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Meteorology in Relation to Disease

On Meteorology in its relation to Disease.

"Man", says Daniell, "may with propriety be said to be a meteorologist by nature; he is naturally placed in such dependence upon the atmospherical elements, that to watch their vicissitudes, and anticipate their disturbances, becomes a necessary portion of the labour to which he is born. The daily tasks of the mariner the shepherd, and the husbandman are regulated by meteorological observations; and the obligation of constant attention to the changes of the weather has endued the most illiterate with a certain degree of prescience of some of its most capricious alterations. Nor in the more refined classes of society does the subject lose

any of its universality or interest: much of the text of experience, indeed, is blunted or lost; but science furnishes artificial aids to observation, which supply, perhaps inadequately, the deficiency; & the general influence of atmospherical phenomena is still felt & acknowledged, though possibly not so accurately appreciated. The generality of this interest is, indeed, so absolute, that the common form of salutation among many nations is a meteorological wish, & the first introduction between strangers is a meteorological observation". Nor need this be matter of great surprise, when we reflect that all things animate & inanimate, not excluding man himself, are more or less subject to the laws of meteorology.

But first as to the meaning of the term, Meteorology. According to Sir John Herschell "Meteorology, which in its ancient etymological sense, included all (the) the appearances of the heavens, as well astronomical as atmospheric, is at present restricted in its meaning to the description & explanation of that class of phenomena which group themselves under the head of weather, of the seasons, & of climate; — phen-

nuena which, scientifically regarded, are referable almost entirely to the investigation of those laws which govern the ever-varying affections of the atmosphere of our globe in its relation to heat, moisture, electricity, & the movements wh. the changes of those relations, brought about by ascensional or other causes, impress upon its parts".

Without here waiting to examine in detail the agents concerned, & the laws which regulate their mutual reactions, or stopping to investigate the various phenomena of meteorology, (except in so far as this may be necessary) which would be foreign to the subject of this paper, but taking these for granted, we shall at once proceed to investigate how far these phenomena induce in man a declination from the normal standard of health. And that this is no more than we are justly entitled to expect, will be apparent from the fact, that climate influences, to a greater or less extent, every known species of animal & vegetable, stamping them with a character peculiar to each individual region. Thus, for instance, the fleece of the sheep

species of sheep varies greatly in different regions: in a temperate climate, the wool grows extremely soft & silky, while in warmer countries, the wool of the same sheep becomes more coarse & even resembles hair. And hence, too, it is that we find certain animals & plants peculiar to individual countries; and we come naturally to speak of the African lion, the Bengal tiger and so on; while, at the same time, in those animals which are common to many countries we find each is distinguished by some variety of character, producing almost distinct species. Take, for example, the horse; which, perhaps, of all animals, seems to be most generally distributed over the whole world. Starting from Arabia, which is probably not only the original climate of horses, but the one best suited to their constitution, we find that those horses are considered the most beautiful; being, according to Buffon, longer, more fleshy, & handsomer than the Barbs. These latter are swift, nervous, slight, & make extremely fine hunters. The Turkish horses are not so well proportioned as the former: while those of Spain, which are reckoned

next in rank to the Barbs, are quick, courageous, graceful, more docile than the Barbs; for this account "they are preferred to all the horses of the world, for the purposes of war, of pomp, & of the manege" - With the English horses, again, are peculiar for their great height, their strength, vigor, & capability of enduring fatigue, combined with great fleetness; rendering them excellent either for hunting or the course, tho' they are wanting in the grace & docility so characteristic of the Arab or Barbary horse. From this single example we gather how infinitely the species of animals vary according to the variety of climate; proceeding to such an extent, as almost to constitute different races -

And so of vegetables - Each country has its own flora as well as its fauna; tho' the former appear to be more limited to certain climates & situations; as the horticulturist too often, in spite of his most anxious care, practically experiences in his attempts to rear, in a moderate climate, plants indigenous to a milder or perhaps tropical climate. And well we know, that if such plants were not protected, as the art of

of horticulture has taught us how, but we treated as our own hardy evergreens, that soon they would cease to live: and even if removed but a short distance from their own native ~~element~~ climate "they languish & what in their distinguishing properties, if further removed they become abortive, & if still further they cease even to live".

Nor, indeed, is man himself free from the effects of climate, tho' he may seem to be an exception, from the fact of his being found in almost every climate & situation. Some have supposed that this universal diffusion of the human species is due in great part to his rational faculties, which enable him to supply ~~the~~ defects, & correct the exuberances of particular climates & situations, rather than to his mere animal formation. Be this as it may, & this is not the place to investigate the matter, certain it is, that man is largely moulded by the external influences of climate - For, how else could we account for the variety & distinction in the temper & disposition of the inhabitants of cold & warm regions? Is it not a fact, patent

to the experience of all, that heat, while it increases the sensibility of the body, acts as vigorously on the mind? How else can the spasmodic hasty, & often passionate actions, as quickly repented of as perpetrated, & the vascillating conduct of the inhabitants of southern countries to be accounted for? And it is found that the effects of heat upon the human temper & disposition are, to render man passionate, to increase the tendency to vindictiveness, levity, timidity, and indolence - How did this escape the notice of that clear sighted & inspiring old Physician, Hippocrates, for thus he accounts for the Asiatics appearing to him a weak timorous people He says "it is chiefly owing to the seasons that they are less warlike, & milder in their behaviour than other Europeans; for the changes are not great with respect to heat & cold, but nearly the same" -

Cold, again, with other hand, blunts to a great extent the excessive sensibility of the system in general, & consequently we are prepared to find that the passions of the inhabitants of cold climates are less easily roused; and further, they are less

tyrannical and fickle, and more active, stirring, brave than those of warmer regions -

But not only does climate thus act on the psychical nature of man, but it also alters his physical condition. Accordingly we find that the growth of certain races e.g. the Samoeids, the Esquimaux, Greenlanders &c is stunted, & tho' meagre, their form is squat. While the natives of more temperate climates, e.g. in the north of the Mogul & Persian empires, Georgians, and the people of Europe in general, are the fairest & most handsome men in the world. How far & in what manner climate modifies or influences the morals, the manners & customs, the intellectual faculties as exhibited in the literature arts & inventions, the laws, religion, form of government &c we cannot now stop to enquire particularly -

If it be allowed that climat does produce, it may be by slow & even imperceptible gradations, such innumerable effects upon man, it will not be deemed surprising that it should bear some relation to, or materially influence the diseases to which mankind is subject. That

it does so, will be apparent from the consideration that various diseases are found to be peculiar to certain countries. As, for example, Cretinism to the valleys of the Alps & Pyrenees & some mountainous parts of Tartary & China: Plica Polonica to Poland, Hungary, & the south of Russia: — the Guinea worm to Guinea, Africa & West India Islands: — while to Britain, tho' unjustly, are usually ascribed Scrofula & Phthisis — And further, when we consider that the atmosphere surrounds us on every hand, that on it our very existence depends, that at every inspiration it is drawn into our bodies, & then brought into the most intimate union with the blood through the medium of an expanded network of the most delicate blood vessels, we are constrained to conclude that the influence of the atmosphere on the human frame in the variations of its physical qualities must be sufficiently remarkable, & must take a considerable part in the production of disease —

To these physical effects we must now turn our attention. And first as to,

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Temperature -

That temperature to a greater or less extent affects the human body must be consonant with the experience of all; for every one must have felt the depressing effects of a dull gloomy day, while on the other hand, a bright sunshining day invigorates & cheers the mind & spirits. Dr Arbuthnot thus remarks, that "people of delicate nerves & movable spirits are often joyful, sullen, sprightly, dejected, hopeful, despairing according to the state of the weather; & these changes happen, but pass unobserved in stronger constitutions" There are days in which the intellectual faculties of memory, imagination, judgment, are more vigorous". How true this is, every one, from his own experience, must be able to verify. That such changes are due, in great part, to variations of temperature must be pretty generally allowed, seeing that heat acts upon the body as the most universal stimulant with which we are acquainted, its effects varying in degree according to its permanence or intensity -

A certain amount of heat is necessary for

the maintenance of life both vegetable and animal, and is absolutely indispensable for promoting the functions of their economy. And if this definite amount of heat be either entirely wanting, or for a time retarded, the seed which is cast into the ground continues to lie there an inert mass, and not until a certain temperature be arrived at does it begin to germinate. But not only is a particular degree of heat requisite for the sprouting of the seed, but a continuous increment is demanded to stimulate the functions of the now animate seed, to enable it to evolve its various parts, & finally to bear & ripen its fruit — The want of this requisite amount of stimulus, or the diminution of it by any untoward accident gives rise to what every practical agriculturist so dreads, a "late season" — This it is too that causes the trees to bud & leaf in spring; the dormant roots, yielding to the stimulus imparted by the increasing temperature, begin again to resume their functions, absorb the moisture from the ground, which is drawn up by the capillary attraction of the intercellular

Canals, and mingling with the store of nourishment laid up in the cells, is carried to the buds' These to the buds which are thus supplied with nutrient material sufficient to cause them to swell & burst into leaf.

On the animal creation the effect of this same stimulus is apparent enough, since it is matter of common observation that the period of their birth happens exactly at that very particular season of the year best suited for their growth & nourishment - So we find birds hatching their young when the heat of spring begins to be felt & the young brought forth exactly at that period when their natural aliment is most plentiful. And when the temperature declines, we find many birds migrating to more genial climates, where both the temperature is higher & the supply of food abundant.

From such & many similar analogies we are naturally led to expect that temperature will have some considerable influence on man. How far it acts in modifying the size, appearance, manners, morals, & faculties of man, we have already sufficiently examined - And if it

be granted that climate influences man in a healthy normal state, surely it will be readily conceded that temperature must operate much more actively on the body, when the functions of the system are imperfectly performed — And interesting as the examination of these changes both in animals & man are to all, to the Physician, in particular, it must have peculiar attractions. And such it has proved to many, but to none more than to Hippocrates, who in fact considers it one of the necessary studies for a conscientious enlightened Physician. Thus we find him speaking in the commencement of his work on Air Waters & Situation, "Whoever would apply himself right to Physic should observe this method. First, he should consider the Seasons of the year, & what every one is capable of producing: for they are not all alike, but differ much from one another, & in their several changes" - And in another place he continues, "The changes of the seasons are more powerful moulders of things than even the situation in which each is reared; and after these the waters - For it will almost

always be found that with the physical and moral constitution of man is greatly modified by the nature of the climate".

What then are the effects of heat upon the human constitution? Looking to the inhabitants of intertropical climates, where we naturally expect to find these effects most fully & fairly developed, we observe that it first acts on the skin producing variety of color; & not only so, but it modifies its whole texture in such a manner as to render it a more efficient emunctory of the system than the skin of the inhabitants of the more temperate climates. "It not merely", remarks Dr. Copland, "exhales a larger proportion of aqueous fluid & carbonic acid from the blood, but it also elaborates a more unctuous secretion, (from the blood) which, by its abundance & sensible properties, evidently possesses a very considerable influence in counteracting the heating effects of the sun's rays upon the body, & in carrying off the superabundant calorie". And further, "those materials which require removal from the blood are eliminated by this surface, which, in the negro especially

performs exciting functions very evidently in aid of those of respiration, & of the biliary secretion. Heat seems to act on the human system, by exciting the nervous system in general, but specially the cutaneous nervous system: by diminishing the force of respiration this' the inspirations & expirations may be more frequent but not so protracted, thus impeding the changes which the blood undergoes in the lungs: and vicariously stimulating the cutaneous and intestinal mucous surfaces to increased activity. — The diseases which prevail in such a condition of the atmosphere are fevers attended with great debility, hepatic diseases, & the bowel complaints, viz Cholera, Dysentery and Diarrhea. To this catalogue may be added many nervous affections.

Cold, on the contrary, seems to produce effects very different. How this acts on the Physical constitution of man by stunting his growth & muscular development & power we have already seen. And as to his moral condition it has long been observed that the inhabitants of those regions which are subject to moderate

Cold, are among the most vigorous both physically & morally of all the nations of the world.

Moderate cold seems to act on the system by corrugating or wrinkling the skin, which thus hides the cutaneous papillæ in the furrows, & as it were causes them to retire deeper into the skin. Thus, the orifices of the glands being closed, the cutaneous secretions are diminished. The cutaneous nervous papillæ are also much contracted, causing that benumbing influence so characteristic a concomitant of intense cold, whereby the sensorium is both insensible to any impression made on the benumbed part, & the part affected is at the same time incapable of being acted on by the will, on account of the paralysed condition of the motor nerves involved in the part. The skin then not being so important a depurant in cold or temperate countries, and the same amount of effete matter being to be got rid of, it follows that this must be eliminated by some other organ. And so it is that the functions of the liver & the lungs are much more active in those inhabiting temperate regions than in the inhabitants of the tropics; while

in colder regions the lungs & kidneys are called into more active play, "the secretion of the bile being diminished by great cold, & its quality rendered more acrimonious", according to Dr. Falconer. And further, by this corrugating effect on the skin the smaller vessels are constricted, their calibre diminished, & thus emptied of their contents. Consequently, the blood is now driven to the internal organs, and accumulating in the large veins of these viscera, they become congested, their functions are thus interfered with, & the whole circulation consequently weakened.

The diseases engendered by such a constitution of the atmosphere are Inflammations, specially of the Respiratory organs, Dropsies of the chest sacs, Hemorrhages &c

But a far more fertile source of disease than either of the two already mentioned causes, is to be found in the sudden & rapid alternations of temperature. "It is to sudden changes in the temperature, says Dr. James Johnson, and occasional deleterious impregnations in the composition of the atmosphere, that nine tenths of its injurious effects in the human constitution

as to be attributed". How just this is, how consistent with common sense appears when we consider the effects of heat (already referred to) upon the body, and rapidly following upon this the diametrically opposite effects of cold — But these effects are greatly increased or modified by the state of the atmosphere as to

Moisture.

