

for he imagined that they were effecting some strange change in him; he had occasionally harboured that idea from the very beginning. On the night of the 27th he fancied that he had returned to his native soil, and about seven in the morning my poor fellow-student ceased to live.

I continued to watch over him; and I do not know whether it was an illusion of my senses, or an actual fact, but more of the tumours seemed to whiten, and others increased in size for two hours after his death; and, after that, I observed many more of these buttons, on the back and loins and thighs, but they were much smaller than any of the others.

Case 5.—M. G., a pupil from L'Ardiche, wounded himself in the fore-finger of the right hand, in July 1830, when practising some operations on a farcied horse. Disorders, but less serious than those of Cases 1 and 3, followed. In August I lost sight of him; but I met with him in January 1831, still in the infirmary, and in June 1833 with the wound in his finger unhealed.

I do not know whether these facts are conclusive, but, at least, they are true; and the whole of the fourth case passed under my own observation.

[This is an exceedingly interesting paper, and reflects the highest credit on M. Vogeli. He who, braving all danger from contagion, and under so dreadful a form, remained at the bed-side of his unfortunate friend, when every one besides had fled, will ever stand high in the estimation of his fellow-men. The destructive agency of these animal poisons is too well known, and the account of poor Couderq bears considerable resemblance to the history of those who have perished from the infliction of slight wounds in the dissection of subjects that had not died of any recognised contagious disease. M. Vogeli's point is not, in our mind, proved—the identity of disease, *the communicableness of farcy*. Some of our British veterinarians may have cases in point.—Y.]

In the same number of the *Veterinarian* is a paper by M. LAUTOUR, entitled "Congenital Hereditary Chronic Glanders," in which the author describes the case of a male foal, borne by a mare which had laboured under glanders for four months, which, from the moment of its birth, exhibited symptoms of disease so closely allied to glanders, that M. LAUTOUR says the case inevitably proves that glanders may be hereditary. The mother was destroyed in six months, and the colt was examined by the morbid anatomist eight months after the birth.

ON THE

LAWS OF COLLECTIVE VITALITY.

By T. R. EDMONDS, Esq., B.A., Trinity College, Cambridge.

IN addressing THE LANCET on a subject which is not usually considered to fall within the province of a medical publication, I beg to remark, in justification of the step, that the laws of vitality are the central points of the science of medicine, and that it is only through observations on collective vitality, that any precise or numerical knowledge can be obtained respecting the laws of individual vitality. The only sure index of the practical success of the science of medicine is in the increase of collective vitality, or in the diminution of collective mortality, without reference to particular diseases. The collective vitality of a population, or of a large class of individuals of all ages, is made up of the collective vitality at each age of life. The absolute vitality at each age of life, is, obviously, the primary question; but my present remarks will be confined to proving the existence of a fixed and simple relation between the vitality of one age and the vitality at every other age, which is the same for every population. When the relative vitality is ascertained, the absolute vitality at each age becomes a question of great simplicity, which may easily be decided by the medical profession, if they make a very moderate use of their advantageous position for instituting observations on human mortality. The value of different tables of mortality is a question of high importance to every accurate medical observer, and it is a great reproach to the medical profession generally, that they borrow their opinions on this subject from writers of other professions, who possess inferior qualifications for arriving at a correct conclusion. Any medical man possessing the most ordinary knowledge of arithmetic, may easily examine and decide for himself respecting the merits of different tables. The assistance of those who have made the science of numbers their peculiar study, is seldom wanted, except to give a theoretical completeness to substantial practical knowledge. The mortality prevailing among people in easy circumstances is sufficiently well known at most life-insurance offices; but very little of that knowledge is communicated to the public, because the parties possessing it are interested in the concealment of the truth. The mortality, however, of sections of the popula-

tion in various degrees of "uneasy" circumstances is far from being known, and in this field a rich harvest may be reaped by the exertions of medical men.

The progress of medical statistics may be marked by three stages. In the first has been stated, without any qualification, the number of deaths from different diseases; in the second stage has been added the ages of the deaths; to the third or final stages must be added the ages and number of those who have and who have *not* been afflicted with different diseases. In many medical publications are registered particular facts or laws of human mortality, sometimes with, and sometimes without, any classification of the disease, or of the ages of the dying. The instances are very rare in which the ages of the contemporary living and dying are stated, although these are the two essential elements of a table of mortality. The most complete and accurate observations of this latter kind have been made by Dr. Heysham, on the general population of the town of Carlisle. And in that branch of medical statistics which has for its object to determine the relative mortality at different ages of life, without reference to particular diseases, Dr. Heysham's observations are universally considered to be of the highest authority. The public are indebted to Dr. Heysham for a most valuable relation of facts; but although these facts have been published nearly fifty years, no person has hitherto attempted to establish the existence of a general law of mortality which indissolubly connects these facts together. I believe that I have succeeded in discovering the general law applicable to this, and to every other observation from which a table of mortality can be deduced. And I now appeal to the medical public as the most interested in the question, and, at the same time, as the most competent tribunal to decide on the merits of the discovery. Independently of its practical value in medical statistics, the discovery cannot fail to interest, most deeply, all physiologists; for it assures us that the chief class of vital phenomena, like the chief class of chemical phenomena, are under the regulation of known and invariable numbers.

