The same applies to 1785.

Before Dr. Farr constructed the English Life Tables, Professor De Morgan pronounced the "Carlisle Table" to be "the best existing table of healthy life in England." The life assurance offices in the United States of America seem to have endorsed this opinion, and made the same table applicable to their interests. And the magnitude of these interests at home and across the Atlantic, resting entirely on Dr. Heysham's operations, is far beyond ordinary computation.

Dr. Peacock, Dean of Ely, in his life of the famous Dr. Thomas Young, F.R.S., writes—"The experience of the London life offices, of which seventeen had been established a sufficient length of time, in 1843, to afford materials for discussion, has afforded a table of the expectation of life from the age of 20 upwards, so nearly in accordance with the results of the Carlisle Tables, as to leave no doubt of its correctly representing the rate of mortality, for the middle of life, of a past generation, amongst that class of persons who are concerned with insurances on lives; but the question may reasonably be asked, whether it is equally competent to furnish the value of the expectation for future generations as well as the past" (vol. i. p. 403). The Dean's questioning of the future of the Carlisle Tables was reasonably based on the improvements in the practice of medicine, the increasing temperance and better social habits of the people, and the general adoption of better sanitary arrangements by the country at large.

When the reader reflects on the size of Carlisle, and its suburbs and outlying district, so limited a range for the construction of a mortality Table, and compares it with the basis of the English Life Table, drawn from the mortality of the entire kingdom, he cannot fail to recognise Dr. Heysham's marvellous aptitude and attention. If the records of nine years, extending over a population that did not quite reach 9000, can be shown to vie with the data obtained from the whole community of England and Wales, and over a period of 30 years, not a word more need be said of the care and thorough knowledge Heysham displayed of his subject.

Carlisle, it may be supposed, offered a sanitary condition reflective of England at large. As a city of middle size—the population of its two parishes being five-sixths urban and one-sixth rural—its trading interests demanding a large proportion of operatives; its crowded lanes, like larger towns, favouring the spread of epidemics, small-pox, fever; and lastly, but probably first in significance, its large infantile population. These circumstances conspired to make Carlisle a fair epitome of the borough and landed interest, *quoad* the general health of the kingdom.

Though Dr. Heysham ceased to register all the details of the mortality in the way that had engaged him from 1779 to the end of 1787, he still watched the general results in the annual increase of the population, and the annual mortality of Carlisle.

Thus Table X. shows the population of St. Mary's and St. Cuthbert's in 1780, 1788,* and 1796; and Table XI. records the number of christenings and deaths in both parishes.

Wishing to show the annual average mortality at different periods in Carlisle, commencing with the year 1779 and ending with 1810, Table XII. was constructed.

Thirty-five years are summed up in Table XIII.

The many questions arising out of Dr. Heysham's Bills of Mortality, and subsequently his correspondence with Mr. Joshua Milne, are freely discussed in Mr. Milne's able treatise on Life Annuities.

A few more memoranda may not be altogether unacceptable to the reader, seeing that they tend to illustrate Dr. Heysham's painstaking exertions, and characterise the circumstances that affected the rate of mortality towards the close of the last century, also the changes brought about by the discovery of Jenner, and the adoption of hygienic measures, and not less the application of more scientific methods in the treatment of disease.

The accuracy of Dr. Heysham's observations compared with the Government returns is strikingly seen in the following Table, constructed from the seventeen years ending with 1796:—

* As before stated, the census was taken in December 1787; but as that of 1780 was taken in January of that year, it seemed the best approximation to make the census appear as taken in 1788.

	BAPTISMS.			BURIALS.		
	Males.	Females.	Both.	Males.	Females.	Both.
According to Dr. Heysham	2298	2162	4460	1829	1994	3823
According to the Government Returns	1864	1772	3636	1798	1946	3744
Omissions in the latter	434	390	824	31	48	79

And in the thirty-one years ending with 1810, the total number of burials in the two parishes of St. Mary's and St. Cuthbert's was—

According to Dr. Heysham	7654
„ „ the Returns to Parliament	7457
Amount of deficiencies in the latter	197

During Dr. Heysham's nine years' observations (1779-1787), when inoculation prevailed, 241 persons died of smallpox; and of these, 228 died under five years of age, eight persons between five and ten years, and only five persons above ten years of age.

Vaccination was introduced in 1800, and twelve years elapsed before a single death occurred in Carlisle from smallpox.

It may interest local readers to know that the population of Carlisle, its suburbs, and villages (St. Mary's and St. Cuthbert's parishes) was 11,094 in 1801, and that it increased up to 13,496 in 1811. At the time of the survey in 1811, the number of

families engaged in agriculture was found to be 236, or in the proportion of 78 to 1000; the families employed in trade, manufactures, or handicraft, were 2377, or 787 to 1000; "all others" not classified in the foregoing divisions, 409, or in the proportion of 135 to 1000 families.

The annual average number of deaths occurring in Carlisle during the first ten years of the present century was 10 out of every 443 of the population; and, if the deaths from smallpox be excepted, the mortality was exactly the same during the nine years ending with 1787. Owing to a great excess in the number of deaths in 1809, the average was raised.

According to Mr. Milne, when smallpox and typhus fever prevailed, as in the nine years ending with 1787, there would die annually 1 in 40 of the population of Carlisle; after the introduction of vaccination, 1 in 44; and, other circumstances being the same, with "little or no mortality from typhus fever, as in the first ten years of the nineteenth century," 1 in 46 of the population.

Dr. Heysham's observations on the comparative mortality of different diseases were all the more valuable that, in the capacity of physician, he could correctly represent the facts, both from his own knowledge and from the reports of his medical friends. The sphere of his survey was so far limited, but this was more than counterbalanced by his perfect knowledge of the district and the

people, their callings, and all other circumstances bearing upon the investigation. In his tabulation of the diseases, or specification of the causes of mortality, in noting the different seasons of the year of their occurrence, and in recording the respective numbers of the two sexes, Dr. Heysham shone above all his predecessors, and thereby rendered his work most acceptable and trustworthy. Mr. Milne remarked upon the high value of Dr. Heysham's statements, and their accuracy and minuteness, in part derivable from the moderate size of Carlisle, but mainly owing to the Doctor's zeal and personal acquaintance with all the data, numerical and medical. Except the Swedish returns, Mr. Milne was of opinion that the documents from which the Carlisle Table of Mortality had been formed were "the only data derived from a fluctuating population that have yet been published (1815), which furnish the means of forming an accurate table of mortality."

APPENDIX.



The CORRESPONDENCE between Dr. HEYSHAM and Mr. JOSHUA MILNE, Actuary to the Sun Life Assurance Office, on the CARLISLE BILLS of MORTALITY.

SUN LIFE ASSURANCE OFFICE,
LONDON, *12th September 1812.*

To Dr. Heysham, Carlisle.

SIR—Being engaged in inquiries relative to Human Mortality, and having met with your valuable Observations thereon, that were published at Carlisle in 1797, I have constructed a Table of Mortality from them, whereby it appears that the inhabitants of your city surpass in longevity those of any other place (so far as I am informed) for which a similar table has yet been constructed.

There are, however, several desiderata, that you may possibly have it in your power to furnish me with, which would enable me to render that Table much more worthy of confidence than I have at present the means of making it.

Under these circumstances, although I have not the honour of your acquaintance, your zeal in the cause of science and humanity, and the liberal and extended views that are unfolded in the little tract above referred to, have emboldened me to take this liberty, in availing myself of my brother's going to Carlisle, to request the favour of your furnishing me with such further information on the subject as it may be agreeable or convenient for you to communicate. As my brother neither understands the subject, nor takes much interest in it, it is necessary that I should write all I have to say; I must therefore beg your indulgence while I make a few remarks upon the documents I am possessed of, and state some of the difficulties which I hope to overcome through your assistance. As the pamphlet above mentioned is stated to be an *abridgment* of your

observations, I hope you may be able to refer my brother to printed information at greater length on the subject, which he will forward me, as I cannot expect you to take the trouble of writing at any great length: but that I may enable you to furnish me with such information as you may not have printed, with as little trouble as possible, I have kept my remarks and queries distinct, and having numbered each of them, have reserved a copy, so that answering them by their numbers you may not have occasion to repeat them.

I can neither expect nor desire that you should go farther into the subject than your taste or your zeal may render agreeable to you; but any information you may give, should it be ever so little, will be very thankfully received by, Sir,
Your most obedient servant,

JOSHUA MILNE,
Actuary to the Sun Life Office.

Expectation of Life at Carlisle by
the Table mentioned within.

Age.	Expectation.
0	39.86
5	51.23
10	48.68
15	44.73
20	41.23
25	37.60
30	34.03
35	30.84
40	27.44
45	24.18
50	21.03
55	17.63
60	14.29
65	11.66
70	9.05
75	6.90
80	5.42
85	4.43
90	3.15
95	1.94
100	.50

By the same Table it appears that out
of the whole number born

One of,	Attains the Age of
2	43 years.
3	63 "
4	69 "
10	79 "
5000	100 "

The Table was constructed from the enumerations of 1780 and 1787, given in Dr. Heysham's 3d Table, and from the Mortality given in the Doctor's 5th and 6th Tables, that took place from the commencement of 1780 to the end of 1787, that of 1779 not being included.