The body is capable of enduring greater vicissitudes of temperature if the air be clear and dry. The changes effected in the blood are then more perfectly carried on, the watery vapour from the lungs is more freely carried off, and consequently it is rendered purer & more fitted for the purposes of nutrition, and thus renders the body more vigorous, and more fitted to resist the noxious influences of aerial & other poisons —

But if the atmosphere be loaded with moisture, the respiration is embarrassed, the watery vapour is not freely carried off from the surfaces specially from the lungs, the vital energies are depressed, the body becomes languid, and consequently being thus already predisposed

the system is more readily affected by the exciting causes of disease.

But if the air be at the same time moist and warm, all these symptoms are greatly aggravated. Indeed the peculiarly unpleasant & depressing effects of this condition of the atmosphere may be experienced at will, by entering a hot house, where the air is humid & warm to an almost suffocating extent. According to the experiments made by Dr. Copland in an intertropical atmosphere on this subject, he found that "heat remarkably diminishes the changes effected by respiration on the blood; and these changes are further diminished by warmth associated with moisture; which, however, promotes the passage of positive electricity from the body. And as the researches of Ritter show that the electricity of the positive pole heightens, while that of the negative depresses the actions of life, the ultimate effect of humid atmospheric warmth, as respects both the state of the circulating fluid and the locomotive electricity of the body, will be to lower the whole circle of vital manifestations, to dispose

to, or even to induce diseases of a low character to occasion adynamic, continued, & remittent fevers, dysentery, cholera, agues, chronic asthma, affections of the liver & spleen &c

Moist & Cold air produces pretty much the same effect in the human frame that cold itself does, only increased in degree. Thus, it acts by lessening vascular turgescence, & preventing the escape of fluid from the cutaneous surface. In like manner it operates upon the pulmonary system by interrupting the free exhalation of aqueous vapour from the lungs. Consequently the blood is not requisitely depurated of its effete matters, but this is to a certain extent compensated for by the vicarious increase of the secretions from the Kidneys & intestinal mucous surfaces; & thus is injurious plethora of the vascular system prevented. The positive electricity of the body is also in this condition of the atmosphere rapidly carried off by induction, which says Dr Copland is a salutary stimulus, and one which experiments have shewn to be productive of increased activity in all the animal functions" - The diseases

most prevalent in such a condition of the air are Rheumatism, Gout, Scrofula, diseases of the Glands, Dropsies, Congestions &c

Wind.

Another great modifier of the health of man is found in the Wind. These may either be hot or cold, moist or dry, and according as they are such they influence to a considerable extent the temperature, moisture, and gravity of the atmosphere.

In this Country the prevailing winds are from the South and West: and then the atmosphere is moist, because these winds as they sweep across the Atlantic Ocean become loaded with its exhalations, which they deposit in the form of showers, mists &c, on the land as they pass over it.

The South wind is said to contain the greatest amount of Ozone; and it is stated by Dr Moffat that "a greater number of diseases take place during the ozone or equatorial periods; (i.e. when the wind veers between South-East and North-West, by the south west) and

that deaths are more frequent during the polar or non-ozone periods; which he accounts for by the fact that in the case of the diseases the atmosphere undergoes greater changes during a southerly direction of the wind, which is shewn by the frequent oscillations of the barometer; and the tendency to death that obtains during the reign of the polar currents, he attributes to the reduction of temperature". The South wind has always been regarded as a pestilential wind, and though favorable to the longevity of the Phthisical and the aged, is said to induce catarrhs & Bronchitis.

The South-West & North-West winds are more or less healthy; they have a considerable amount of ozone, and usually bring with them, rain -

The Easterly Winds are peculiarly cold, dry, and arid. They are most frequent in March, April, and May, and are produced by the current established to replace the warmer air, as it rises from the surface of the Atlantic and more southerly countries now warmed by the sun, and passes to the

northward of the Equator. They are peculiarly inimical to Phthisical patients and the Aged; and by the precipitation of the moisture in the air in the form of fog, induce Rheumatisms, Bronchial & Pulmonary affections.

Wind also acts mechanically on the health of man by the variations in the rapidity and slowness of its movements, and by altering the state of the atmosphere with regard to the Density of the Atmosphere.

Of the influence of the atmosphere on health by the variations in the state of its density, there can be little doubt, when we consider how great is the load pressing upon our bodies at all times, and how variable & unequal this pressure is being at one time greater at another less, as indicated by the diurnal fluctuations of the Barometer. And since it is well known, that the pressure of the atmosphere diminishes in a certain ratio for every hundred feet we rise above the level of the sea, so we are prepared to find that those who live on hills and in elevated situations differ consider-

ably from the dwellers in valleys or in the lower districts around the sea. And it is observed that the former are generally a more active vigorous, intelligent race as compared with the slow, deliberate, & dull inhabitants of the lower regions - Hence too the reason why we feel oppressed, heavy, & generally dull and indisposed to active exertion in certain atmospherical conditions; whereas when the barometer stands low, the mind is decidedly more cheerful & elastic, and all the corporeal & mental faculties are exerted more perfectly -

Then as to its action upon the body. Too great pressure drives the blood from the surface upon the internal viscera, inducing congestions of these structures, and pulmonary complaints - While a considerable diminution in the pressure disposes to a freer circulation in the surface capillaries, leading perhaps to congestions of the surface, with copious perspirations and diminished secretions from the other emunctories. Moreover, in this latter condition of the atmosphere it is found that Apoplexies are more common; and the proportional mortality from diseases of

the brain is much greater during the months of summer, when the barometric pressure is highest as well as the temperature, than during the colder months when the barometer is at its lowest. This difference in the mortality has usually been ascribed to the increase in the temperature alone, without any regard being paid to the influence of the density of the atmosphere which as it appears to us is the chief agent in causing this increase in the mortality — As a proof of the active influence of this condition of the atmosphere on disease, it has been repeatedly observed that epidemics are usually associated with an extremely high state of the barometer. Thus Dr. Prout records, concerning the outbreaks of the Cholera in 1832, that "on a particular day, the 9th of Feb. 1832, the weight of the air suddenly appeared to rise above the usual standard. xx On the days immediately following, the weight of the air continued above the standard, though not quite so high as on the 9th of Feb. when the change was first noticed. The air retained its augmented weight about six

weeks." So of the visit of this same disease in 1834 the readings of the barometer were very high; and it is recorded by Mr Haviland that they exceeded the mean readings of seven years during the months of Feb. March, April, Aug, & Sep, during which last two months the epidemic was at its acme'. And Mr Glashier from observations made during the three epidemics of 1832, 1849, & 1854 determined, among many other facts, that there is an increased pressure of the atmosphere greatest at the worst period of the epidemic; and an increased density of the atmosphere, not arising from an increase of watery vapour." In another place he says in summing up the results of his inquiries, "during the height of the epidemic, in all cases, the reading of the barometer was remarkably high. In both 1849 & 1854, the first decline of the disease was marked by a decrease in the readings of the barometer" &c From these observations we cannot help coming to the conclusion, that the pressure of the atmosphere has a very marked influence on the constitution, health, & diseases of man.

Electricity.

To the excess or deficiency of Electricity in the atmosphere, it has been sought to ascribe, in some degree, the outbreak of certain epidemics. And lately between the disturbed state of the atmosphere, so far as this constituent is concerned, a connection has been attempted to be established with certain morbid tendencies and diseases.

Electricity, we know, does act on the body as a stimulus; and as such is constantly made use of in those diseases which are characterized by a loss of nervous energy there. And indeed, it seems to serve some essential purpose in the animal economy, for every animal is found to possess a certain amount of this fluid; as may readily enough be demonstrated by combing the hair rapidly in the dark, or by shaking a flannel shirt just taken from the body, in both of which instances a crackling noise will be heard & bright sparks of light emitted. However, it is matter of common observation that some persons feel very unwell & uneasy before

a Thunder storm; and by the peculiar dull, heavy sensation, and the weighty headache can even predict the approach of a thunder-storm with astonishing accuracy. These facts all tend to induce us to believe that this electrical condition of the atmosphere has some influence on man. But of its influence or in producing disease or any epidemics, our knowledge does not warrant us in very positively asserting what that is. And as no observations on this subject are as yet made by the Meteorological Society of Scotland, we are consequently not in a position to examine into the effects of this powerful agent on disease -

Ozone.

This substance, so named from its peculiarly pungent odor, was discovered by Professor Schönbein in 1848, and is found to be produced in various ways and under several circumstances; as by passing electric sparks thro' Oxygen; in the decomposition of water by electricity; and in the oxidation of Phosphorus when exposed to

the atmosphere. It likewise exists in the atmosphere, tho' by no means always, tis at times very abundant. It is supposed to be, either an allotropic form of dentoxide of Hydrogen, or a teroxide of Hydrogen. Its properties are somewhat similar to those of Chlorine, being incapable of supporting life, bleaching vegetable matters, acting energetically on metals, and somewhat resembling it in odour, but more like what is perceived after a thunder storm or powerful electric discharge in the Laboratory - It is a most powerful oxidizing agent; and is supposed to be the chief element in reducing the Compounds arising from decomposing animal & vegetable matter in the air - According to the experiments of Mr. Haviland in this body, he found that "when it is in excess in the atmosphere, the eyes frequently become affected by its stimulating properties; the pituitary membrane also suffers, and after its prevalence for many days the organs of respiration become affected. Influenza and other pulmonary affections take place, neuralgia & inflammatory

diseases among animals, whose powers of resisting morbific influences are small when compared with those possessed by others higher in the scale of creation. The disinfecting property of Ozone appears from the statements of Schönbein to be great. His observer states that an atmosphere containing $\frac{1}{1000}$ of this peculiar element is capable of purifying 540 times its volume of air produced from putrid meat".

The presence of Ozone & its amount in the atmosphere are determined by what is called Schönbeins Ozonometer. This acts by taking advantage of the peculiar property which Ozone possesses of liberating the Iodine of Iodide of Potassium, and this in conjunction with Starch gives to the test paper the characteristic blue color. This colored paper is then compared with a fixed standard, and according to the depth of the tint struck on the paper, so is the amount of Ozone present in the air determined.

But this test is subject to serious fallacies. For, as has been pointed out by Dr. Mitchell &

Thus, the amount of Ozone indicated by these papers is in direct ratio to the height of the wind; and consequently, during a calm, the same amount of Ozone may actually be present in the atmosphere as when a high wind prevails, and yet the papers, exposed for exactly the same length of time, may indicate a very different amount of Ozone. And this arises from the fact, that the paper exposed during the calm is acted on "only by the Ozone in the air immediately surrounding it"; while over the other papers on the contrary, "a continuous stream of air flows, carrying with it the reagent — fresh Ozone arriving at each instant to add to and increase the indication by setting more iodine free". Other objections have been urged by Mr. Mitchell, the most serious of which seem to be, that other reagents set free the Iodine as well as Ozone; and that a paper once tinted, early in the morning sky, may yet at the usual period for reading the amount be again entirely bleached, thus indicating the total absence of Ozone.

Now, these are serious objections. And, of course, till some means be found to obviate them, all attempts at measuring the amount of Ozone present in the atmosphere by this method must give results utterly false — Still, we cannot doubt that this substance must have a material effect in modifying — ing, to a greater or less extent, the prevalence, it may be the very existence of disease, specially of epidemic diseases —

But for the reasons already adduced, and further, because the observations with respect to this agent are not yet sufficiently extended over Scotland, it were useless to attempt to draw any conclusions as to the relation of this element to disease —

In order more definitely to ascertain the connection between the meteorological phenomena of the atmosphere and the various diseases, we shall compare the ~~meteorological~~ reports of the Meteorological Society of Scotland with those of the Registrar General for the last five years, to judge in this manner of the effect of these phenomena

the disease. And in doing so, we shall confine ourselves, for the sake of brevity, to the phenomena exhibited during the last five years in the eight principal towns of Scotland, as giving a pretty fair estimate of the whole country.

The first thing that strikes us in this comparison is, the close connection that exists between the coldness of the season and the number of deaths. In fact we are at once impressed with the truth of the words of the Registrar General, "that the coldest month is the most fatal, and that each month yields a number of deaths exactly proportioned to its coldness: and that contrary to the assertion of all writers on sanitary matters, the deaths do not increase with the heat, but constantly and rapidly diminish; — that, in fact, in this country 'it is cold that kills and not heat'."

In proof of this assertion we have only to compare the meteorological character of the years 1854 & 1860, with the deaths of these respective years. The year 1854 was characterized by a temperature much above the average during the winter and early spring months, and the summer

Table shewing the influence of Temperature on the Mortality.

	Temperature of		Mortality in	
	1859	1860.	1859.	1860.
Jan.	41.0	35.9	2174	2557
Feb.	41.5	34.9	1993	2795
Mar.	44.2	39.1	2072	2559
Apl.	43.1	42.1	1925	2537
May.	52.4	50.9	1729	2168
June.	56.6	54.4	1630	1916
July.	58.5	59.3	1619	1941
Aug.	57.7	55.4	1597	1738
Sep.	52.8	50.7	1536	1596
Oct.	46.0	47.4	1678	1902
Nov.	40.0	39.3	2039	2011
Dec.	34.9	34.4	2353	2328

months showed an average temperature. While the year 1860 was as much below the average in temperature as the winter & spring of 1859 were above it. Thus in March 1859 when the mean monthly temperature was 44.2° Fah^{t} (nearly three degrees above the average of the last 5 years for that month) the deaths only amounted to 2072, being about 150 below the average of this month. While in March 1860, when the mean monthly temperature was only 39.1°, being rather more than 2° below the average, the mortality was proportionately increased, amounting to 2559, being no less than 340 above the average. Thus comparing the same months of these two years, and observing that all the other meteorological phenomena corresponded as nearly as possible, with the exception of that of temperature wherein they differed to the extent of 5.1°, so we find that they differed in the rate of their mortality by the startling amount of 487 deaths. This increased mortality as the result of greater cold is still better illustrated in the month of February. Here it will be observed that in the year 1859 there is an in-

crease of .5° in the temperature of Feb. over that of Jany., and that there is a corresponding decrease in the mortality by 181 deaths. While in 1860 there is a fall in the temperature to the extent of 1° between that of Jan. & Feb., and coincident with this fall there is a large increase in the number of deaths, viz, 258 in excess over that of Jan. But this is more strikingly illustrated by comparing together the same months of these two years. Between them there is a difference in the temperature of 6.6°, and in the mortality a difference of 802 deaths - Such is the influence of temperature upon the mortality - Further, in 1854 the temperature gradually rose from Jan. to Aug. with no slight exception, and with this rise the mortality as steadily decreased, also with no exception due to other atmospherical variations, until it reached its minimum in September, tho' in this month the temperature fell nearly 5° below that of Aug. This seeming contradiction to the law just laid down admits of ready explanation, from the fact that both heat and cold are cumulative in their effects.