In every table of mortality, the ratio of deaths at any one age of life, bears the same fixed and simple relation to the ratio of deaths at any other specified age. This invariable relation is maintained by *three* numbers, which regulate the progressive variation in mortality from extreme infancy to extreme old age, each number being confined to its peculiar province. There are three principal periods in ani-

mal life, depending on the power of procreation,—*before, during, and after*, the existence of the procreative power, and the three periods over which one of the numbers constantly presides. The limits of the "procreative period" are not capable of being exactly defined in any table of mortality, because, as is well known, no such exact limits exist in nature. In most tables the "procreative period" terminates at the age of fifty-five years nearly, which is probably a mean between the ages at which the male and female of the human species lose the powers of procreation. In all tables the age of minimum mortality coincides with the commencement of the "procreative period."

About fifty years ago, Dr. Price, who is generally admitted to be one of the highest authorities in matters relating to human mortality, remarked that all good tables agreed in three points. First, in exhibiting a ratio of deaths very rapidly and regularly decreasing from birth to the age of nine or ten years; secondly, in showing a ratio of deaths slowly increasing from adolescence to some age between fifty and sixty years; and, thirdly, in showing a rapid increase in the ratio of deaths at ages exceeding sixty years. Dr. Price never attempted to express in numbers the glimmering of truth which had thus evidently flashed on his mind. I am now enabled to state the precise numbers which nature invariably uses in the regulation of her operations. In infancy the annual *decrease* in the ratio of deaths is 32.4 per cent.; during the "procreative period" the annual increase in the ratio of deaths is 2.991 per cent. After the procreative period, the annual increase in the ratio of deaths is 7.969 per cent. It is only below the age of six weeks that the theory appears to fail, especially for the male sex. The apparent error may be attributable, either to the effects of the act of birth, or to the greater mortality of infants born between the seventh and ninth month from conception. It does not however appear improbable, that the date of conception, and not the date of birth, is the proper commencement of the "infancy period."

Any person who is able to perform the operations of addition and division may easily satisfy himself as to the correctness of these numbers, by inspecting any good table of mortality. He may begin at any age in the table after the period of infancy, and divide the remainder of the table, by marking off successive intervals of ten years. He has then to add, in each class of ten years, the numbers in the parallel columns of living and dying, and afterwards to divide each sum of the dying by

the parallel sum of the living. If the successive quotients increase one-third part for every ten years during the "procreative period," or double every ten years after the procreative period, these results will be in near conformity with the theory announced. In the period of infancy, conformity with the theory is indicated nearly by the proportion of three to two between the successive annual deaths. It may be useful to observe that there are some printed tables of mortality which are valuable in some respects, but which cannot affect the present question, because they are founded upon the ages of the dying only. All writers on the subject agree in declaring that the ages of the living as well as of the dying are essential to the construction of a correct table of mortality.

Mr. Milne, the actuary of the Sun Life-Insurance Society, enjoys a very high reputation as a practical and scientific observer of the laws of human mortality. This gentleman has expressed himself in terms of the highest approbation respecting the merits of the Carlisle observations of Dr. Heysham, and he has published a complete and extensive series of life-insurance tables, founded upon those observations. The Carlisle table of Mr. Milne appeared to me to rest on higher authority than any other existing table of mortality, and on that account I have chosen it as the best criterion of the correctness of the new theory. By the help of the three discovered numbers, I have constructed a theoretical table which does not differ from the Carlisle table of Mr. Milne, more than Mr. Milne's table differs from tables formed by other authors from the same materials. As an example of coincidence between my table (published under the name of "Village Mortality") and Mr. Milne's Carlisle table, I present a comparative view of the "expectation," or mean duration, of future life, at different ages, according to the two tables.

I have published a most complete and extensive series of Life-Valuation Tables, founded upon a rate of mortality which is exactly twenty per cent. higher at every age than the mortality of the two just mentioned tables. I have applied to them the designation of "Mean Mortality," because I consider them founded upon an absolute mortality which is most generally applicable. The chief table of the series coincides very nearly at every age with the Sweden Table of Dr. Price, who has expressed a more favourable opinion of the observations on which that table is founded than of any other observations. Since, then, the new theory leads to results almost coincident with those of two tables

of the highest repute, and founded upon very different circumstances, I may be justified in declaring that very little doubt can be entertained of its truth, even if it were contradicted by tables of inferior authority.