P.S.—I should also be much obliged to Dr. H. for his permission to publish such parts of his Tables, or other information he may be pleased to afford me,

as may give the proper degree of authenticity to such documents, and without which no deductions from them could have any just title to the confidence of the public.

REMARKS.

1. The statements of the number of annual deaths at every age under 20 years are as satisfactory as I could desire; but the number of the still-born is not mentioned.

2. The number of annual christenings brought to account must always be expected to fall short, more or less, of the real number of annual births. The christenings of Dissenters are expressly stated to be included; but Quakers do not baptize, and there are probably few years or none, in which some children do not die before baptism. I am informed that many poor Irish have settled in Carlisle of late years, much the greater part of whom are, I suppose, Roman Catholics: and it is said that some amongst the indigent classes neglect the rite of baptism altogether, to save the fees.

3. Calculating from the given number of annual christenings, and that of the annual deaths at every age under 5 years, I make the number of the living under that age, about one-tenth part less than it was found to be, by the enumerations of 1780 and 1787.

4. The whole number of the living under 5 years is given, without any specification of the number living in each particular year of age included in that interval.

5. The numbers, as well of the living, as of the annual deaths after 20 years of age, are only given for each interval of ten years, although it is very desirable that they could be obtained for each interval of five.

6. There is also given a statement of the number of the inhabitants in 1796, but the ages are not attended to, neither were they in the Surveys of 1801 and 1811 by order of Government; but, on some one or more of these occasions, probably Dr. Heysham, or some other gentleman distinguished by the same curiosity and intelligence, may have taken care that the numbers of the living at the different ages should be ascertained, as in the Surveys of 1780 and 1787, or still more minutely; and the information so obtained would not only be applicable to the most important purposes, but would very much enhance the value of what had been previously published.

QUERIES.

1. May there not have been births of Quakers, Roman Catholics, or others, which are not entered amongst the christenings in Table 8, although the deaths of some of them (under 5) may be entered in Table 5; and if so, what may probably be the proportion of these to the whole number of births?

2. May not some of those who migrate into the place in quest of employment, bring children with them under 5, whereby both the number of the deaths, and of the living under that age, may be increased without a corresponding increase of the births; and what proportion may the number of children so brought in, probably bear to the whole number in the place of that age?

If this and the last Query could be answered with tolerable precision, the difference noticed in the 3d remark might be accounted for, and reduced to little or nothing; then the remarkably small mortality amongst infants in Carlisle might be firmly established.

3. In Table 3, of the number of inhabitants of different ages, the sexes are not distinguished, which is much to be regretted, as we are thereby deprived of the very interesting and curious truths which might otherwise have been deduced from that distinction in the tables of the number dying annually at each age, and of each sex.

Can I be favoured with the numbers of the living thus distributed?

4. In the 10th page of the pamphlet we are informed that Dr. Heysham's tables of the numbers dying of different diseases at each age, are omitted, as wholly appertaining to medical subjects; but I should set great value upon them.

Could I be favoured with a copy?

Possibly, too, the number of the still-born may there be noticed.

5. If the living at each age were determined according to the 6th Remark, the deaths at all ages from 1787 till the time of such enumeration would be wanted.

Can they be procured?

CARLISLE, Nov. 1, 1812.

DEAR SIR—Your brother delivered to me your obliging favour on the 26th of September, and as I presume he will have by this time arrived in London, and put into your hands the volume of observations on the Bills of Mortality, etc., I take the liberty of informing you, you have my full permission to make what use of them you may think proper, and I shall now with pleasure com-

municate to you all the information in my power with reference to your remarks and queries.

Remark 1st. As the still-born were never entered in the register of deaths, I did not deem it necessary to notice them, and indeed, it would have been difficult to have obtained an accurate account of them.

2d. After the three first years (1779-1782) I think the number of christenings will be nearly correct, and will fall very little short of the number of living births, as I made it my business to gain the best information on the subject from every species of Dissenters. Although the Quakers do not baptize, they keep a regular register of births, which is annually transmitted from the different preaching houses in the country to the general meeting in London. With respect to the Established Church, I prevailed on our clergy to register all the private baptisms, which had not been the case before, and at that period we had scarcely one Roman Catholic family in the place. It is since that period that the great influx of the lower ranks of Irish Catholics has taken place.

4th and 5th. The information required in these remarks cannot, I am sorry, be obtained.

6th. The same difficulty occurs here. The Survey of 1796 was made by the editors of the *History of Cumberland*, and was, I believe, partly correct as to numbers, but no notice was taken of ages. The Survey of 1801, I have reason to think, was made in a slovenly manner; that of 1811 is tolerably accurate; you will find it pasted on the inside of the back of the observations.

Query 1. This is answered in a great measure by what I have observed on remark 2d.

2. There can be no doubt that, between 1779 and 1787, some few parents would bring with them into Carlisle children under 5 years of age; and, on the contrary, others would take children of the same age away with them, but what were the exact respective numbers of each at this distance of time cannot be ascertained; it may, however, be observed that the migration into, and emigration, was not very considerable during this period.

3. I am sorry I neglected to distinguish the ages of the different sexes.

4. You will find the Table of deaths and diseases of persons of different ages in the book I sent by your Brother, for every year except 1780, which, on examination, I found is wanting, and for that table I have made the most diligent search, but in vain.

5. The information required cannot be procured.

You will observe, by examining the Table of deaths and diseases of persons of different ages, that, in 8 years, 238 children, chiefly under 5 years of age,

fell victims to the smallpox; whether any died of that complaint in 1780 I cannot tell from the want of the table of that year,* but I am of opinion there would be few, if any, as the smallpox had raged so generally and dreadfully the year before. It may, therefore, be of importance to you to be informed that, since 1800, when the practice of vaccination was introduced into Carlisle, I have reason to believe not one person has died of the smallpox. The mortality, therefore, of infants for the last 11 or 12 years, will be much less than it was during the period of 9 years—namely, from 1779 to 1787. As I have no copy of what I sent you, I beg you will send it by some convenient opportunity, and

I remain, dear Sir,
Your much obliged humble servant,
JOHN HEYSHAM.

SUN LIFE OFFICE,
LONDON, 11th November 1812.

Dear Sir—I received in due course your very obliging favour of the 1st inst., and have been much gratified by the kind and handsome manner in which you received my application, and by the particular attention you paid to each of the inquiries I troubled you with.

I also received (through my brother) your valuable volume of observations; after all the pains you had taken in collecting those for 1780, it is much to be regretted that the Table for that year should have been lost; those, however, that have been preserved are much more complete and valuable than anything of the kind that I am acquainted with.

I have composed a Table from them, exhibiting the aggregate results at one view, and beg leave to hand it you herewith; in order to bring it into a convenient size, you will observe that I have added a supplemental Table of the diseases whereof not more than one died.

I have taken the numbers of the genera from the edition of the *Synopsis Nosologia Methodica* of Dr. Cullen, that was published at Edinburgh in 1803, being, I believe, the last, and have included the pleuritic cases with the three of Peripneumony that occurred in 1782, all under the same genus *Pneumonia*; these, I think, are the only liberties that I have taken, and I beg you would have the goodness to correct any error I may have fallen into in so doing, and

* The Table of 1780 was afterwards found, and showed only 3 deaths from smallpox.

inform me of it, if you do not intend to publish the Table yourself, as in that case I would rather avail myself of your permission to do so, than suffer it to be lost to the public.

I have the "Abstracts of the Answers and Returns made pursuant to the Population Acts of 1801 and 1811" that were printed by order of the House of Commons, but unfortunately the ages were not taken.

I am happy to hear of the complete success that has attended the practice of vaccination at Carlisle. It is quite obvious that the mortality amongst children must have been entirely changed since the introduction of that practice.

You will also receive herewith the volume of observations, which I hope you will not find injured by the use I have made of it, and I shall be happy to hear of its arrival in a state that was satisfactory to you. As soon as the work I am engaged upon is printed, I shall have the pleasure of sending you a copy, which, however, will not, I fear, be for many months yet.—I am, yours, etc.

JOSHUA MILNE.

The letter from Dr. Heysham of January 7, 1813, to Mr. Milne has been lost.

SUN LIFE OFFICE, LONDON,
13th January 1813.

To Dr. Heysham.

DEAR SIR—I duly received your esteemed favour of the 7th instant. Although, after the trouble that the Table of Diseases for 1780 must have cost you, it certainly is a pity it should be lost, I do not consider that that circumstance lessens in any material degree the value of those that remain; as the general mortality of that year appears from your other statements to have been almost exactly the common average.

What in my opinion renders your Tables of Diseases peculiarly valuable, is their being continued for so many years, and the diseases having been ascertained by yourself, and those medical friends whom you induced to furnish you with the requisite information.

I beg you would accept my best thanks for the trouble you have taken in examining the Table I compiled from yours, and for your authority to publish it.