They do not, as a general rule, tell immediately by increasing or diminishing the mortality, but take some time to exert their baneful or ameliorating effects. Consequently, it is not till the month after that the bad effects of a fall or the good effects of a rise in temperature are apparent in their full extent. And moreover, if the temperature has for a series of weeks been high or low, the good or bad effects of a change are manifested but slowly.

Another interesting fact which comes out from an examination of this table is, the steady decrease of the mortality all thro' the summer months. Now, according to a popular fallacy, this season of all others, is the one when epidemics are considered to be most rife. How is this a most popular delusion, but it is constantly repeated by writers, who ought to know better, but who, probably taking the matter for granted as an established fact, never thought of enquiring into it to see if it were really a fact. And according to this established custom we find this fallacy propagated by a writer on Sanitary Science in a recent edition of an extremely useful & general-

by accurate standard work in the following terms "In England the hottest months of the year are the most unhealthy, and this unhealthiness is increased if the atmosphere is unusually moist. The next most unhealthy portion of the year is the cold months; and the public health suffers more if an unusually moist atmosphere prevails." Now, to this statement we entirely demur, as calculated to mislead and as contrary to fact, as is clearly proved by these and many other statistics. How then, it may be asked, came this common and popular idea to be originated? Most probably as Dr Stark has pointed out in his report to the Registrar General, it arose from the very fallacious notion that "atmospheric agencies must have the same action in all parts of the world, irrespective of climate, locality, and race; and it is from neglecting to make this discrimination that we find it constantly asserted by writers, that epidemics seem to be generally associated with summer or hot weather". And as all popular superstitions, beliefs, sayings, have some foundation in truth, so here we find that it is not wanting in this case. For,

by that natural tendency to generalization which pervades the human mind, people readily came to believe, in fact took it for granted, that because in tropical climates the cool months were the healthy ones, and the warm months proved the most fatal period of the year, so must it also be in Britain and other more temperate lands. "And even the observations made in favoured temperate lands", adds Dr Stark, "suggests the cause of this fallacy; for even here we find that the moment the mean monthly temperature rises above 60°, diseases are induced by the heat which prove fatal to the population nearly in the exact ratio of the rise of the mean monthly temperature above 60°."

From an average of five years, the order in which the months arrange themselves with regard to fatality seems to be, Jan. March, Dec. Feb. And the reason why March takes such a prominent place is to be attributed to the cumulative effects of the cold telling then most fatally upon the already weakened constitutions of the sick; it being preceded by the three coldest months of the year. While the order in which the months stand

with regard to their salubrity is, Sep. Octs. Aug. thus again shewing the effects of heat in reducing the mortality. For tho' Sep & Octs. are by no means the warmest months, yet they are preceded by the three warmest in the year; which themselves would doubtless have turned out to be the most healthy, were it not for the fact, that with the increase of heat the Bowel Complaints slightly increase, tho' almost all the epidemics are then at their minimum. Hence we may fairly conclude with Dr Stark, indeed the fact stares us in the face, that "the prevalence & fatality of all the ordinary epidemics in this country increases with the increase of cold - increases as the supposed putrid exhalations become less virulent, or are quite arrested". And further it appears that the mean temperature most favorable to health in Scotland, judging from an average of the last five years is between 48° and 59° -

Here is a remark made by Dr Copland in speaking of the effect of a variable climate on man in the following terms, "The rapid & frequent vicissitudes of weather preclude, as respects the community generally, the regular adoption of

means to guard the body against their operation; consequently the frame becomes habituated to their operation; ~~consequently~~, and thereby fortified against their injurious operations & impressions which would otherwise be made upon them. That countries thus situated are benefited rather than injured by this state of weather & season, is shown by the robust frames, the mental activity, & the longevity of their inhabitants".

Now, however willingly we concede that the mental powers are benefited by such rapid atmospherical changes, we certainly cannot concur with this opinion. In fact we hold exactly the contrary. And judging from a simple analogy, the conclusion to be arrived at is one exactly opposite to that of Dr Copland. For suppose the weather to have been mild & genial, & suddenly it becomes cold & chilly what is the result? Simply this, that it will have pretty much the same effect on the system that the sudden transition from a heated atmosphere into the cold air of midnight has. The functions of the skin which have been in such vigorous action, and the process of perspiration

much increased, are now suddenly checked, and the blood which was formerly attracted to the surface, is now rapidly determined from the surface of the body to the internal organs, & chiefly to the lungs, speedily inducing a train of pulmonic disorders & catarrhs. And in like manner a sudden change from cold to heat is injurious to the constitution. And this we see daily exemplified when a thaw succeeds a continuance of frosty weather, and the thermometer rapidly rises 8 or 10 degrees, when there succeed numerous attacks of Influenza, Bronchitis &c. These evil effects are greatly aggravated if the atmosphere be at the same time very humid. Thus in reporting on the influence of such weather on Cholera when it made its appearance in this city in 1848, Dr Stark remarks, "Whenever, during the progress of the epidemic, unusually close, damp, mild, relaxing weather occurred, & was followed by any change, but especially by a change to frost, so as to cause the formation of a damp fog or mist, the cases of Cholera increased in numbers, in some cases more than doubles-

And again, damp, foggy weather, accompanying, following, or alternating with very mild, close, damp, relaxing weather, during which the air is unchanged with moisture, is invariably followed by a greatly increased mortality".

But if derangements of the system induced by the sudden diurnal transitions of temperature are so trying to the healthy constitution, they are decidedly much more detrimental to the weak, the sick & the aged. And in none of them are these effects so speedily manifested as upon the Aged. They are peculiarly sensitive to atmospherical phenomena, but particularly to that of Cold. While in other diseases the effects of Cold do not tell immediately by raising the mortality yet in their case, the decline even of one degree in the mean temperature of the month from that of the preceding speedily proves fatal to an increased number. So too, the East winds have a pernicious effect; tho' by the time they usually appear the temperature has risen considerably, still the keen,

Table shewing the influence of Atmospherical Phenomena upon the Aged.

1880. Months.	Mean monthly Temperat.	Mean monthly Humidity	No. of days on which E. Winds blew	Actual Mortality
Jan.	35.9.	87.	9.	143.
Feb.	34.9.	84.	2.	157.
Mar.	39.1	80.	3.	132.
Apl.	42.1	74.	13.	149.
May.	50.9	75.	12.	129.
June.	54.4	80.	13.	97.
July.	59.3	80.	9.	83.
Aug.	55.4	87.	6.	68.
Sep.	50.7	81.	3.	67.
Oct.	47.4	84.	4.	78.
Nov.	39.3	87.	15.	71.
Dec.	34.4	88.	12.	109.

piercing, dry aridness of that wind is peculiarly hurtful to the Aged. While again the mild balmy weather of Aug. & Sept. reduces the mortality among them to a minimum.

These effects were well illustrated in the year 1860, when the temperature of the first 5 or 6 months was considerably below the average, the full allowance of Easterly Winds in April, May & June prevailed, & the humidity was above the average.

From the accompanying table it appears that in Feb. the deaths were increased by 14 owing to a fall of a single degree in the temperature below that of the preceding month, tho' probably the East winds in the latter end of Jan. helped up the numbers somewhat. Then again this same noxious element came into play in April, raising the mortality by 17 even tho' the temperature rose 3°. The drying effect of these winds is also well illustrated in this table by comparing the state of the air as to humidity during this month as compared with that of the former, when we find it reduced to

74 (saturation being = 100) in April. And when these winds declined in frequency & the more balmy Westerly winds prevailed, & the atmosphere was now well heated in the months of Aug & Sep. the mortality was at it's minimum.

Hence we gather that an average mild temperature with a moderately humid condition of the atmosphere, & freedom from the baneful East winds, are the conditions most favorable to the preservation of the life of the Aged.

Phthisis.

This is the disease which has long been regarded as the scourge of Great Britain. But that it is not peculiar to Great Britain has been pointed out by the Registrar General. In fact, he has shown by comparison of statistics that this is a great mistake, & that in many countries the mortality from this disease is much higher. This is the case for instance with the more temperate States of America. In the State of Massachusets a five years average shews that diseases of the tubercular class in the

prove fatal in the proportion of 479 deaths in every 10,0000 persons in the population", while in Scotland, in the year 1855 when this statement was made, the deaths only amounted to 366 in the same proportion. Be this as it may, it cannot, however, be denied that Phthisis cuts off a vast proportion of our population; indeed, it ranks first as the most destructive disease. It is of importance, then, that we should ascertain, if possible, the causes which seem particularly to induce or to foster it.

Looking, then, to the statistical returns, we find as regards season, that the Spring, (i.e March, April, & May,) is by far the most obnoxious period of the year to the consumptive; next to it Winter; then Summer; least fatal of all Autumn.

From this fact, it becomes apparent that Phthisis is not materially aggravated by cold; the latter indeed has little effect in increasing the mortality. The curve of mortality from Consumption pursues a pretty even course throughout the whole year, and does not coincide so

minutely with the wave of temperature as some other diseases, e.g. Bronchitis & Pneumonia.

Since Spring is the most fatal season what then are the leading meteorological phenomena of these months? Certainly they are the keen, cold, piercing, East winds — those it is which prove so hurtful to the Phthisical patients. They seem to act by inducing inflammatory affections of the lungs already debilitated by disease, and which unable to stand the exhausting attacks of this aggravating complication, the phthisical speedily sinks under it — "There certainly is something in an Easterly wind", remarks Dr Johnston, "independent of its temperature, which is inimical to the free & regular performance of the animal functions, & particularly the functions of the skin; for invalids will feel its effects in rooms where the temperature is regulated by a thermometer, nearly as much as this they would in the open air". To the truth of this, the rheumatic patient, particularly, can add his testimony. This "something" is just the extreme dryness of this wind, & it proves so injurious

to the consumptive by carrying away too quickly from the surface the natural evaporation, thus chilling the body; & also by inducing inflammatory affections of the lungs & bronchial tubes." The atmosphere, at this season, is also peculiarly free from humidity, due to the drying nature of the prevalent winds. Another phenomenon of this season is the rapidity of the diurnal changes in the temperature, as evidenced by the great daily range of the thermometer.

The next most fatal season is the Winter season. This is characterized by the greatest amount of Barometric pressure throughout the whole year, and also the greatest range of the Barometer; while the cold is then most intense, & the atmosphere very moist, two conditions most unfavorable to all kinds of disease; and the Easterly winds prevail for about $\frac{1}{5}$ of the season only. We have thus an indication that cold does to a limited extent increase the mortality of Phthisis. Of course when it is said that cold or any other meteorological

phenomenon increases or tends to increase the mortality, this must be understood as spoken relatively, or in comparison with some standard. Now, naturally, this standard of comparison is the lowest amount of deaths from the particular disease. In the case of the disease now under review this occurs in Autumn. But it just so happens that the first of the Autumnal months is that in which Diarrhoeas are most prevalent, and the two latter months are not far behind those of Summer in the average mortality from this cause. From this circumstance, we cannot help being impressed with the fact that the reason for this large increase in the deaths from Diarrhoea is to be found in this, viz that it is the old enemy with a new face. Knowing how common Diarrhoeas are in the latter stages of this distressing malady, & seeing that the chest affections of the Phthisical are diminished as the heat increases, and that with this increase of heat the Diarrhoeas synchronously increase, we are inclined to believe that the Consumption is not in reality much ameli-

orated after all, but merely changes its seat & form, setting up a painful, exhausting, fatal diarrhoea, to which the already much weakened patient too speedily succumbs.

Still, we are not prepared positively to deny that cold does cause a rise in the mortality from Phthisis, but do maintain that this is a very minor cause of the increase. Mr. Haviland has most carefully collected a number of statistics on this matter, & we extract from his work the following as illustrative of the effect of temperature in the number of deaths from Phthisis.

An. mean. temp.	Average an. no. of deaths from Phthisis in London.
51°	6890
50°	6740
49°	6719
48°	7190
47°	7156

And he adds, "these tables certainly indicate a relation between the mean annual temperature & the mortality from Phthisis in London: a less number of deaths taking place at 51° than at 48° & 47° by $\frac{1}{28}$, although it will be

seen that the number of deaths were greater when the temperature was at 48° than when it was a degree below; and the same obtains between the degrees 50° & 49°. We are inclined to think that other causes than temperature operated to bring about this apparent relation. So are we; — and the other cause we ascribe to the Easterly winds inducing or accompanied by great dryness of the air. One such was the theory on which Mr Jeffreys proceeded when he constructed his Respirator. He says, "The action of the air is to dry the cool, (in winter to chill,) any warm moist surface exposed to it, whether that surface be inanimate, as a towel dipped in warm water & hung in the air, or animate as the membranes of the throat & lungs. Such membranes therefore that they may bear this action of the air, are in health well supplied with the means of supplying themselves with warmth & moisture, as fast as they are carried off by the air x"x When diseased, & delicate or irritable they cannot endure this action of the air without suffering. But if their natural moisture can be preserved, the

chilling air wanded off, then their irritability speedily subsides, & their true energy returns. To facilitate this desirable end Mr. Jeffreys proposed & constructed his portable respirator.