Age.	Mean duration of Life according to	
	Milne.	Theory.
	Years.	Years.
1	44.67	44.59
5	51.25	51.21
10	48.82	48.79
15	45.00	45.05
20	41.46	41.40
25	37.86	37.83
30	34.34	34.34
35	31.00	30.92
40	27.61	27.55
45	24.46	24.25
50	21.11	20.96
55	17.58	17.64
60	14.34	14.47
65	11.79	11.65
70	9.18	9.20
75	7.01	7.12
80	5.51	5.41
85	4.12	4.04
90	3.28	2.97
95	3.53	2.15

I am not aware of the existence of one table of mortality, founded upon sufficient materials and supported by good authority, which really or apparently opposes the theory now advanced. There has however been recently published a table of mortality of the annuitants of the British Government, which exhibits the anomalous appearance of a constant rate of mortality (for the male sex only!) between the ages of twenty or forty-five years, whilst every table of unselected lives exhibits an increase of thirty-four per cent. for every ten years difference in age. This anomalous appearance may be accounted for by the known disturbing effects of "selection." The error in the construction of this table, which renders it of no practical value, consists in confounding together the mortality of all individuals of the same age, without any regard to the age at admission. If there were no proof at hand, it is evident, upon the slightest consideration, that recently admitted annuitants or insurers will suffer a considerably lower rate of mortality, than those of the same age who have been admitted many years previously.

The proof of the fact now stated has been recently furnished by the publication of the experience of the Equitable Life-Insurance Society, which supplies the means of classifying the mortality according to ages at admission. It results from such a classification, that the mortality of those admitted at one and the same interval of age, increases fifty per cent. for every ten years below the age of forty-five. But the increase of mortality deduced from the same lives in aggregate, without any regard to the age of admission, is only twenty per cent. in every ten years; so that there is a difference of nearly thirty per cent. consequent on confounding the reduced mortality of the late admissions with the higher mortality of the early admissions.

If it be granted that a similar difference would appear, if Government annuitants had been classed according to ages of admission, it will follow that the Government table offers no opposition to this theory, even in the case of select lives, provided the lives compared are selected or admitted at one and the same age.

The nature and weight of the evidence in favour of the theory will be readily seen on inspection of the following table, in which is shown, for decimal intervals of age, the number of deaths in one year for every hundred living, according to the observation of the highest repute, and in which is also shown the coincidence of two theoretical tables with the observed facts.

Between Ages.	Fact.	Theory.	Fact.	Theory.
	Sweden, 21 years, 1755-75.	Mean Mortality Table.	Carlisle, 9 years, 1779-87.	Village Mortality Table.
10—20	.71	.70	.59	.58
20—30	.92	.93	.75	.78
30—40	1.22	1.25	1.06	1.05
40—50	1.74	1.68	1.43	1.40
50—60	2.64	2.40	1.83	2.01
60—70	4.81	4.83	4.12	4.05
70—80	10.23	10.04	8.30	8.46
80—90	20.78	20.18	17.56	17.16
90—100	39.41	39.85	28.44	33.45

From the above it will be seen that the two theoretical tables are in perfect accordance with the facts at every age except between fifty and sixty. But the discrepancies here do not affect the truth of the theory, because they depend on the termination of the "procreative period," the fixing of which forms no part of the theory. It is rather remarkable that the discrepancy in one case is precisely the reverse of the discrepancy in the other case, arising from assuming the age of fifty-five as the termination of the procreative period. Whence it may justly be inferred that the theoretical tables are more valuable than either of the separate facts, with respect to the prediction of future mortality.

The Government returns, very recently published, of the mortality prevailing in England and Wales during the seven years 1818-24, yield results in accordance with the theory, at every age for each sex, with one single exception. Between the ages of twenty and thirty years the reported mortality of females is twelve per cent. higher than the result of the theory. Half of this excess is probably erroneous,

from two causes; first, the understatement of the ages of females; secondly from an undue proportion of omissions of the number living between the ages of twenty and thirty, when the population is most moveable, and consequently most difficult to enumerate. The remainder of the excess is probably real, and arises from the greater mortality of the class of females who earn their livelihood by prostitution, and who are generally between the ages of twenty and thirty years. It is hardly necessary to observe that the truth and universality of the theory cannot be shaken, except by observations in which the individuals compared differ in age, but resemble each other in all other important circumstances.

Grafton Street, Fitzroy Square,
March 28, 1835.

* * * So far are we from regarding discussions on the laws of mortality as foreign to our pages, that we invite communications on the subject; promising, however, to use minute care to prevent opinions (whatever we may publish) from obscuring or uselessly supplanting facts and principles.—Ed. L.