I have been rather surprised at your expression of astonishment at finding how few there are now living of the gentlemen to whom you had presented these Tables annually, as they were published, about 30 years ago; since your

tables of the number of annual deaths at every age afford the most indubitable proofs of a singularly small mortality amongst the general mass of the inhabitants of Carlisle. You may perhaps indeed only mean that, as you have not been in the habit of keeping any register of the number of your departed friends, you had no idea before how much you had been favoured yourself in surviving so many of them.

But, to facilitate to you the determination of the question whether or no the mortality has been greater amongst your friends than the general mass of the population of the same ages in and about your city are subject to, I insert this little Table :

Out of 100 living in Carlisle at the age of	30	35	40	45	50	55	60	65
The number that survive 30 years is .	64	56	47	35	21	11	4	1
Being then aged respectively . . .	60	65	70	75	80	85	90	95

If the respectable gentlemen you mention have gone more quickly off the stage, you will probably think with me, that inactivity and repletion may have accelerated their course in comparison with that of their poor neighbours.

I acknowledge that it is altogether unreasonable in me to give you further trouble after what you have already had. But if you should take sufficient interest in the question yourself, you would oblige me by informing me at your leisure, how you consider the industrious classes of the people in and about Carlisle, and especially the labouring poor, to have been circumstanced, as to the facility of obtaining a subsistence, during the nine years in which your observations were made, in comparison with their general circumstances for the whole time within your memory or knowledge.

The general rate of mortality that results from your observations, corresponds very exactly with that which, in my opinion, may be legitimately deduced from the enumeration of the people, and the extracts from the parish registers throughout England and Wales, that were printed by order of Parliament in 1802 and 1812; but it is considerably less than that of any town in Britain wherein such observations have hitherto been made, or than the general mortality of any foreign country except North America, where the incessantly increasing demand for labour has greatly meliorated the condition of the people. As the number of persons in the class above referred to is incomparably greater than in those above them, the general results of such tables must always depend principally upon them, and therefore a continually increasing demand for labour for a certain period, might keep the rate of mortality during its continuance

materially below the level at which it might have stood, both before that encouragement had been held out, and after it was withdrawn.

Thus it is obvious that, if the period intervening between the years 1778 and 1788 should have *accidentally* been one of great prosperity and increasing opulence in Carlisle, it might be very unsafe to draw any conclusions as to future events from Tables depending upon such accidental data. I have not the least reason to think that has been the case, but both on account of your judgment and your accurate local knowledge, your sentiments on the subject would be highly esteemed by, dear Sir, yours, etc.

JOSHUA MILNE.

CARLISLE, February 6, 1813.

MY DEAR SIR—You will recollect that my Observations were published during a period of war, and in that respect similar to the present times; but perhaps you may not recollect that during the American war the price of all the necessaries of life was extremely different from what it has generally been during the present war. But if at that time food was cheap, wages were also low, and I think that the labouring classes have lived better during the last fifteen years (the years of scarcity excepted) than from 1778 to 1788, and I am also of opinion that the mortality of late has been diminished. In my former communication I have stated the difference with respect to the smallpox among children, and I have now to inform you that, for the last fifteen years, we have had, notwithstanding the great increase of population, very few cases of typhus, a disease, as you will see by examining the Tables, in a great measure fatal to adults. No less than 119 died of that disease during the nine years. This number I have been able to ascertain, though the Table for 1780 is lost, having noticed in the body of the Observations that three died of that disease in that year. Therefore, taking it for granted that the mortality from all the other disorders remains nearly the same, it is evident the general mortality must be diminished from the absence of these two fatal complaints, the first chiefly to children and the second to adults. In order, however, to enable you to judge of our present situation, it occurred to me, upon the receipt of your last favour, that you might derive benefit from a statement of the Bills of Mortality for the year 1812. I have selected 1812 in preference to 1811, when the last survey took place, because that year was peculiarly healthy, no epidemic of any kind having appeared; whereas, I apprehend 1812 may be esteemed a pretty fair average year (notwithstanding the very high price of provisions), two epidemic diseases having prevailed—namely, the measles and the hooping-cough. The measles commenced in the latter end of June or beginning of July, and as that disorder

had not visited Carlisle for several years, there were a large number of children liable to infection. The disease was consequently very general; I conceive upwards of 1000 were affected. The epidemic, however, was extremely mild, and considering the number affected few died. Before I offer any observations on the christenings and burials, I will give you a comparative statement of the deaths in the parish of St. Cuthbert in the last two years. In 1811 the deaths were only 97; in 1812 they amounted to 151.

Before the returns of the survey of 1811 were transmitted to the proper office in London, I examined them with great care, and found the population of the two parishes of St. Cuthbert and St. Mary, Carlisle, to be 13,495. I deemed it, however, prudent to delay writing to you till I had an opportunity of comparing my account with the account published by Government; and as our clerk of the peace, to whom the work was transmitted, does not reside in Carlisle, I did not receive it till within these few days. On examination, I found a difference of *one*, which difference occurs at Harraby, where I make the inhabitants 57, the printed work makes them 58; this error has either arose from the enumeration or the press. As you are no doubt in possession of the work, by referring to page 49, letters (l) and (m), and to page 54 summary, city of Carlisle, you will find the population to be 13,496, I shall therefore take them at that number. In 1812, the 55th Regiment of Foot and a troop of the 2d Dragoon Guards were stationed at Carlisle, amounting to 300 men, and some of these men had wives and families; but as both regiments have lately been removed, it is impossible to ascertain the exact number of wives and children, and as it will be perhaps best to err on the safe side, I shall consider the population at 13,796. The burials are accurate, but I apprehend the christenings will fall considerably short of the births. The minister of one of the Dissenting congregations was taken ill early on and died before the conclusion of the year, and no successor has yet been appointed. We have also a small number of Anabaptists, who, I understand, do not baptize children. With respect to the Established Church, although there are no fees paid for christening, yet here, as in most other places, the parents give an entertainment to their friends on the occasion; many, I understand, delayed the ceremony last year on account of the distressed state of the times.

Of the number of christenings 3 were Quakers,* 15 were Presbyterians, and 48 were Catholics—total 66.

* Dr. Heysham must have meant three births among the Quaker body, as Quakers do not baptize.

The following statements regarding the Births and Burials in Carlisle were sent to Mr. Milne on the 6th February 1813:—

	Males.	Females.	Total.
Baptisms—Saint Mary's . . .	123	105	228
Saint Cuthbert's . . .	89	99	188
Wreay Chapel . . .	5	5	10
Births among Quakers . . .	2	1	3
Baptisms—Roman Catholics . . .	25	23	48
Presbyterians and others	8	7	15
	<hr/>	<hr/>	<hr/>
	252	240	492

Burials—Saint Mary's . . .	81	101	182
Saint Cuthbert's . . .	76	75	151
Wreay Chapel . . .	1	0	1
Quakers . . .	2	2	4
	<hr/>	<hr/>	<hr/>
	160	178	338

Excess of Births over Burials . . . 154

	Males.	Females.	Total.
Deaths in 1812 . . .	160	178	338
Christenings in 1812 . . .	252	240	492

Deaths in St. Cuthbert's . . .	151
Deaths in St. Mary's . . .	187
	<hr/>
	338

Should you require any further explanation you may command my services.
—I remain, dear Sir, yours, etc. J. HEYSHAM.

SUN LIFE OFFICE, 13th Feb. 1813.

DEAR SIR—I received in due course your obliging favour of the 6th inst., and beg leave to thank you in the kindest manner for the great and successful pains you have taken to satisfy the inquiries I troubled you with.

I shall always consider myself to have been peculiarly fortunate in having procured the assistance of a gentleman whose zeal disposes him, no less than his abilities qualify him, to render it of the most effectual kind. I am in possession of all that has been printed by order of Parliament on the population of the kingdom, and the numbers of annual baptisms, burials, etc., for the last century.

I did not fail to compare those for Carlisle with your valuable Tables, and had the satisfaction to find that your numbers were always the greatest, consequently your omissions (if any) the least; in the number of burials the difference is generally small, but in the baptisms almost always considerable.

I have also compared the statement of the population in your last favour with the parts of the last published "Abstract, etc.," which you referred me to, and find it perfectly correct.

I am particularly obliged to you for the baptisms and burials of the last year, and am much gratified to find the mortality so small, even in a year of hardship and scarcity that succeeded several of prosperity and plenty.

Drs. Haygarth and Percival, many years ago, began to remark a gradual diminution in the general mortality, as may be seen in their excellent papers in the *Philosophical Transactions*; Dr. W. Heberden, in his tract on the Increase and Decrease of Diseases, showed that it still continued to decrease, not only here, but in the principal cities of Europe, though more slowly; and there is, I think, every reason to expect that, as the arts and manufactures approach perfection, and a taste for their productions diffuses itself lower and lower amongst the industrious classes, the ravages of putrid and pestilential diseases will diminish. But while such nests of poverty, wretchedness, and pestilence, still exist in crowded cities, as that wherein you state the jail-fever of Carlisle to have been engendered, in your valuable and interesting tract on that subject, and which the late and much to be lamented Dr. Willan, in his work on the Diseases of London, shows to be still but too common in this metropolis, the general mortality in great towns must, I fear, continue to be much higher than in your favoured city. I beg pardon both for the haste and carelessness wherewith I write to you, and for the digression I have insensibly wandered into.