The result of this enquiry then seems to be that cold & particularly dry air aggravates this disease by irritating the lungs, & by carrying off their natural moisture with too great rapidity; as well illustrated by the dry East winds of Spring in Scotland. While the moist balmy weather of Autumn, with its great humidity, & prevailing moist south-westerly breezes, lessens materially the mortality from Phthisis.

Such being the case, the great practical interference for us as Physicians is, to provide during the Spring months, as best we can, for our Phthisical patients just this very weather which obtains in Autumn, which seems so genial & so kindly to their malady. This it appears to us may be done in either of two ways:- Either by sending the patient to a climate where this condition of atmosphere prevails: or by keeping him at home, strictly confined to one, or at most to two rooms directly communi-

cating, with a temperature properly regulated by the thermometer and by the feelings of the patient or his attendants; and more particularly still, by the most unwearied attention in maintaining the atmosphere at its proper pitch as regards moisture, regulating this too by the dry and wet bulb thermometer, never suffering the humidity to sink below 80° or to rise above 85°. This may readily be done by either hanging a damp sheet in the room, or by conducting into it the steam of boiling water. This second method it does appear to us has many advantages, particularly if the patient's disease be far advanced. He is thereby saved the fatigue & trouble of travelling, how great this is can hardly be well reckoned by one in perfect health. He enjoys all the comforts of a home, how dear even indispensable these are to the sick, every one well knows who has had any thing to do with such. He is surrounded by his anxious friends, enjoys the pleasure of their society, no mean advantage to the phthisical patient. How all these the patient leaves behind him when he quits his

home to seek health in a foreign land. For the comforts of a home he exchanges the loneliness of a lodging; for the society of friends, he obtains that of strangers or uninterested foreigners, speaking to him, it may be, an unknown tongue. And if the disease be far advanced, he goes from his country to the milder south to suffer under aggravated hectic, & finds there a more speedy grave.

But if it be decided that a change of locality is better for the patient, & it has its advantages, where is the necessity for sending him to a foreign land, or to another country at all? In our own Western Isles of Scotland & Argyleshire, we have precisely such a climate as our patient demands. For according to the report of the Registrar-General for Scotland, it appears that in these islands the population is cut off by Phthisis in the proportion of 144 in every 100,000 persons; in Argyleshire in the proportion of 135 in every 100,000; while in the town districts it rises to the enormous proportion of 453 in every 100,000 persons. In fact, it is an old tradition, & we have had occasion to

notice has seldom arisen that traditions are devoid of some foundation, which is confidently repeated at the present day, that the natives of the Western Isles of Scotland are remarkably free from pulmonary consumption, that most of those who have fallen victims to the disease had contracted it during a residence on the mainland. And, adds the Registrar General, "From what has even been imperfectly ascertained, it is quite apparent that the Western Isles exhibit a freedom from Consumption surpassing that of any locality to which we send our consumptive patients; it can scarcely be doubted, that, if comfortable houses, with the appliances for health which Science has shown to be necessary, were reared in proper & sheltered sites, on some of the larger more easily accessible of those Islands, they might prove of far more value to the Consumptive than all the foreign stations to which they are at present forced to resort. The accessibility of those islands, the mild winter climate they enjoy, the far greater humidity of the atmosphere over them — more especially during the Spring season, when the

cold, and, easterly breezes blow over Britain, the increase to largely the deaths from Consumption — & the ease with which the patient could be removed to them in the earlier stages of the complaint, when it is still curable, are recommendations to these Islands, as residences for the consumptive, deserving serious attention. But the fact is, the whole ~~Coast~~ County of Argyll exhibits the same freedom from Consumption as compared with other parts of Britain".

Bronchitis & Pneumonia.

These two diseases are largely influenced by cold, the mortality from them increasing directly as the Barometer falls - This is exactly what might have been anticipated, judging from the known effects of cold, constricting & collapsing the surface vessels & so determining the blood to the internal viscera, more particularly to the lungs. And as a natural consequence if that organ is at all predisposed to disease, it soon becomes congested & inflamed inducing Pneumonia; or if it be the air passages that

that are delicate, then that the more fatal malady Bronchitis is produced. These two diseases seem to go hand in hand together, and as the one rises or declines so does the other. We may therefore conveniently consider them together —

These two diseases are wholly regulated as to their fatality it appears to us by the temperature of the atmosphere, and the rapid variations in it. Hence the amount of moisture in the atmosphere has very little to do with it as suggested in the Registrar General's Report. He founds his assertion on the fact, clearly enough brought out, that the Insular districts of Scotland are much less fatally affected by diseases of the Respiratory organs, than either the Mainland or the Town districts. And this he ascribes to there necessarily being more moisture in their atmosphere. He says, "the diseases of these organs are much lowest in the mild, damp climate of the Insular districts, very much higher in the Town districts where one would almost have expected their mortality to have been less, seeing that a town population is, on the whole,

so much better housed & protected from sudden atmospheric changes than are the inhabitants of the country. × × × As Scotland partakes of the nature of an insular climate to a much greater extent than England, "it is interesting to see the effect of that milder, dampier climate in keeping the proportion of deaths from these diseases lower than in England." Now, it appears to us, that this diversity in the mortality, both between the insular & town districts of Scotland, & between Scotland & England, is not to be ascribed to the greater humidity of their atmosphere, but to their greater steadiness of temperature as evidenced by their smaller thermometric range, due no doubt to their insular locality. And we found this hypothesis on the ground that the deaths from these diseases are precisely highest in the town districts when the humidity is at its average maximum. Thus the 3 most fatal months are Dec. Feb. & Jan., as ascertained from the average of the last five years, and it so happens that these three months are at the same time the most humid: but further these are

Table shewing the effects of meteorological phenomena upon the mortality from Diseases of the Respiratory Organs.

Months	Mean monthly Temperature		Mean monthly Humidity		Monthly deaths from Bronchitis		Monthly deaths from Pneumonia	
	1854.	1860	1854.	1860.	1854.	1860.	1854.	1860.
Jan.	41.0	35.9	82	87	157	327	84	127
Feb.	41.5	34.9	82	84	154	525	93	183
Mar.	44.2	39.1	81	80	132	375	64	135
Apl.	43.1	42.1	77	74	115	385	73	116
May.	52.4	50.9	68	75	90	242	67	99
June.	56.6	54.4	74	80	54	150	67	77
July.	58.5	54.3	78	80	70	129	53	80
Aug.	57.7	53.4	75	81	54	84	49	53
Sep.	52.8	50.7	78	81	68	77	54	31
Oct.	46.0	47.4	81	84	53	106	48	78
Nov.	40.0	39.3	86	87	154	181	86	80
Dec.	34.9	34.4	83	88	256	235	110	116

the three coldest months in the year. While the least fatal months are Oct. Sep. Aug. when the temperature of the atmosphere & the earth has become thoroughly warmed, the humidity is about an average, and the moist genial south westerly winds are most prevalent. Nor can the Barometric pressure be said to be at all concerned in the matter, for the average barometric pressure of the winter & Autumn months differ only by about 0.022, the greater density being in favor of the Autumnal months, or those in which they are least fatal.

The accompanying table serves more clearly to shew the effect of cold in aggravating the diseases of the Respiratory organs.

In this table it will be observed that the difference between the mortality of 1859 & 1860 is very great, and is in exact proportion to the difference in their temperature — The density & humidity do not seem to have much effect, for it will be seen that sometimes the one year & at times the other is more humid & greater in density — But what cannot fail to strike me at a glance is, the immense

excess in the mortality from both diseases during the year 1860 over that of 1854. And how this mortality increases with the fall of the temperature is well illustrated in the rise in the mortality of Feb over that of Jan. 1860, when there was a fall of 1°, & an increase of deaths from Bronchitis to the extent of 198, & from Pneumonia of 56.

Hence the conclusion from these observations is, that of all diseases none perhaps are more influenced by atmospherical changes, none more immediately under the control of temperature, than the diseases of the Respiratory organs. And just in proportion as the season advances from the cold & stormy months of winter thro' the bracing spring, to the warmth of summer and the more genial autumn, does the fatality of these diseases decline to their minimum —

Diarrhoea —

We have already had occasion incidentally to observe that this and the other bowel complaints viz Dysentery &

Cholera, are almost the only exceptions to the general law, that, in this country, it is cold that kills & not heat. In the case of these diseases this law does not hold good; in fact, exactly the reverse obtains.

When speaking of Phthisis, we took occasion to observe that probably this anomaly was to be accounted for, mainly by the changes of the symptoms in those suffering under that malady; & that, in reality, it was the consumptive patients who contributed to the large increase in the mortality from Diarrhoea, due to a certain train of their symptoms being greatly aggravated by the increase of heat, during the latter part of summer, & the early autumn months, under which they rapidly sank from sheer exhaustion of their already much debilitated frames.

But, however, be this as it may, there is no room to doubt the undeniable fact, that as summer merges into ~~ad~~ autumn, so the deaths from the bowel complaints become vastly more numerous, than during any other season of the year. This has been fully & satisfactorily brought out in the Registrar General's Rep[illegible]

Table shewing the effect of
Atmospherical phenomena upon
the mortality from Diarrhoea.

Months.	Mean monthly Temperature		Mean monthly Humidity.		Actual Mortality	
	1857.	1861.	1857.	1861.	1857.	1861.
Jan.	37.6	37.3	86	88	45	27
Feb.	40.4	40.2	84	83	38	23
Mar.	40.4	42.3	77	80	39	17
Apl.	43.4	45.9	78	78	41	22
May.	50.6	49.8	75	74	43	25
June.	54.9	58.0	75	82	42	28
July.	60.3	57.8	71	80	107	59
Aug.	61.5	58.5	78	80	154	57
Sep.	57.2	54.5	82	82	220	46
Oct.	51.0	49.8	84	87	122	46
Nov.	45.1	38.9	83	86	56	26
Dec.	46.4	38.0	83	90	44	27

The accompanying table may serve to shew how far this disease is modified by a cool summer & autumn, such as we experienced last year; and the opposite effect of a warm summer, such as occured in 1857.

From this table we at once see how very far above the average mortality of the months, (which in the average of 5 years is 99) that of Sep. 1857 was. But in looking to the temperature of that month, we find it greatly lower than that of the three preceding months; an instance of the cumulative effect of heat upon the system, just as we have seen in regard to cold. We have given the average monthly humidity, in order that by comparing that of the two years we may observe whether this element has any particular influence in contributing to the rise in the mortality - that it has not, is the result arrived at from such comparison; for it will be seen that the whole year 1857 was much drier than 1861, & yet the mortality of the former year was enormously above that of the latter. Yet some have not hesitated to ascribe to moisture in cu-

junction with heat a great share in raising the number of deaths. But this is still further disproved by the following most interesting fact brought out in the mortality returns, viz, that the Insular districts, which surely must be allowed to be the most humid parts of Scotland, suffer less from this complaint than either the mainland or the Towns – "No disease," says the report already referred to, "exhibits more strongly the influence of site on its prevalence & fatality than Diarrhœa; for while the Insular districts furnished only 17 deaths in every 100,000 persons, the mainland districts yielded 34 deaths, & the Town districts 75 deaths in like populations" –

It cannot then be moisture alone which makes such havoc among the population by inducing this disease. Neither can the cause of this large increase in the mortality of the towns over the islands be wholly ascribed to the greater amount of heat in the former over the latter, tho' certainly this must have considerable influence. But it is to be found in the combined effects of these two acting on collections of dead & decaying animal & vegetable matters

open drains & cess-pools, dung heaps, & such like pestilential sources drawing forth those fetid exhalations & putrid emanations, which poison man, & finally kill him - Of course such pest-breeders are more numerous in towns than in the islands, for the prodigious "quantities of vegetables which are brought into cities for man's use, are not all consumed, & what remain die, are acted on by the heat & moisture putrify, & send forth their putrid effluvia - Besides decayed vegetables, there is ever a large mass of dead animal matter for heat & moisture to act on & corrupt; & in proportion as the emanations from these sources are concentrated in the water we drink, & the air we breathe, so will the number of victims be."

The conclusions we arrive at from such considerations are, that just as the number of deaths from Phthisis decline towards Autumn, so the mortality from Diarrhoea rises, augmented as we incline to believe by many of the consumptive cases assuming the form of Diarrhoea. But a more fertile cause is certainly found in the increase in the warmth of the atmosphere, whe-

combined with moisture acts in decaying matters, & so breeds life-destroying exhalations. and we have seen that for every degree that the temperature advances beyond 58°, so do the deaths from Diarrhoea.

The Zymotic Diseases.

This class of diseases seems to be very much less under the influence of weather or other meteorological phenomena. In fact the origin of epidemics, what it is that causes their spread, what are their predisposing causes external & internal, what induces them to select particular districts, leaving others unscathed, is still involved in much obscurity & darkness. The medical world, indeed, knows little of their laws, for undoubtedly they are subject to such tho' we may not be able to fathom or to understand them - Still it has long been matter of common observation & belief that with the outbreak of epidemics, certain atmospherical phenomena occur, as manifested by various signs, as for example, "a disturbance of the regular & ordinary condition of the atmosphere; an inversion of the seasons, -

summer in winter, winter in summer —; long continued drought succeeded by torrents of rain causing rivers to overflow, & the seed to rot in the ground; cloud, mist, fog, favoring dampness &c &c.