It remains only that I thank you for your obliging offer to continue your valuable communications in case I find myself under the necessity of troubling you again; and I remain, dear Sir,

Your much obliged, etc.,

JOS. MILNE.

SUN LIFE OFFICE, 31st December 1813.

DEAR SIR—In consequence of your obliging offer to give me any further information I might want, I trouble you once more.

You no doubt think me slow; but I have not been idle. I have experienced considerable difficulty in getting the algebraical part of the work I have in hand

printed to my mind; it is now, however, about half finished, and I hope to publish early in the spring.

I am just now entering upon the popular part, where I have occasion to show upon what authorities the Tables depend, and to compare the mortality at Carlisle with that which the late returns to Government from all parts of England and Wales exhibit.

It will be useful, too, to compare the present mortality at Carlisle with that which prevailed during the time of your observations. This, I think, will be best done by taking the annual average number of deaths during the five years, whereof 1811 was the middle one, and comparing that with the number 13,796, which (including the military, with their wives and children) you consider to have been the actual population in 1811.

No safe inference can be drawn from the mortality of a single year; but if you consider the addition of 300 for the military to raise the population too high for the average of these five years, I have to beg you would be kind enough to say what number you consider to approach nearer the truth.

The part of the requisite information which I already have I insert here, that you may correct it if you find it necessary; and hope you will be able, without much trouble, to supply the number of deaths in 1811 and 1813.

	Deaths of		Births.	Authorities.
	Males.	Females.		
1809	155	210	365	} Returns to Government.
1810	147	148	295	
1811	127	132	259	*
1812	160	178	338	Your favour of 6th Feb. last.
1813	188	189	377	*

If the distinction of the sexes be attended with any trouble whatever, pray omit it, and I am not much concerned about the christenings.

To a work just published by Dr. Watt of Glasgow, on "The History of Nature and Treatment of Chincough," there is subjoined, "An Inquiry into the

* The information asked for by Mr. Milne for the years 1811 and 1813, I have taken the liberty of inserting along with the other returns; it is contained in Dr. Heysham's letter of January 23, 1814.

Relative Mortality of the principal Diseases of Children, and the number who have died under ten years of age in Glasgow during the last thirty years," by which it appears that smallpox still occasions some mortality there, and that the mortality from measles has increased almost as much as that from smallpox has diminished. The work, I think, cannot fail to interest you, and lest you should not at present possess it, I beg leave to hand you an extract which contains what is most material with regard to the changes that have taken place in the relative mortality of the diseases of children. Pray favour me with your sentiments on the prevalence and the fatality of measles, or any other diseases which may have appeared to increase, either in the degree of their mortality, or the frequency of their occurrence, since the introduction of vaccination. I hope, too, to hear none have died of the smallpox in 1813.

From your information respecting whooping-cough and measles in your favour of February last, I have little doubt but that your case in Carlisle has not been similar to theirs in Glasgow.

In the work I am employed upon I shall have occasion to notice some of the results of inquiries which have been made, in Sweden, into the relative mortality of different diseases, where registers have been kept of the numbers that have died of each disease throughout the whole kingdom (consisting of a population of three millions) for more than 20 years.

I find that *the remittent Fever of Infants*, which they express by the single word *Alta*, makes a conspicuous figure. You have probably seen a pamphlet published by the late *Dr. Rutter*, on this disease, in 1782 (2d edition in 1806); and *Mr. Coley*, a surgeon at Bridgenorth, has just published a work on the same subject. Pray inform me if what you have called, and has been generally called, worm-fever, be not the same, and whether you would wish me to call it *the infantile remittent fever* in what you have authorised me to print. Uniformity of nomenclature and classification, certainly, is very desirable in such Tables, which otherwise lose half their value, from the difficulty of comparing them with each other.

By forwarding such information as it may be convenient for you to collect, or to communicate at the earliest opportunity, will yet further oblige,

Dear Sir, yours already obliged, etc.,

JOS. MILNE.

23d January 1814.

DEAR SIR—I received your favour of the 31st of December, and, with pleasure,

communicate every information in my power, and am glad to find your work will be published in the course of this season.

With respect to any increase in the mortality of measles, I have not observed it here any further than, in consequence of no deaths from smallpox, a greater number of children will be liable to be infected with that disease when it prevails, than would have been the case had a considerable number of them been carried off by smallpox. So far with respect to the facts, and in what manner vaccination can predispose the bodies of children to be more severely affected by measles I do not pretend to know. From the extract you have enclosed, I find the measles have been epidemic every year from 1807 to 1812 in Glasgow—namely, 6 years. Such is not the case either in Carlisle or in the county of Cumberland, the disorder generally only appearing about every 4, 5, or 6 years.

The scarlet fever, certainly, occurs more frequently of late than was formerly the case, but then it does not spread so extensively, and, I apprehend, taking into consideration the difference of population, it is not more fatal than it was during the period I published the Observations.

I have not had an opportunity of seeing the works you allude to on the subject of infantile diseases, but am disposed to believe that worms (the tape excepted) are not attended with very fatal consequences; when, however, they exist in the intestines, some are generally expelled in almost all febrile diseases, and hence they have, by the vulgar, been considered as the cause. I therefore see no objection to your altering the designation.

In the beginning of September last a poor woman from Scotland, with her child just recovered from the smallpox, came to a lodging-house in one of our suburbs, and communicated the infection to some children residing under the same roof; from these, others in the neighbourhood caught the disorder, to the number of 12 or 14—of them two died. By having recourse to vaccination, the progress of the disease was soon checked—no one case having occurred since the beginning of December. These two are the only deaths from smallpox in Carlisle since vaccination was introduced. Subjoined you will find an *accurate* account of the deaths in 1809, 1810, 1811, and 1813; the numbers do not agree with the Government returns, which, I apprehend, you will seldom find correct, even with respect to burials, and still seldomer with respect to christenings. The difference here, I apprehend, arises from the burials of Quakers having been omitted. It is somewhat unfortunate that during this period, considerable fluctuations have taken place in the population of Carlisle. I am perfectly satisfied our population was the greatest in the year 1809, and until the month of September 1810. During that month a sudden and almost total

suppression of the manufactures of this city took place ; in consequence a very great number of families were thrown out of employment, which occasioned a considerable emigration. I am of opinion no less than 1000 inhabitants left Carlisle between the 1st of October 1809 and the latter end of March 1811 ; however, to be on the safe side, I would advise you to take them at 600. The survey ordered by Government was made in April 1811, when the emigration had ceased, and I conceived the population remained nearly stationary from that period to the latter end of 1812, when, from the patriotism and valour of the Russians, trade and manufactures began to move, and are now in full vigour ; and I think you may safely take the increase in 1813 at 500. In 1809, 1810, and 1811 we had full 100 soldiers, which will make 700 in the two first years to be added to the population of 1811, and 100 to that year. The 74th Regiment succeeded the 55th Regiment, which, with detachments and recruiting parties, made the Garrison full 300, independent of soldiers' wives and families, during the last year. I therefore consider the population of Carlisle for the last five years to be as follows,—namely, in

1809.	Resident Inhabitants	-	-	-	-	-	14,096
	Soldiers	-	-	-	-	-	100
							<u>14,196</u>
1810.	Resident Inhabitants	-	-	-	-	-	14,096
	Soldiers	-	-	-	-	-	100
							<u>14,196</u>
1811.	Resident Inhabitants	-	-	-	-	-	13,496
	Soldiers	-	-	-	-	-	100
							<u>13,596</u>
1812.	Resident Inhabitants	-	-	-	-	-	13,496
	Soldiers	-	-	-	-	-	300
							<u>13,796</u>

1813.	Resident Inhabitants	-	-	-	-	-	13,996
	Soldiers	-	-	-	-	-	300
							<u>14,296</u>

Now, as the emigration took place in the last three months of 1810 and the first three months of 1811, some calculation will be required, and, as you are a much better calculator than I am, I leave that point for you to settle. I also think it proper to remark that in burials three were the consequence of executions,—namely, two in 1809, and one in 1813.

BURIALS.

		Males.		Females.		TOTAL.
1809	-	158	-	216	-	374
1810	-	148	-	155	-	303
1811	-	127	-	132	-	259
1812	-	160	-	178	-	338
1813	-	188	-	189	-	377
						<u>1651.</u>

With kind wishes for the success of your work, I remain, dear Sir, yours, etc.,
JOHN HEYSHAM.

SUN LIFE OFFICE, 14th February 1814.

DEAR SIR—I beg leave to trespass once more upon your patience, in consequence of having (in Dr. Willan's work on Vaccination) met with an extract of a letter from you, dated 14th May 1806, wherein there is this passage:—“Since the introduction of vaccination into this city, the smallpox has occasionally occurred, but has never raged as an epidemic, and the mortality from that disease has been very inconsiderable, compared with what it used to be before the introduction of vaccination,” which does not appear to agree exactly with the information you were so kind as to favour me with on the 1st November 1812 ; that, “since the introduction of vaccination in 1800, you had reason to believe that not one person had died of the smallpox in Carlisle.” Probably you were led to this belief by inquiries subsequent to the date of the above extract from Dr. Willan ; I think it fortunate, however, that I have met with that extract, as, had I published the other statement without being aware of it, the apparent contradiction might have shaken the confidence of some persons in the other valuable documents which I owe to your zeal and intelligence.

Although the sexes are not distinguished in your Tables of the Mortality from different diseases, yet that produced by such as are peculiar to females, may, I suppose, be extracted, and would be useful to me; but I am under some uncertainty with regard to two of these. One person is reported to have died between 40 and 50, "of a discharge of blood;" was that uterine hæmorrhagy?

And five of cancer, between 70 and 80; can you inform me if any of these 5 cases were cancer of the breasts, or of the uterus?

I have the satisfaction to inform you that, upon consulting the London bills for the last 14 years, I find that there is no such increase of the mortality from measles as that which Dr. Watt has found in the Glasgow bills.

By favouring me, when convenient, with the desired information on these subjects, you will again do a grateful service to, dear Sir, yours, etc.

JOS. MILNE.

[Dr. Heysham's reply dated 18th February, has been lost.]

SUN LIFE OFFICE, 24th February 1814.

DEAR SIR—I have now to acknowledge the receipt of your esteemed favour of the 18th instant, with information that is perfectly satisfactory as to the chief object of inquiry in my last; the others (which indeed I knew it was not likely that you should be able to satisfy) are of very little importance to me.

I am only sorry that you should have taken so much trouble, as Dr. Willan appears to have printed the whole of your letter, although in his work it is only stated to be an extract from it.—I remain, dear Sir, yours, etc. JOS. MILNE.

SUN LIFE OFFICE, March 22d, 1814.

DEAR SIR—In endeavouring to determine the rate of mortality at Carlisle, with the degree of accuracy which I doubt not but that you are desirous of as well as me, I find that there are still a few points on which my information is defective; and, after the zeal you have already manifested in promoting the inquiry, I am satisfied that no apology is necessary for troubling you again.

You know that according to the Act (51 G. III. cap. 6) directing the survey of 1811, an answer to the following question was to be returned to government:

"How many persons (etc.) are there actually found in your parish or place, etc. exclusive of men actually serving in His Majesty's Regular Forces, in the Old Militia, or in any embodied Militia, and exclusive of Seamen either in His Majesty's service, or belonging to Registered Vessels?" And the same de-

scriptions of persons were directed to be excluded from the returns of 1801. In the Population abstract, $\frac{1}{10}$ th is estimated to be the proper addition to the returned numbers, in order to obtain the whole population for England and Wales; and for the Metropolis, they increased the returned number in each case by its twenty-fifth part. The returned population of your two parishes (omitting Middlesceugh and Braythwaite) was—

in 1801 . 11,060; and
in 1811 . 13,496.*

The mean population (returnable according to the Act) was therefore, during these 10 years, 12,278; and if we increase this by $\frac{1}{10}$ th, namely 409, the true mean population will appear to have been 12,687.

But I should think $\frac{1}{10}$ th too great an addition for Carlisle, and your accurate information will no doubt enable you to estimate the proper addition much more nearly.

The great fluctuation in your population since October 1810, prevents me from determining the rate of mortality by means of the annual deaths you favoured me with on the 23d January last, as I could have done had the number of the people either remained stationary or varied uniformly. I must therefore have recourse to the two enumerations in 1801 and 1811, thence determine the mean number of the living during the intervening 10 years, and divide it by the annual average number of deaths in the same period. Those for 1809 and 1810, you have already favoured me with, and it is very desirable that I should obtain the exact numbers for the first eight years of the ten; for I find that the returns to government are not sufficiently accurate to answer my purpose; the number of deaths in your two parishes in the 17 years ending with 1796, were, according to the Population Abstract—

	Males.	Females.	Total.
	1798	1946	3744
but according to your tables they were	1829	1994	3823

But as I do not know what trouble it might cost you to furnish me the numbers of deaths in 1801, 1802, 1803, 1804, 1805, 1806, 1807, and 1808, with the same accuracy as the information you have already favoured me with, I do not think it reasonable to ask it, but will leave it to your own determination, and shall be perfectly well satisfied with what you have already done, should you decline it.

* "I will take care to increase this number by 600, according to your advice in your favour of the 23d January last."

Although I know that no one else would perform the task so well as yourself, yet if you know any one that you can depend upon, and who will accept of a compensation for their trouble in furnishing this, or any other information of the kind, that you conceive may be useful to me, I shall be very happy to pay them on their own terms; and shall be much obliged by your employing them accordingly.

I believe that the mortality in moderate-sized towns like Carlisle, with flourishing manufactures, is much less in comparison with that of country parishes and villages than has generally been supposed; and I have reason to believe that the law of mortality in your two parishes has, for the last thirty years, been very nearly the same as the average of the kingdom.

But it is very desirable to determine this as nearly as possible. There are no adequate data for instituting a comparison *at the time your Observations were made*; but the late surveys afford the means of doing so, for the term of ten years that intervened between them: *Provided only* that, by means of the data I now trouble you about, we could determine what the rate of mortality really was in your two parishes during the same period. Then, by means of your Tables of the ravages of diseases, and your more recent information respecting vaccination and typhus fever; it might be shown that, from 1779 to 1787, the mortality was the same, excepting so far as smallpox and typhus increased it.

This would not only afford useful information to the public, but would establish the reputation of your valuable Observations, and contribute to that of the many Tables I have derived from them and am about to print.

You inform me that, within the last fifteen years, very few cases of typhus have occurred; can you form any estimate of the deaths it has produced in the same time or their annual average number? Can you assign the reason of the disease having become less frequent?

By Sir F. M. Eden's "*State of the Poor*," I find you used to exclude all infectious diseases from the poor-house. Have you any separate fever wards or house of recovery, as they have at Chester, Manchester, Liverpool, London, etc.? Your own tract on the Jail Fever, the writings of Dr. Haygarth, the collection of papers published by Dr. Clark at Newcastle in 1802 (who, I see, consulted you), and the labours of many other eminent physicians, must, no doubt, have contributed greatly to improve the methods both of prevention and cure in such cases, and must thereby have sensibly reduced the general mortality of the kingdom.

Dr. Jenner's first work on Vaccination was, you know, published in 1798,

and the House of Recovery, in the metropolis, for the prevention and cure of infectious fevers, was opened in 1802.

	Smallpox.	Fevers of all kinds.	
According to the Bills of Mortality, there died in the ten years ending with 1800, of . . .	18,477	19,884	
In the ten years ending with 1813 . . .	11,228	11,172	Sum.
Difference of the two equal periods . . .	7,249	8,712	15,961

Before I close this long letter, allow me to state distinctly the queries I now trouble you with, and number them; then, by answering me according to the numbers, you will be spared the trouble of transcribing the queries, as on a former occasion.

1. At what number do you estimate the amount of omissions (according to the Act), in the return of the population of your two parishes in 1801?
2. And at what number in 1811?
3. At what time of the year was the enumeration of 1801 made?
4. What was the true number of deaths in each of the eight years 1801—1808?
5. Probable number of deaths by typhus fever during the last sixteen years?
6. Reason of that disease having become less frequent?
7. The population of your villages appears to have been 400 less in 1811 than in 1780: has not this been occasioned by some of them having in the intermediate time been included in the suburbs, and so been returned as part of the city?
8. Towards the end of your Observations you say the deaths by accidents were omitted in a few of the first years. Were not these omissions *in the Tables of diseases only*? Were not all the burials that took place in these years included in the other Tables of the deaths at different ages?—I remain, dear Sir, yours, etc.

JOS. MILNE.

P.S.—You will be pleased to observe, Sir, that according to the present method of instituting the inquiry, we shall have nothing to do with the soldiers (or others) who might be resident in Carlisle *after* the enumeration in April 1811; and if the 100 military who were there in 1809 and 1810, were the only persons of that description who were there during the ten years, then we must add but twenty to the mean permanent population for them, as they were but

one-fifth of the time in the place. The increase of deaths from them could therefore be only one-fifth of what they would have been had they remained there till the ten years had expired. [Here a portion of the manuscript is destroyed; then come the words "regular forces;" two more words are wanting; then follow "ten years, I must request you would have the goodness to give the duration of their continuance as near as you can."]

The other persons omitted, according to the Act, would, I suppose, shift about much less. From the reluctance I felt at troubling you any further, I had prepared this part of my work for the press; but having at last resolved upon this step, I shall suspend it until I am favoured with your answer, and then do that part of it over again.

[Dr. Heysham's letter of 29th March is wanting.]

CARLISLE, *April 1, 1814.*

DEAR SIR—Having half-an-hour's time to spare, I inform you that I have consulted my medical friends respecting Query 5, and we agree in opinion that the average number of deaths from typhus during that period will scarcely amount to *one* each year.

Q. 6. On this subject I cannot satisfy my own mind; we must therefore rest satisfied with the fact.

The people in general certainly pay more attention to cleanliness, and upon the whole live better than they did; yet during the period of sixteen or seventeen years we have had several years of scarcity, and some of great distress from want of employment.