From the patient & most careful observations of Mr. Glaisher during the epidemics of Cholera in 1849 & 1854, the following meteorological phenomena were found to characterize the atmosphere during the origin & progress of this fatal disease, constituting what may be termed the epidemic meteorology. He says in summing up the results of his enquiry, that "these epidemics of 1849 & 1854 were attended with a peculiar state of atmosphere characterized by a prevalent mist, thin in high places, dense in low. During the height of the epidemic, in all cases the reading of the barometer was remarkably high, the atmosphere thick; & the temperature above the average. A total absence of rain, & stillness of air amounting almost to a calm, accompanied the progress of the disease on each occasion — In places near the river (the Thames) the night mean temperature was

high, with small diurnal range, with a dense tepid moist air charged with the many impurities arising from the exhalations of the Thames, & adjoining marshes; a deficiency of electricity, & was shewn in 1854, a total absence of Ozone, most probably destroyed by the decomposition of the organic matter with which the air in these situations is so strongly charged. In both 1849 & 1854 the first decline of the disease was marked by a decrease in the readings of the Barometer, in the temperature of the air & water; the air, which for a long time previously had continued calm, was succeeded by a strong South-west wind, which soon dissipated the former stagnant & poisonous atmosphere". And such is the character of the atmosphere in most epidemics, heavy, warm, & moist, with disturbed electricity; and the determining cause of the particular form of disease, whether Typhus or Cholera, or Scarlatina or whatever other epidemic it may be, is some extraneous matter-some poison, which is capable of generating that individual disease, & no other. This is

inhaled with the respired air into the lungs, & thus the poison is introduced into the system, & act upon those whose constitution is already predisposed to its influence, giving rise to the special form of epidemic.

From examination of the mortality tables, indeed as is generally very well known, most epidemics are much more fatal in the town districts of Scotland than in either of the other two; being nearly double that of the insular district. This increased destructiveness seems to be justly ascribed to the overcrowding together of the inhabitants of towns, which must necessarily exist to a much larger extent than in the insular district; and this, of course, largely contributes to the spreading of the disease by contagion & infection: and further by the vitiated atmosphere of town dwellings, which greatly tends to weaken the constitution of the town-people, thus acting as an efficient predisposing cause.

Measles.

This epidemic presents two anomalies - The first is, that the

season of the year when it is most fatal is unlike the others. The Summer, as ascertained from the average of the last five years, during the months of June, July, & Aug - while the least fatal season is Autumn next to it Winter. This indeed was not the season in which it proved most fatal in the time of Sydenham, for we find him thus speaking of that epidemic which prevailed in 1670; the measles "set in early as usual, i.e. at the beginning of Jany. They gained strength every day, until the end of their height about the vernal equinox; after this they gradually decreased at the same rate, & the month of July were wholly gone" - And so too in London during the year 1854, Rubeola was found to be most fatal in Spring, & appeared to be vicarious with small-pox, rising & declining as this disease declined & rose in its fatality, until it attained its second maximum in Autumn - Rhazes, again, thus speaks of this epidemic, "when the Summer is excessively hot & dry & the Autumn is also hot & dry, & the rains come on very late, & the measles quickly seize those who are disposed to them". But it must

remembered in connection with the foregoing statement that must probably they were founded on observations made during one single year, consequently the deductions made by those acute accurate observers, being thus formed on insufficient data, can neither be regarded as satisfactory, nor strictly correct.

The second anomaly is, that in the year 1836 the deaths from Measles were most numerous in the Insular district of Scotland; the death from this cause being 61 in every 100,000 persons, while in the Mainland they only amounted to 25, & in the Town district to 51 - Again in 1833 this not actually greater, the mortality was nearly the same in the Insular & Town districts, the numbers being respectively 69 and 79 - How considering that the predisposing causes are manifestly much superior in the towns than in the islands, as already explained, this certainly is a most striking anomaly, as brought out in the two detailed annual reports of the Registrar General

How are we to account for the Summer being the season of the year in which this epidem-

Table shewing the effects of Temperature & Humidity upon the mortality from Measles during the 3 most & least fatal months of the year

Months.	Mean monthly Temperature 1859.	1860	Average monthly Temperature	Average monthly Humidity	Mean monthly Humidity 1859.	1860	Actual monthly Mortality. 1859.	1860.
June.	56.6	54.4	57.9	75	74	80	15	149
July.	58.5	54.3	58.7	75	78	80	19	174
Aug.	57.7	55.4	58.5	78	75	81	16	99
Sep.	52.8	50.7	54.2	80	78	81	15	66
Octo.	46.0	47.4	48.0	83	81	84	12	47
Nov.	40.0	39.3	40.7	85	86	87	12	49
Dec.								

ie is most prevalent? Looking to the meteorological phenomena which characterize these months we observe, that they are at once the driest, the least humid, & precisely the months in which the barometric pressure is greatest & the range least, while the thermometric range is almost at its maximum, & the Westerly winds most prevalent. This however does not throw much light on the subject - From an examination of the mortality tables of the last five years, we are inclined believe that Measles are most prevalent in seasons when the Humidity of the air is abnormally great, & the temperature under the average - This is especially the case in the year 1860, during which year the deaths from Measles in the eight principal towns of Scotland for the last five years attained their maximum, while during the preceding year they were at their minimum. It may be interesting therefore to compare their respective meteorological phenomena during the three most fatal & the three least fatal months.

Hence from the accompanying table it is at once seen that while the temperature of 1859 was

slightly below the average, that of 1860 was much more so - in fact it was a very cold summer temperature; which at the same time this was greatly aggravated by the excessive humidity of the atmosphere - And accordingly, we find the number of deaths proportionately fewer during that season which approaches most nearly to the average standard - That this is the more likely to be true, we conceive to be still further evidenced from the fact already stated, that the insular town districts are quite equal in their mortality from this cause. The heat of summer acting on the surrounding water is very apt to induce a hazy misty atmosphere, which is peculiarly beneficial to the spread of this malady - And as if confirmatory of this statement, we find it recorded in the Report of the Meteor. Society in July 1860, that "Fogs frequently occurred during this month, which at the same time, this is the very month during all the months of the last five years, in which the number of deaths from this this epidemic attained its maximum.

Scarlatina -

Here again, as we have so often had occasion to observe, the Summer months prove to be the most healthy season, so far as Scarlatina is concerned, June May & July being the least fatal, while Nov. Oct. Jany & Dec. kill off the greatest number -

The leading meteorological feature of Nov. (in an average the most deadly months from S.) is excessive humidity; great density of the air, its constantly varying, the mean Bar. range of the whole year being greatest in this month; while the temp. is low, the diurnal range is also small; Westerly winds are in the majority - June, again, the least fatal month, is remarkable for its excessive dryness; average density of the air, it being at the same time very steady, the barometric range being then at its minimum for the whole year; its high temp. very great diurnal variation, it also attaining the maximum for the whole year; while Easterly & Westerly winds prevail in an equal number of days

The two years in which Scarlatina was the most least fatal during the last five, were 1860 & 1861 -

The year 1860 began with a temp. somewhat

Table shewing the influence of meteorological phenomena upon the mortality from Scarlatina.

Months.	Mean monthly Temperature		Mean monthly fall of Rain in inches		Mean monthly Humidity		Mean monthly Mortality	
	1860.	1861.	1860.	1861.	1860.	1861.	1860.	1861.
Jan.	35.9	37.3	4.68	4.52	87	88	148	131
Feb.	34.9	40.2	4.31	2.98	84	83	89	58
Mar.	39.1	42.3	3.64	5.22	80	80	69	57
Apl.	42.1	45.9	1.13	0.90	74	78	44	38
May.	50.9	49.8	2.08	1.31	75	74	52	24
June.	54.4	58.0	4.70	2.52	80	82	56	21
July.	54.3	57.8	1.75	3.69	80	80	65	32
Aug.	55.4	58.5	3.80	7.17	81	80	86	26
Sept.	50.7	54.5	1.57	5.03	81	82	162	29
Octo.	47.4	49.8	4.19	3.39	84	87	272	58
Nov.	39.3	38.9	3.60	6.21	87	86	237	67
Dec.	34.4	38.0	3.52	2.82	88	90	182	54

below the average, a considerable fall of rain, & a large amount of Westerly winds. After spring set in the temp. rose to the usual height, there was less rain, & an unusual prevalence of West. erly winds. On the whole, the year was characterized by an average temp., a small supply of rain, but much more than the average amount of Westerly winds, the density & barometric range being on the whole tolerably normal. While the year 1861 was remarkable as being very mild during the later winter, & the spring months, with a normal rain fall; the summer & autumn being a little below the average in warmth, owing no doubt in great part, to the very remarkable deluge of rain which prevailed during those seasons in almost every part of Scotland. The Barometer stood abnormally high, whilst its range was as abnormally limited -

How as regards the difference in the mortality from this epidemic, it is very great. But the whole will come out more clearly from the accompanying table - From this table then, it appears that Scarlatina is least fatal in very rainy weather, & an atmosphere characterized by

great density of moisture, and a temperature rather below the normal standard -

Still, it does not appear that this epidemic is much influenced one way or other by such atmospheric phenomena -

Hooping - Cough -

This epidemic seems to be more under the influence of the weather than either of the two preceding - For we find that it usually proves most severe, & the mortality attains its maximum in the cold months. Jan. Dec. & Feb. proving most fatal in the number of deaths; while the warm months of July. Aug. & Sep. seem to stay its fatal progress somewhat.

From a careful comparison of the mortality records and the meteorological returns, Hooping Cough seems always to gather strength, & to be peculiarly fatal, when to the cold there is added an excessive fall of rain; and of course, the more persistent this is the more fatal the malady If there be superadded to these two conditions, an unusual or even the average quantum of Easterly winds, the death-wave of Hooping Cough rapidly rises -

Happily, the presence of all these phenomena at one & the same time is exceptionally rare -

This comes out well on comparing the two years 1858 & 1859, during the former of which all the atmospherical phenomena were tolerably normal except the Humidity, which was far below the average throughout the whole year - The mortality during this year was on the whole small, being up to the month of June very much below the average. In June however it rose slightly, due probably to the occurrence of the Easterly winds in the latter end of May & beginning of June; it continued to increase in July & Aug. there being in these two months a fall of nearly eight inches of rain. The number fell considerably in Sep, that month being unusually mild with a continuance of westerly winds - But in Oct, when the temperature fell 2° below the average, & nearly 6 inches of rain fell, the mortality speedily rose higher than it had been during the whole year; the year closing in Dec with a temp. decidedly mild, a large fall of rain, and an increase of deaths from Hooping Cough of more than 30 above the average of this month - And this high rate of

mortality continued throughout the whole of the year 1854 - During the first four months there fell upwards of 14 in. of rain, but the temp. was mild, else the deaths from this epidemic would have been fearful - They reached their maximum in April, when the East winds setting in, and the temperature being exceedingly variable, and accompanied by a heavy & long continued rain-fall, no less than 188 individuals above the monthly average of 103 fell victims to this wearing out disease -

We had intended to have examined into the effects of weather & climate & meteorology in general upon various other diseases; & to have shown how Typhus, contrary to all popular ideas on the subject, is least fatal in July, Aug., & Sep., three of the hottest months of the year, how similar it is in its course to Scarlatina, & to have ascertained whether a largely increased mortality from this cause is, as has been maintained by some, to be regarded as a forerunner of Cholera - to have shown how the mortality from Diseases of the Brain is undoubtedly much greater in warm than in cold weather, &

the influence a cool season has in decreasing the mortality — how the deaths from heart-disease are greatly modified by the atmospheric agencies — and how Apoplexy & Paralysis are most fatal between the end of Autumn & the beginning of Winter — but time, and the already too great length of this paper forbid us entering on these subjects, however interesting —

But enough has already been adduced to show that the influences of the various atmospherical phenomena are great, as modifiers of disease; how necessary it is, that these should be borne in mind by the physician, in his treatment of the various diseases, which come under his cognizance —

Claud Muirhead. — Surg.

Edinburgh
31st March. 1852.

Appended are several tables, for the purpose of displaying in a diagramatic form what has been attempted to be

made out in the foregoing pages.

Tables I & II. exhibit us an average of the last five years

a. The Monthly Temperature:

b. The Monthly Mortality of several diseases:

c. The relation which subsists between these diseases and the temperature:

d. The relation of these Diseases to one another, as regards their mortality:

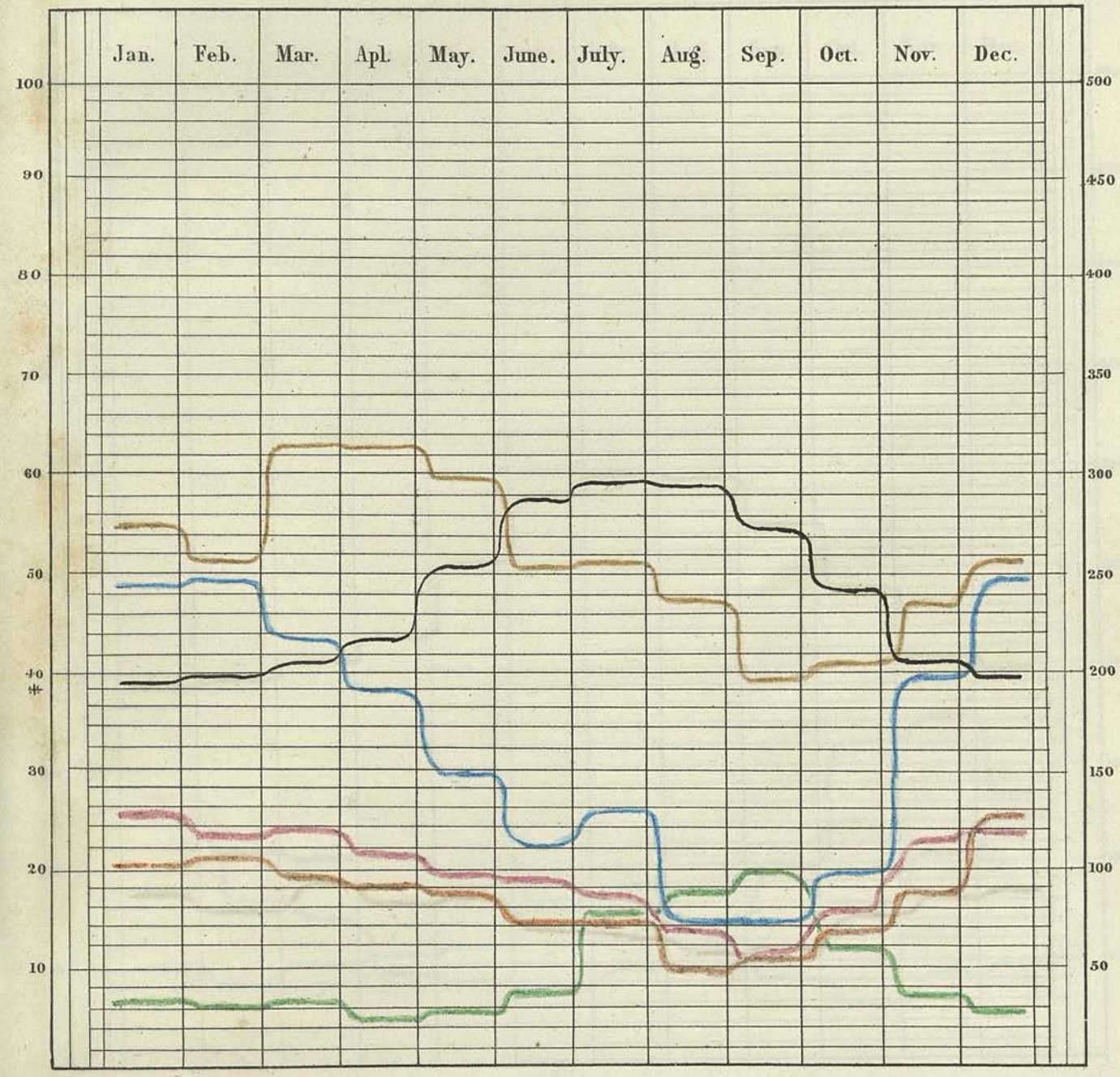
e. The most fatal month of the year so far as each Disease is concerned:

f. The month which is most free from the ravages of each Disease examined —

Tables III – X illustrate the same facts for each individual year —

Phthisis - Bronchitis - Pneumonia - Age - Diarrhoea -

Mean Monthly Average Mortality for the last five years from 1857 to 1861 inclusive.