Q. 7. You have here, I apprehend, made a complete mistake. In 1780 there were in the villages only 1378 persons, whereas, in 1811 there were 1850; though Newtown, the population of which was in 1780, 92, was, in the Survey of 1811, united with Caldew-gate, one of the suburbs. When on this subject, it may be necessary to state that, in my Survey, the population of *Newtown* and *Morton Head*, comprehending *Newby*, was distinct, but the two *Blackhills*, or *Black Halls*—namely, *high* and *low*—were united. Whereas, in the Survey 1811, *New Town* was united with Caldew-gate; *Morton Head*, comprehending *Newby*, was united with Cummersdale, and the two *Blackhills*, or *Black Halls*, were separated.

8. The deaths from accidents were always included in the number of burials, and were inserted in the Tables, but were excluded in my calculations to ascertain the comparative mortality of different ages, etc., till 1785. In 1780, for

instance, I have stated that 1 in 34½ nearly, of all the inhabitants have died this year in consequence of *diseases*, and under 5 years old, 1 in 9 and 9-11ths nearly; between 5 and 10, 1 in 56¼, etc.

1785.—During this year 1 in 37 and 1-7th, nearly, of *all the inhabitants*, have died,* and under 5 years old 1 in 10 and 2-3ds nearly; between 5 and 10, 1 in 151 and 1-3d.

Almost immediately after I wrote to you in January, a woman with a child in the smallpox, after begging in various parts of Carlisle, came to my house to get a pass. I ordered her to leave the town without delay. She had, however, communicated the infection, and the smallpox soon after reappeared; many, however, have not been affected, and none have yet died; but unfortunately a boy, aged 9 years, who was vaccinated in October 1805 by one of our most intelligent and attentive surgeons, is now labouring under the confluent smallpox.

You are no doubt acquainted with several members of Parliament; I therefore request you will authorise me to enclose my future letters to some one or more of them; till then I remain, dear Sir, yours, etc.,

J. HEYSHAM.

SUN LIFE OFFICE, *2d April 1814.*

Dear Sir—I feel much obliged by your kind note of the 29th ult., the more especially as it shows that you sympathise with me in the solicitude with which I look for your aid; I have myself to blame for not looking more minutely into those parts of the subject before I came actually to reduce the materials into order, and apply them to use: however, I cannot but acquiesce, both cheerfully and thankfully, in the very reasonable delay which your much more important avocations render necessary; and the great object is to have the thing done well rather than hastily.

When I troubled you on the 22d March, I had not your Observations at hand, but I recollected that the doubt expressed in my 8th query had some time before occurred to me, and I had deferred inquiring particularly into it; however, in a few hours after I had despatched that letter I satisfied myself that the omission of the deaths by accidents, mentioned at the head of the 10th page of the abridgment of your observations, took place only in calculating the number for your 7th Table.

Upon referring to my own papers, indeed, I find that in reducing all your valuable Tables of diseases into one, I had compared the totals of the deaths in

* Deaths by accidents are included in the calculation this year, which have hitherto been omitted.

every interval of age with those in your 5th and 6th Tables, after deducting the deaths in 1780, and find them to agree exactly.

The 4th question put to the Clergymen of England, under the Act 41 G. III. cap. 15, demanded the number of baptisms and burials, both of males and females, for *each* year, only from 1780, inclusive, downwards. You have already printed the numbers, according to your accurate researches, to 1796; those I particularly want, and which I troubled you about in my last letter, would carry these down to the end of the year 1810, that is as far as the Government returns yet go, provided that those for the years 1797, 1798, 1799, and 1800 were also supplied. Those four years, however, are not essential to my purpose, and I leave it entirely to you to do what you think best; after observing that it is my intention to print your numbers along with those returned to Government, by which the greater accuracy of yours will be made manifest, and the means will be afforded of estimating the probable amount of the omissions in the Government returns generally, so far as two parishes only can furnish these means.

We should then be enabled to determine the rate of mortality in each of the four intervals, 1780-1787, 1787-96, 1796-1801, and 1801-1810; between the five enumerations, from the beginning of 1780 down to the end of 1810.

I also purpose reprinting most of your observations very nearly as they stand in the abridgment, in order to give the fullest and clearest information I can, respecting the population of Carlisle, during the time in which your observations were made, and shall therefore be happy to receive any instructions you may favour me with, either as to alterations or additions, and remain,
Sir, yours, etc. JOS. MILNE.

SUN LIFE OFFICE, 4th April 1814.

DEAR SIR—As I could not find a member in town on Saturday, I had delayed the enclosed for a “frank,” which indeed I am not yet certain that I shall obtain to-day, but they shall both go with the first I can get.

This morning I am favoured with yours of the 1st instant, still I had rather let mine of the 2d go, as it will explain how I came to give you unnecessary trouble.

I beg you to accept of my best thanks for your last information respecting smallpox and vaccination, as well as your answers to my 5th, 6th, 7th, and 8th queries.

On the subject of smallpox, I have the pleasure to remark to you, that by having mentioned in your Observations (Abridgment, p. 9) that 90 died of that

disease in 1779, and only 151 in the eight succeeding years, it follows that 241 died of it in the whole period of nine years, but in the eight for which your Tables of diseases are preserved, its victims were 238; therefore in the year 1780, for which the table is lost, only 3 must have died of it. [This surmise of Mr. Milne's was correct.—H. L.]

In consulting the Population Abstracts of 1801 and 1811, I was a little puzzled, not only by the differences you have been kind enough to explain, but by some of what were termed villages, in your survey of 1780, and kept separate both from the city and suburbs, being included in *the city of Carlisle* in the returns to government (as printed). Thus, Botcherby, Cummersdale, and Brisco, with others, are all enumerated under the head *City of Carlisle*; they are indeed called townships, but so are Castle Street, English Street, Fisher Street, etc. called, and it does not appear by these printed statements whether these streets, or the places above mentioned, are the most central with regard to the city.

To explain myself fully, I beg leave to state the population of your two parishes (excepting Middlesceugh and Braithwaite); the sexes need not be distinguished.

1811. Inhabitants in Blackwell, High	253
„ Blackwell, Low	149
„ Carleton	173
„ Harraby	58
„ Upperby	228
„ Wreay	104

Thus there would appear to be only	965
In the villages, and in the city of Carlisle, there are stated to be	12,531

13,496

I beg that you would take no further trouble about this part of the subject; my principal reason for putting the query was with a view to the difference between the proportion of males to females, in the city and suburbs, and in the neighbouring villages.

I should value your communications low indeed if I could consider them expensive, whatever weight you might send me by post under one cover, without any privilege; but if you will have the goodness to address them to John Irving, Esq., M.P., London, with J. M. under the seal, they will reach me in safety.—I remain, dear Sir, yours, etc.

JOS. MILNE.

M

CARLISLE, *April 10th, 1814.*

DEAR SIR—I was favoured with yours of the 2d and 4th instant, the day before yesterday, and now enclose the register of the burials for the year 1801 to 1808, which you may depend on being perfectly correct, and which will answer your 4th query. The enclosed surveys of 1780 and 1811 will throw light upon the observations I made in my last letter on your 8th query, as they will give you a clear view of that subject. In a former letter I stated that the survey of 1811 was made in April of that year, which was only partly the case, as a considerable part of St. Cuthbert's was not finished till 27th of May, when the emigration had nearly ceased, and when the population was about the least. I am happy to inform you that Master Hodgson, who was affected with confluent smallpox, after being vaccinated, is perfectly recovered; and it is somewhat remarkable that I was called on the 2d of this month, the day after I wrote to you, to visit a patient, the son of one of my own tenants, John Hewson, who was 16 years old on the 26th of February last, and who was in the smallpox, and was at the height on Thursday the 7th. The pustules were large and numerous, though not confluent. This boy was inoculated at Wigton (by Mr. Bell, who is now dead, but who was a very good and attentive surgeon, whom I was well acquainted with, as he was a considerable time under me as surgeon and apothecary to our Dispensary) when he was a month old, which, however, did not succeed. The inoculation was repeated exactly a month after, and at the usual time both arms inflamed, and he was affected with the usual symptoms attending the eruptive fever, afterwards with eruptions, which, though not very numerous, were defined all over his body and limbs, and the pustules were full as long as those he is now affected with, and from which Mr. Bell took matter to inoculate other patients. Thus at the same time we have had two patients in the natural smallpox, one after vaccination, and the other after inoculation.

I will endeavour to procure the burials for the years 1797, 1798, 1799, and 1800, as soon as possible, and will also transmit you the best information in my power respecting queries 1, 2, and 3.—Yours, etc. J. HEYSHAM.

AN ACCOUNT OF THE BURIALS IN THE PARISHES OF

(Years.)	St. Mary.	St. Cuthbert.	Wreay Chapelry.	Quakers.†	Total.
1797	176	103	3	2	284
1798	107	85	1	2	195
1799	102	68	1	5	176
1800	180	136	...	2	318
4 years	565	392	5	11	973
1801	134	94	1	7	236
1802	142	101	1	1	245
1803	139	97	1	4	241
1804	170	109	2	6	287
4 years	585	401	5	18	1009
1805	137	68	...	3	208
1806	173	112	5	8	298
1807	191	145	3	6	345
1808	196	116	4	5	321
4 years	697	441	12	22	1172
First 8 years	1150	793	10	29	1982
Second 8 years	1282	842	17	40	2181

[In a future part of the correspondence, apparently, the following memoranda had been sent to Mr. Milne by Dr. Heysham. They will appear appropriately here.—H. L.]

BURIALS.		Males.	Females.	Total.
1809.	St. Cuthbert . . .	66	93	159
	St. Mary . . .	87	118	205
	Wreay . . .	2	3	5
	Quakers . . .	3	2	5
		<u>158</u>	<u>216</u>	<u>374</u>

* Wreay Chapelry is in the parish of St. Mary, but is separated from it by a portion of St. Cuthbert's intervening. Most of the burials at Wreay are from St. Cuthbert's.

† Only one burial-place for Quakers in the two parishes; it is situated in Fisher Street, St. Mary's, Carlisle.

BURIALS.		Males.	Females.	Total.
1810.	St. Cuthbert . . .	64	63	127
	St. Mary . . .	81	88	169
	Wreay . . .	2	1	3
	Quakers . . .	1	3	4
		<u>148</u>	<u>155</u>	<u>303</u>
1811.	St. Cuthbert . . .	54	43	97
	St. Mary . . .	66	84	150
	Wreay . . .	3	3	6
	Quakers . . .	4	2	6
		<u>127</u>	<u>132</u>	<u>259</u>
1812.	St. Cuthbert . . .	76	75	151
	St. Mary . . .	81	101	182
	Wreay . . .	1	...	1
	Quakers . . .	2	2	4
		<u>160</u>	<u>178</u>	<u>338</u>
1813.	St. Cuthbert . . .	105	83	188
	St. Mary . . .	79	98	177
	Wreay . . .	3	5	8
	Quakers . . .	1	3	4
		<u>188</u>	<u>189</u>	<u>377</u>

SUN LIFE OFFICE, 16th April 1814.

DEAR SIR—I received in due course your esteemed favour of the 10th instant, with the valuable documents it enclosed.

Your having separated the burials of the Quakers, and those in the Chapelry of Wreay, from the rest, is highly satisfactory, for it thereby plainly appears that all these have been omitted in the returns to Government; there must also have been other omissions in the returns, but in some years these are the only deficiencies in the account laid before Parliament.

Your statement of the surveys of 1780 and 1811, distinguishing each of the

places mentioned as forming part of the city, suburbs, or villages, is also very valuable to me, and completely satisfies my seventh query, as it furnishes a key to the statements printed by Government, which, with regard to the object of that query, would otherwise have been unintelligible.

Accept my best thanks for your information of the two anomalous cases of natural smallpox, after both the kinds of inoculation; the subject is extremely curious as well as important.

In expectation of your further information, when it may be perfectly convenient to you, I remain, under the most grateful impressions from your past favours, yours, etc.

JOS. MILNE.

SUN LIFE OFFICE, 20th April 1814.

DEAR SIR—I was yesterday favoured with yours of the 16th, together with the burials for the four years ending with 1800, and the enumeration in 1801.

It appears singular that, although your numbers always exceed the returns to Government (of the numbers buried) except in the year 1800, for that year they fall 73 short of them—yours being 245, the others 318. It is also worthy of remark, that although the burials in St. Mary's in that year are nearly double what they were in the two preceding years, and about $\frac{1}{3}$ as much more than they were in the two following years; yet those in St. Cuthbert's in 1800 were less by about $\frac{1}{3}$ than in the preceding or the following years.

I thank you for your useful information respecting the number of prisoners in Carlisle Jail. I had not overlooked them in the Population Abstract for 1801, but purposely omitted them, because I thought it probable they had been omitted in 1811, and because their number is so small, and the persons generally in such periods of life, that, if the jail be well regulated, as I doubt not but that it is (where the magistrates are so intelligent), the mortality in it must be considerably under the general average of the two parishes (including all ages); and on these accounts the omission could hardly have had any sensible effect upon the result I was in quest of. But nothing certainly should be neglected that can contribute anything to accuracy; and now that you have enabled me to do better than guess at the numbers in 1811, I will not fail to include those for 1801.

You add greatly to the value of the documents you favour me with, by the attention you show in transmitting them as quick as you can, that you may delay me the less. It happens, however, that I can make but little use of those

I now have until I obtain the others, which must be combined with them. I therefore wait anxiously, but not impatiently; and remain, dear Sir, yours, etc.

JOS. MILNE.

CARLISLE, *April 24, 1814.*

DEAR SIR—Queries 1 and 2. The Cumberland Militia consists of 615 rank and file, which have never been stationed in the county since the war. Several of them have wives and families, and a few of the wives and families attend the regiment, but how many is uncertain. A considerable number of Carlisle men have, during the whole course of the war, enlisted in the army and marines, but the exact number cannot be ascertained. We have few or no sailors, scarcely any of the inhabitants having gone into the navy since Mr. Pitt's Navy Quota Act was carried into execution; and even before that time we procured some of our men from London. I have therefore no hesitation in giving my opinion that 1-30th is by far too great a proportion for our two parishes. You must, however, take into consideration, that as the overseers of the poor took little or no interest in the two surveys of 1801 and 1811, and instead of entering into them with zeal, considered them an additional task imposed on them by Government, there can be no doubt but several omissions took place in both the surveys in the most populous parts of the city and suburbs. The returns from the few villages, I think, we may consider as nearly correct. What, however, was the amount of these omissions will ever remain unknown.

Query 3. Though I consider this query not of much importance, yet it has given me a great deal of trouble. I have made numerous inquiries without having gained any information; but I have strong reason to believe, from my own recollections, that the survey of 1801 was made either in the month of January or February, or perhaps in both.

When Sir F. Eden published [his work], the workhouse of that part of the parish of St. Mary's which lies within the liberties of the city of Carlisle, and which comprehends Scotch Street, Fisher Street, Castle Street, and Abbey Street, independent of its situation, which is far from good, was, upon the whole, well regulated and conducted. But at that period the workhouse of the parish of St. Cuthbert's and that of Caldew-gate, including Cummersdale, were most miserable receptacles.

The parish of St. Cuthbert has since built one on a healthy elevated situation, about a quarter of a mile from the town, which was finished in 1809, and is well managed. In one of the wings apartments are intended for fever cases,

none of which, however, have yet occurred. Within these two years Caldew-gate has taken a new house, and considerable improvement has taken place in the management of it.

	Paupers.
On the 2d of this month St. Cuthbert's contained . . .	48
St. Mary's	31
Caldew-gate	16
	—
	95

This will appear to you a very small number for the population of the place, but considerable sums are paid weekly to paupers in their own houses.

The mortality of the country parishes in the county of Cumberland is certainly considerably less than the mortality of Carlisle. In the years 1780 and 1781 I collected a great deal of information on this subject for the late Mr. Wales of the Charter House, who then had it in contemplation to publish on the population of this island, in answer to Dr. Price's pamphlet on the same subject. If you could possibly procure an inspection of his papers, I am certain they would prove highly interesting and useful.

On an average of ten years, from 1771 to 1780, of a great number of country parishes.

In Leath-ward, one person in 56 and 2-3ds died. In Eskdale-ward one in 54 and $\frac{1}{2}$ died, and the country parishes in Cumberland-ward, as far as my recollection goes, were even more healthy than Leath-ward. See Hutchinson's *History of Cumberland*, vol. i. p. 522.

Independent of the military regularly stationed here since 1809, we have always had, since the commencement of the war, several recruiting parties both for the army and the marines. The constant average number of them, I think, may probably amount to forty or fifty.

I consider it as a most fortunate circumstance that you adverted to the very great difference of the mortality in the two parishes in the year 1800, although, after I received your favour of the 20th, I thought myself almost certain that I was correct; yet, knowing how liable we all are to error, I immediately re-examined the register of St. Cuthbert's, and to my surprise discovered two leaves of the book adhering, which I must, on my first inspection, have turned over together, and I found the burials for that year, instead of 63, to be 136. Having the book in my possession, I deemed it necessary to re-examine all the four years, and discovered another mistake in 1797 of seven burials, which were entered at the

bottom of the page of the burials of 1796, the year being written in pale ink ; therefore, in that year, instead of 96 there were 103 burials.

Burials in both parishes, including [the chapelry of] Wreay and [the] Quakers, in	1797 were	284
	in 1798 „	195
	in 1799 „	176
	in 1800 „	318
Total		973

I think I have now furnished you with all the information in my power, but should you, in the progress of your work, discover any circumstances wanting which I can supply, you may command my services, and you have my full permission to make use of my Observations in the manner you may think proper, taking care to correct any grammatical errors, etc.—I remain, dear Sir, yours, etc.

JOHN HEYSHAM.

P.S.—We have now very few cases of natural smallpox, and only one child has died of that disease since 1st of January.

SUN LIFE OFFICE, 30th April 1814.

DEAR SIR—I received on the 27th your esteemed favour of the 24th instant, wherein you have completed the answers to my queries, which have given you so much trouble. It was not without great reluctance that I troubled you with these last, being well aware that the answers could not add very materially to the mass of valuable information I had previously derived from you. I had, indeed, made assumptions, which led to almost exactly the same results as the authentic documents you have lately favoured me with, but these *might have been* much wider from the truth ; and you have enabled me to give that authenticity to my materials, which removes all ground for doubt or suspicion.