Phthisis -

Bronchitis

Pneumonia -

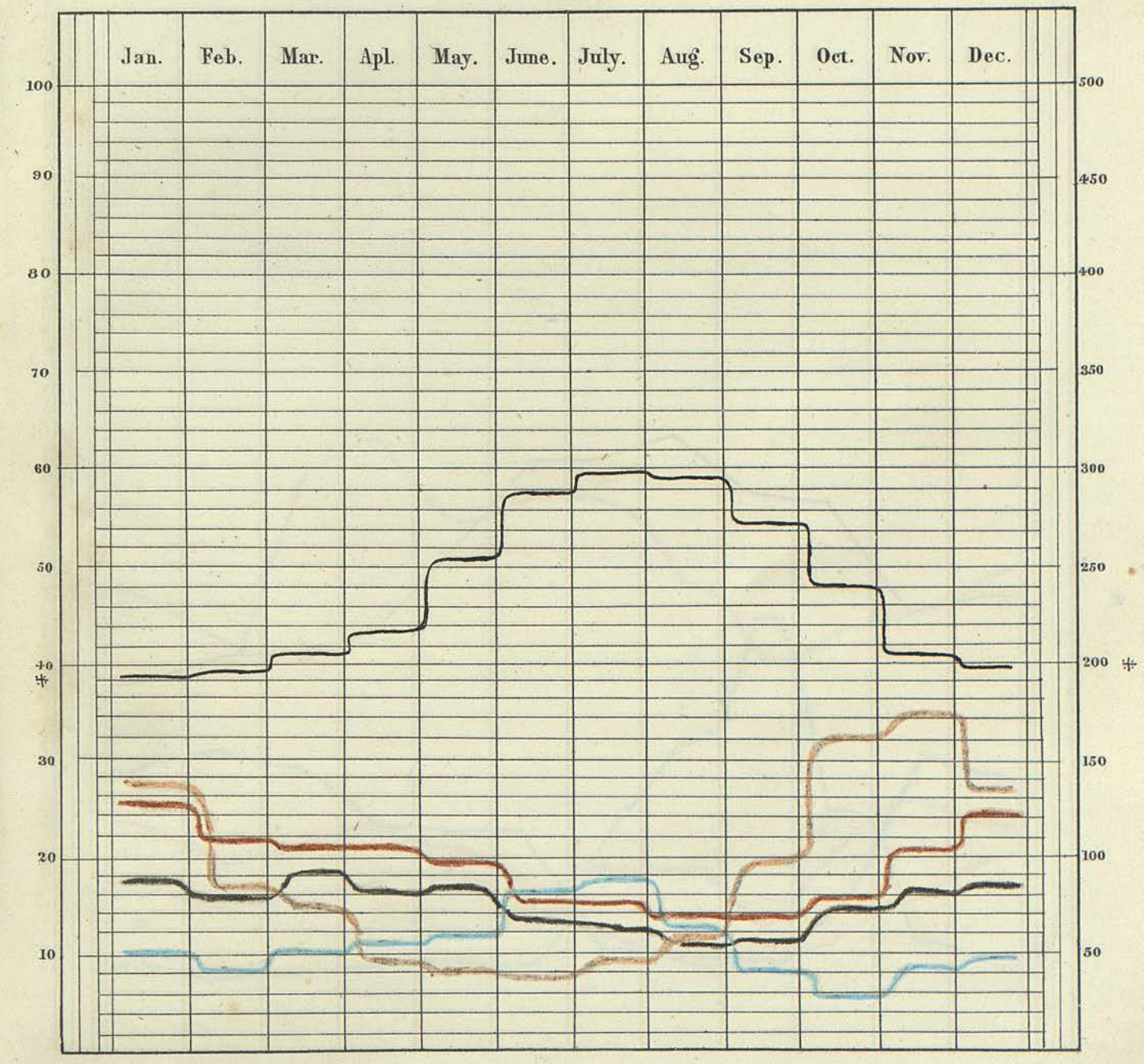
Age -

Diarrhoea -

Mean Monthly Average Temperature -

Measles – Hooping Cough – Scarlatina – Typhus –

Mean Monthly Average mortality for the last five years from 1857 to 1861 inclusive.



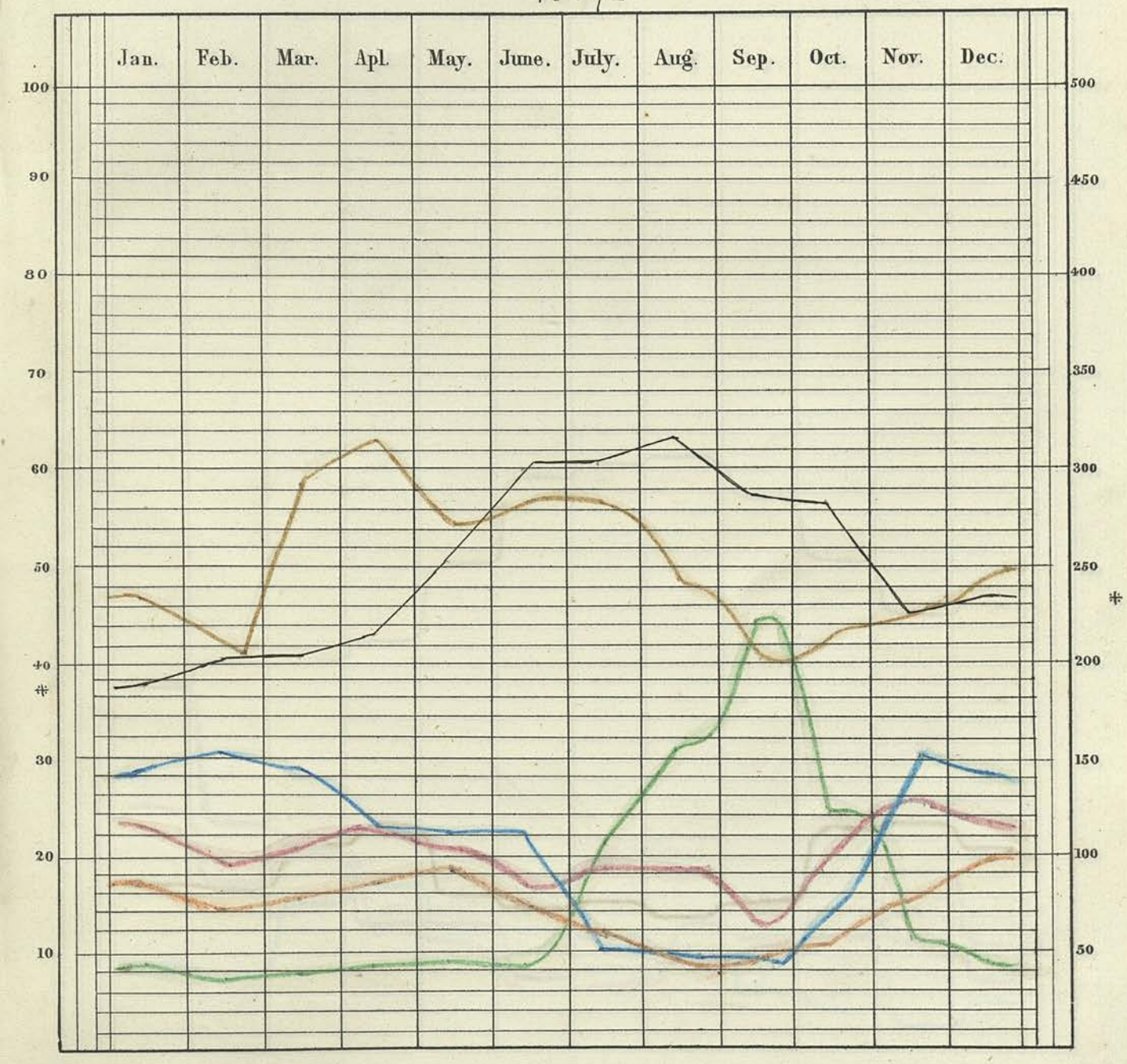
Measles.
Scarlatina.
Hooping Cough.
Typhus.

Mean Monthly Average Temperature.

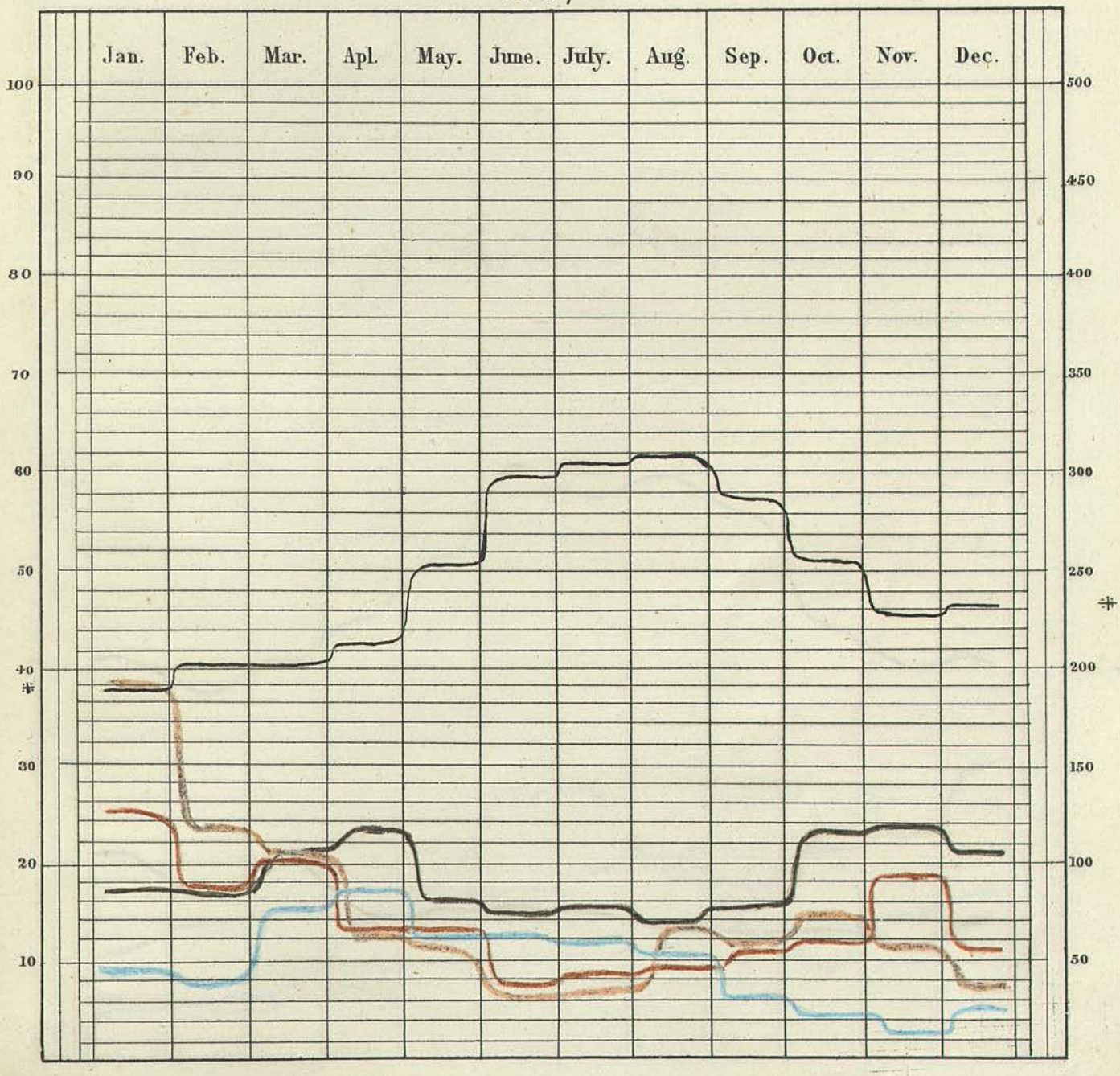
Phthisis - Bronchitis - Pneumonia - Age - Diarrhoea -

Monthly return of mortality for the years

1857 -



Measles - Hooping Cough - Scarlatina - Typhus -
Monthly return of Mortality for the year
1857.