I particularly regret that you should have taken so much trouble to determine in what part of the year 1801 the survey was made. I did not think it likely that it would be attended with any difficulty, or I should have requested you to take no trouble about it. The only use I meant to make of it was to determine what the number of the people was on the 1st January 1801, and on the 1st January 1811, as it was in the intervening period that the deaths took place which I was to determine the rate of mortality from ; and it is obvious

that, *if the increase of the people was uniform*, the number of the living in the beginning of May in each of those two years would be rather greater than in the beginning of January ; consequently the mean number of the living from the one May to the other would be rather greater than from the one January to the other, which last is that with which the registered burials in the intervening period should be compared.

The late Mr. Wales, master of the mathematical school at Christ's Hospital, did (as well as Mr. Howlett and others) publish a pamphlet on the population of England, in answer to Dr. Price, which I some time ago took great pains to procure, but without success. His books and, I believe, his manuscript papers too, were sold by auction soon after his death, and were, I understood at the time, very productive to his heirs.

I have taken care to make the corrections you were so kind as to direct in your last.

I now see that the autumn will be well advanced before my work will be ready for publication.

I cannot close this letter without acknowledging again the grateful sense I entertain of your polite and kind attentions throughout all the trouble I have given you. Nothing, I am sure, but the most ardent zeal for the promotion of this useful and interesting branch of knowledge, could have carried you through all the drudgery you have undertaken, and executed in the ablest and most satisfactory manner, for, dear Sir, yours, etc.

JOS. MILNE.

P.S.—Men of speculative habits, like me, have, you know, but little power of conferring benefits ; but if I can be of any service to you, upon any occasion, I shall be much gratified by your commands, as I should have told you before, had I not expected you to take it for granted.

SUN LIFE OFFICE, 20th May 1814.

DEAR SIR—I now beg leave to hand you an estimate of the population and mortality in your two parishes from the commencement of your Observations to the end of last year.

It is not my intention to impose any more tasks upon you. In the Appendix to the work I have in hand I purpose to insert an abstract of your Observations, but (except the information you give respecting the enumeration of 1796) these only extend to the first nine years. It will probably be two or three months or more before that Appendix can be printed, and if, in the meantime, it should

afford you an agreeable amusement at any intervals of leisure, to compare the variations in the rate of mortality as exhibited in the enclosed Table, at different times, with the corresponding variations in the circumstances of the people, especially with regard to the proportion of the wages of labour to the prices of the necessaries of life, and the presence or absence of epidemical diseases; then, by making notes of what might appear to you most worthy of remark, you would enable me to extend your observations, and would render what is here attempted much more interesting and instructive.

In constructing the enclosed I have assumed that the population increased continually and equally in the interval between each of the enumerations of 1780, 1787, 1796, 1801, and until the emigration commenced in 1810; 45 are added to the returned numbers of 1801 and 1811 for the recruiting parties; 100 for the regular forces in 1809, 1810, and 1811; and 300 in 1812 and 1813. I have considered the population to have increased in 1812, the emigration having then ceased, and the baptisms having exceeded the burials by 154. The mortality in 1807, you will observe, was considerably greater than in any other of the ten years from 1801 to 1811, except in 1809; and in this last it was so great as materially to affect the average of the ten.

I should be very sorry if, in consequence of this letter, you took any step that was irksome to you. If after a short time, when you shall have had leisure to turn the subject in your mind, you should think it probable that you would ultimately forward me any further observations, I should be obliged by your signifying such expectation to me. The actual mortality since the introduction of vaccination has not been reduced quite so much in comparison with what it was from 1779 to 1787, as I should calculate upon from that cause and the decrease of typhus fever; probably the operation of some adventitious causes in 1807 and 1809, which you may have it in your power to point out, may account for the apparent anomaly.—I remain, dear Sir, yours, etc. JOS. MILNE.

P.S.—The rise or great increase of manufactures in Carlisle, by increasing the demand for labour, and consequently its recompense, will, I expect, be found to have had a sensible effect in reducing the rate of mortality; but I do not know at what times these took place.

SUN LIFE OFFICE, 23d March 1815.

DEAR SIR—I have now the pleasure of transmitting you the work you know I have been some time engaged upon, and to which you have contributed some of the most valuable materials.

The expectations of life in Table III. are not exactly the same as those sent you in September 1812, because the Table of Mortality these last were derived from differed a little from the second in the present work, having been deduced only from the deaths in the eight years that intervened between the enumerations in January 1780 and December 1787, and upon the supposition, too, that none died above the age of 100 years.—I remain, yours, etc. JOS. MILNE.

LONDON, May 2, 1815.

MY DEAR SIR—I duly received your kind letter of the 23d April,* and am much gratified by the flattering manner in which you mention my work; also to learn that so eminent a judge as Dr. Milner [Dean of Carlisle] thinks favourably of it. If it meet with the reception of the public, which these and the opinions of some other distinguished judges would lead me to hope for, it must be obvious to every reader that it will be owing in a great measure to your own valuable observations.

I beg you to accept of my grateful acknowledgments, both for the services you have rendered in prosecuting the work, and your kind wishes for its success, and remain, dear Sir, yours most faithfully, JOS. MILNE.

CARLISLE, 14th June 1814.

DEAR SIR—I received your favour of the 20th ult., with the enclosed Table of the estimate of the population and mortality of our two parishes, which I have every reason to believe as correct as the subject will admit of. I think, with very few exceptions, the population has been continually and uniformly increasing since I came to Carlisle until the autumn of 1810. As, upon research, I can find no memoranda respecting those years in which the mortality was greatest, I dare not venture to suggest any observations from memory.

As you were kind enough, in a former letter, to offer your services, I avail myself of this opportunity to request you will, at your complete leisure, favour me with your opinion on the following subject, which may possibly at some future period prove of advantage to me or my family. I hold an estate by lease for three lives, of the Corporation of Carlisle, renewable for ever on the payment of a certain fine of twenty shillings on each life, or rather on the renewal of a new life, for I am not bound to renew immediately on the death of the first, or even of the second; the three lives now being are three of my sons, who are all in perfect health, and have had all the specific epidemic contagious diseases incident to this country, and are of the following ages,—22 years, 21 years, and,

* The copy of Dr. Heysham's letter of the 23d April is lost.

17 years. Query—Should the Corporation be willing to dispose of their interest in this estate to me, what is the exact sum I ought to pay?—Yours, etc.

JOHN HEYSHAM.

LONDON, 22d June 1814.

DEAR SIR—In answer to your favour of the 14th inst., I have to inform you that, if you have the lease of an estate dependent on three lives, now aged 22, 21, and 17 years respectively, with the condition that you and your successors may renew it continually whenever any life may fail, by putting in such another as you may think most for your own advantage, upon paying a fine of 20 shillings, then the present value of all the fines that may be paid for such renewals for ever will be 14 shillings and one penny; upon the supposition that the life renewed with will always be the best that can be found, that is, a healthy one of 7 years of age, the rate of interest being 5 *per cent per annum*, and the law of mortality such as your observations show to have prevailed in Carlisle during the nine years in which they were made. But (the rest being the same) if we use the Northampton Table of Mortality, constructed by Dr. Price, which has generally hitherto been taken for the basis of such calculations, we shall find the value to be one guinea and tenpence halfpenny (£1 : 1 : 10½). And generally, whatever the fine certain may be, if you multiply it by 704.067, and divide the product by 100.000, the quotient will be the present value of all that may from henceforth be paid for renewals, according to the Carlisle Table. But to obtain the value according to the Northampton Table, this fine must be multiplied by 109.428, and the product divided by 100.000, interest being still reckoned at 5 *per cent*.

I have given the general theorem for the solution of such questions in the 450th article of the work I have in hand, and have shown its application by a numerical example, 645. This is one of the cases wherein the difference in the law of mortality makes a greater difference in the value sought than perhaps any other.

The Expectations of Life, according to the Law of Mortality

At the Age of	Carlisle.	Northampton.	
17	43.57	35.20	According to Dr. Price's Table, one person out of 25.18 died annually at Northampton.
21	40.75	32.90	
22	40.04	32.39	
7	50.80	41.03	

Hence you will see it is of some importance that I should clearly set forth the authority on which the Carlisle Table depends, and show its agreement with the general law of mortality throughout England; this has been the occasion of most of the trouble I have given you for many months past. You have enabled me to do it to my own satisfaction, and, may I presume to hope, to the satisfaction of the public.

JOS. MILNE.

To prove to the reader of these pages the great difference between the Carlisle Tables of Mortality, which guided Mr. Milne's reply to Heysham's query, and those of Northampton or some other equally erroneous Tables, which guided the Equitable Assurance Office in 1810, the following reply should be perused. It ought to be stated that Heysham's case, as given above, was put to the Equitable, and here is the reply: "The present value of £1, to be paid on the extinction of each life for ever in the above lease [the lease between the Corporation of Carlisle and Heysham's lives] is two pounds four shillings."

(Signed) WILLIAM MORGAN.

Equitable Assurance Office, 3d April 1810.