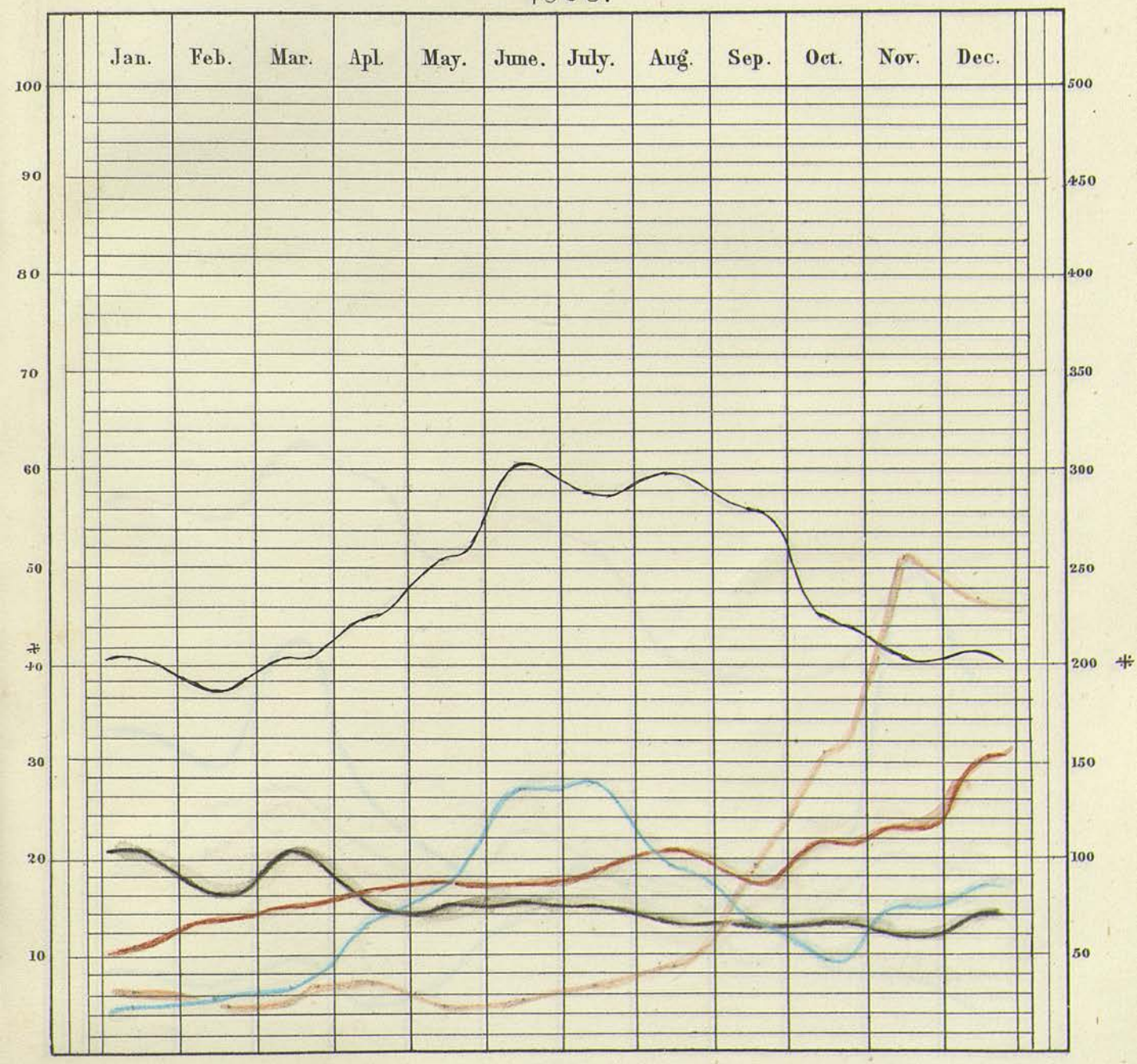


* Mean Monthly Temperature

Measles - Hooping-Cough - Scarlatina - Typhus -

Monthly return of Mortality during the year

1858.



Measles.

Scarlatina.

Hooping Cough.

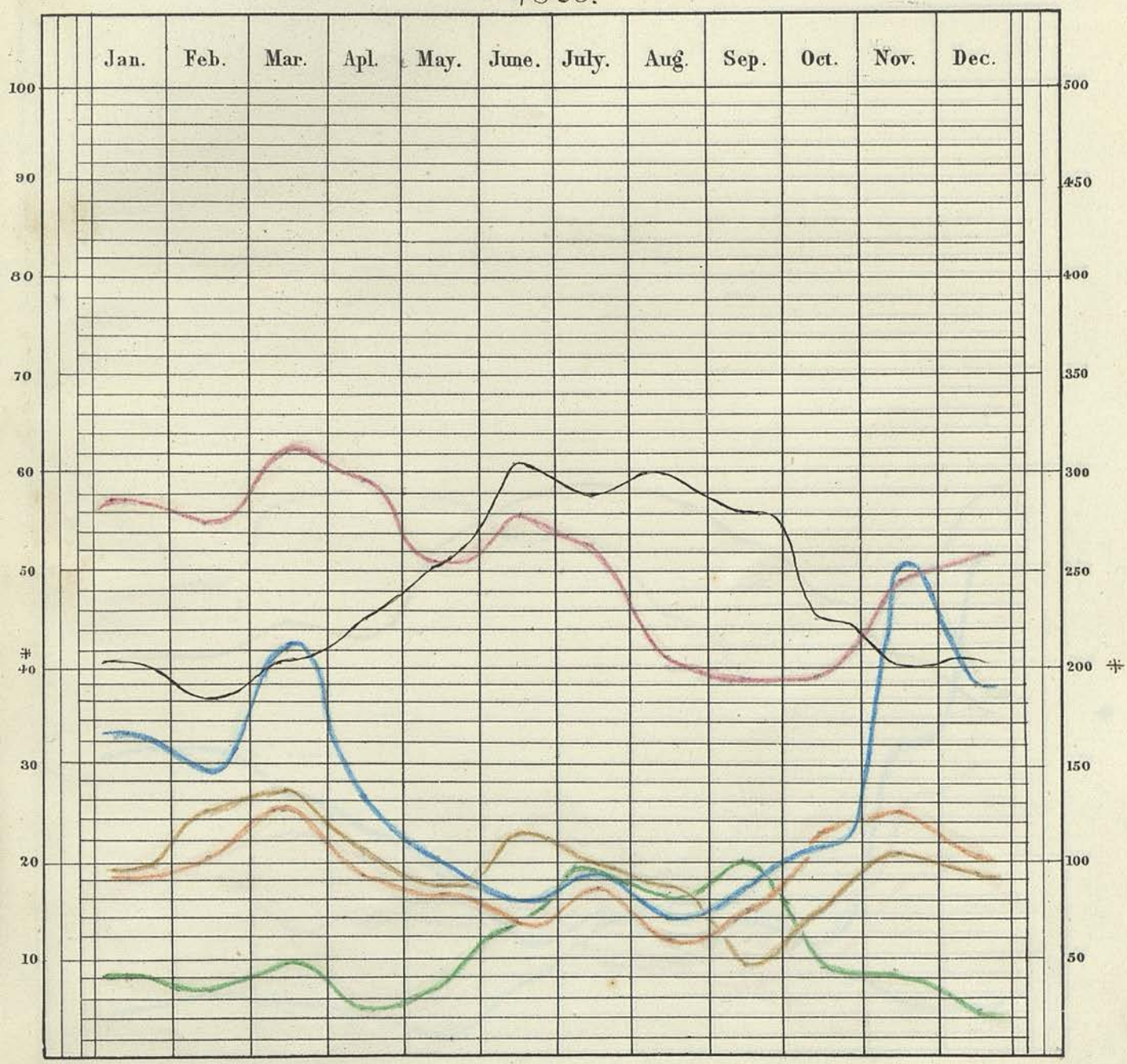
Typhus.

* Mean Monthly Temperature

Phthisis – Bronchitis – Pneumonia – Age – Diarrhœa –

Monthly returns of Mortality during the year

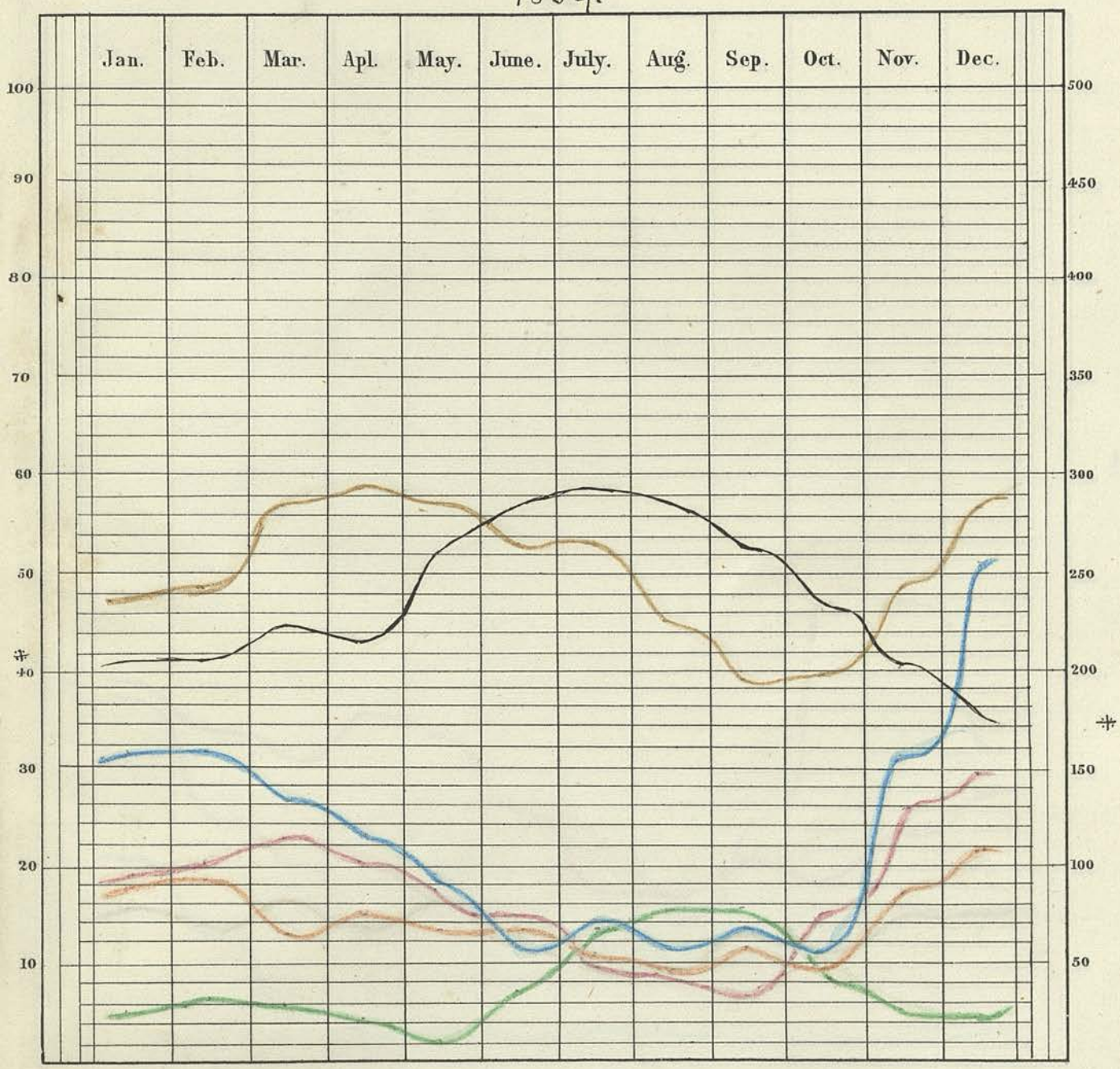
1858.



Phthisis - Bronchitis - Pneumonia - Age - Diarrhoea.

Monthly return of Mortality during the year

1859.

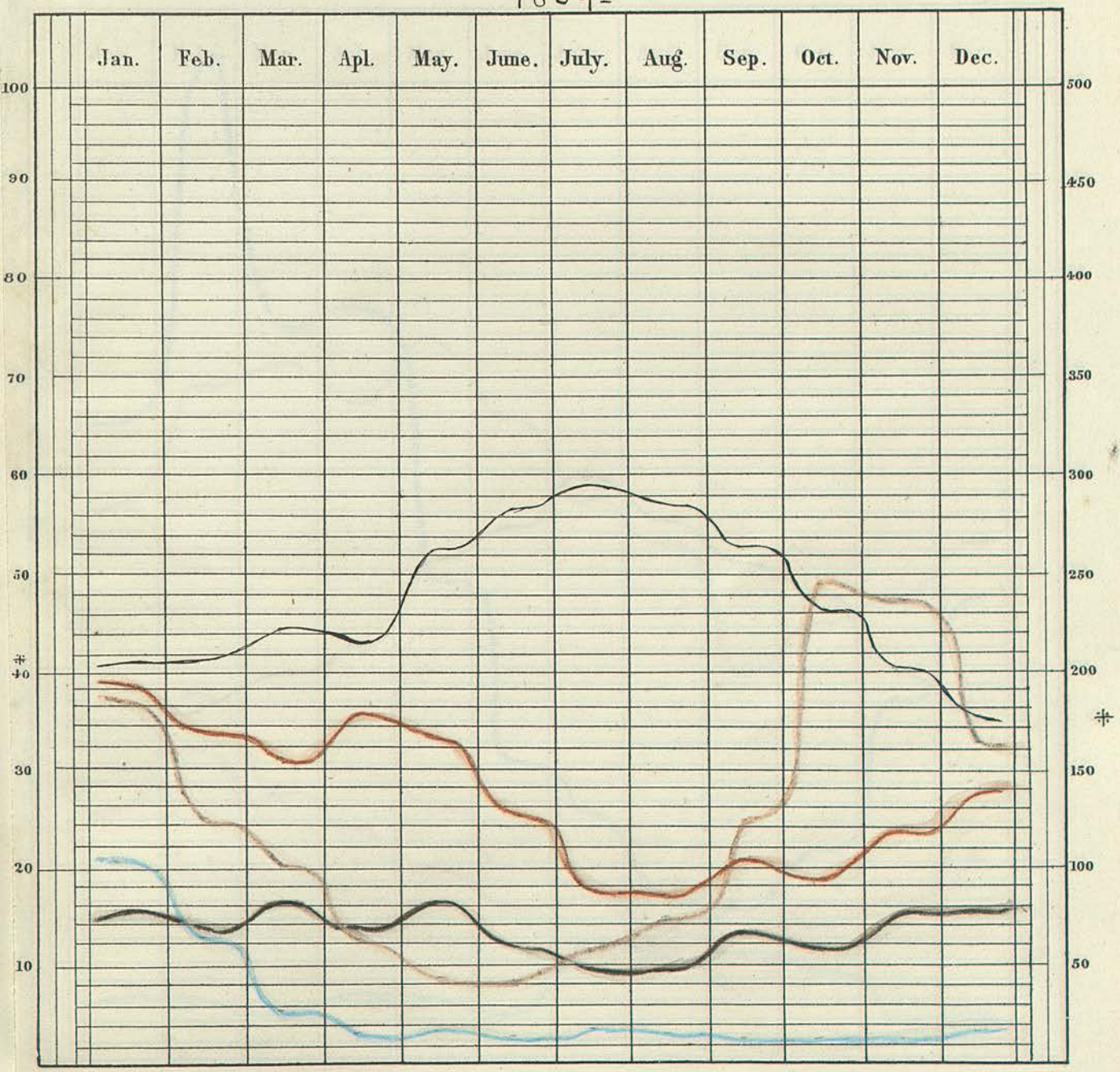


* Mean Monthly Temperature.

Measles – Hooping-Cough – Scarlatina – Typhus –

Monthly return of Mortality during the year

1859–

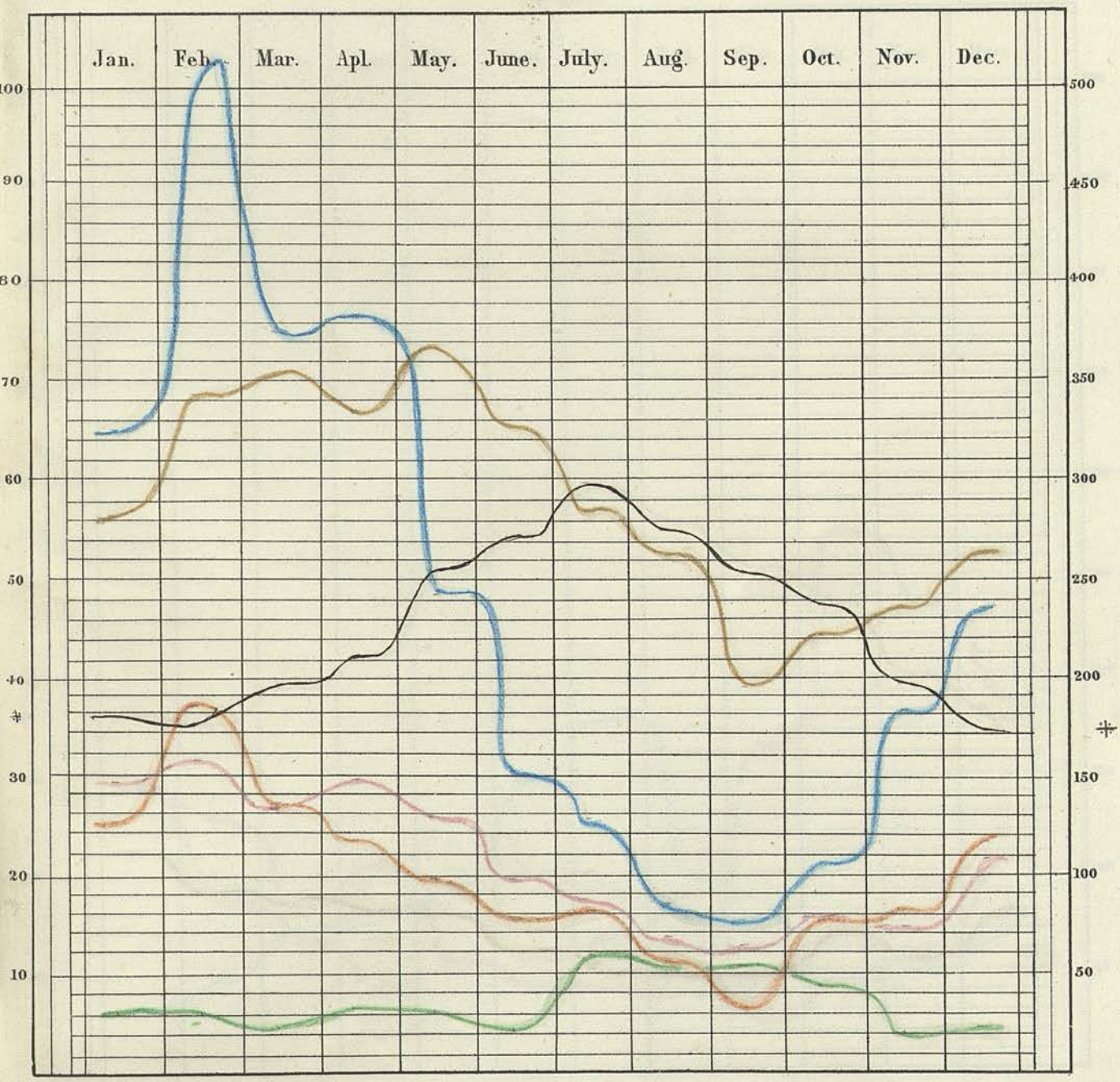


* Mean Monthly Temperature.

Phthisis – Bronchitis – Pneumonia – Age – Diarrhoea.

Monthly return of Mortality for the year

1860.



Phthisis –

Pneumonia –

Bronchitis –

Age –

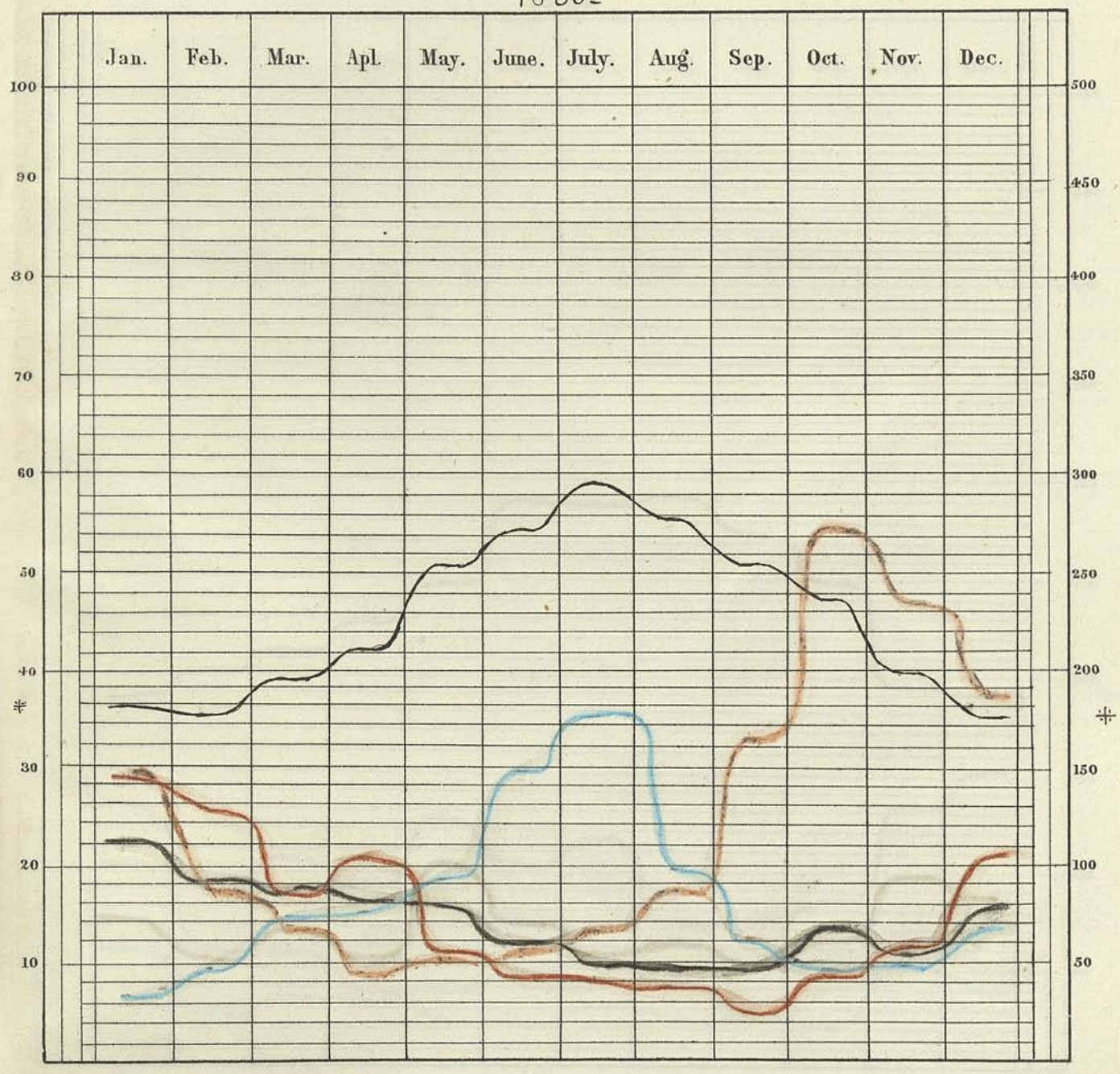
Diarrhoea

Mean Monthly Temperature –

Measles – Hooping-Cough – Scarlatina – Typhus –

Monthly return of Mortality during the year

1860.



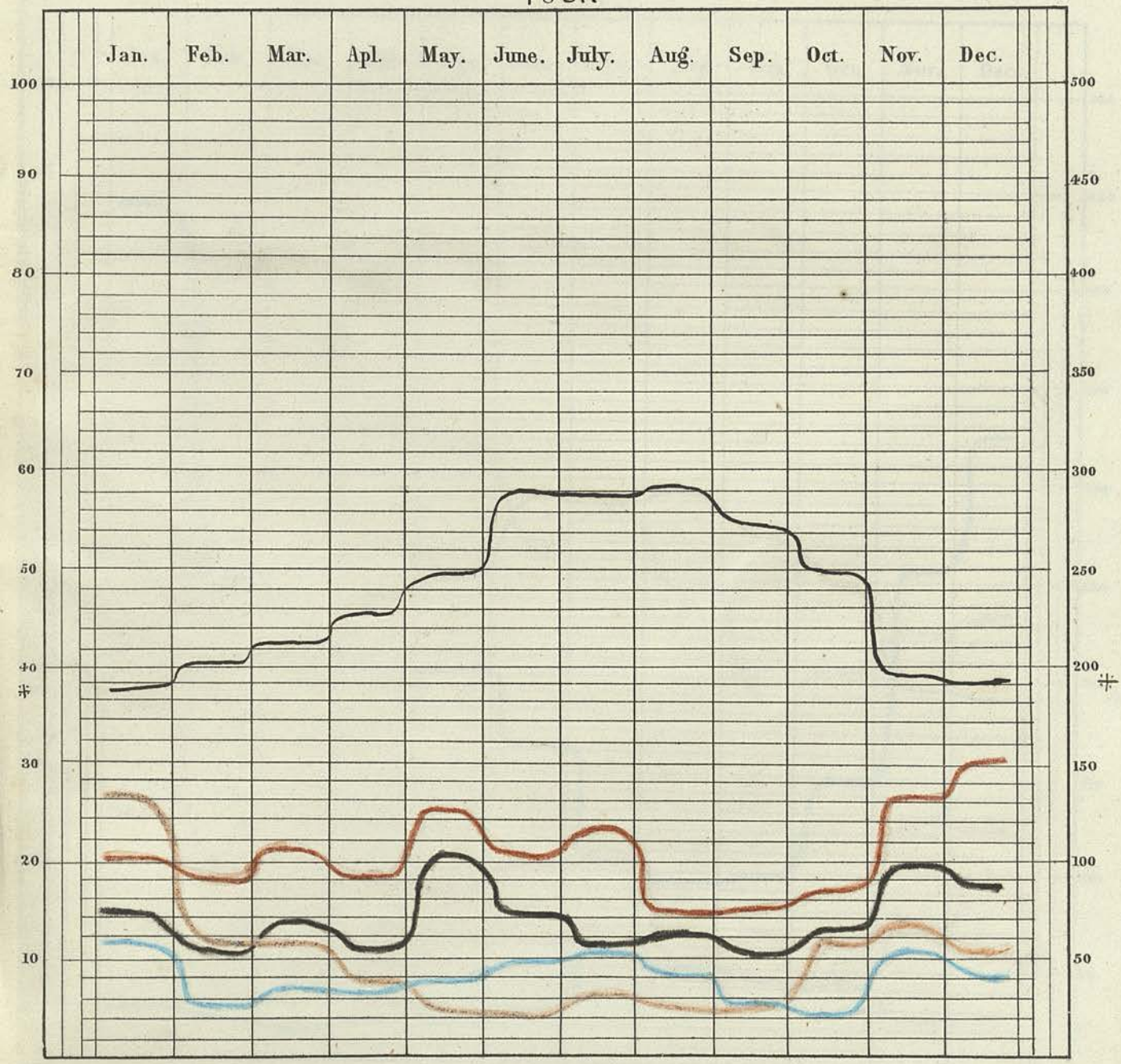
Measles – Hooping Cough –

Scarlatina Typhus

* Mean Monthly Temperature.

Measles - Hooping-Cough - Scarlatina - Typhus.

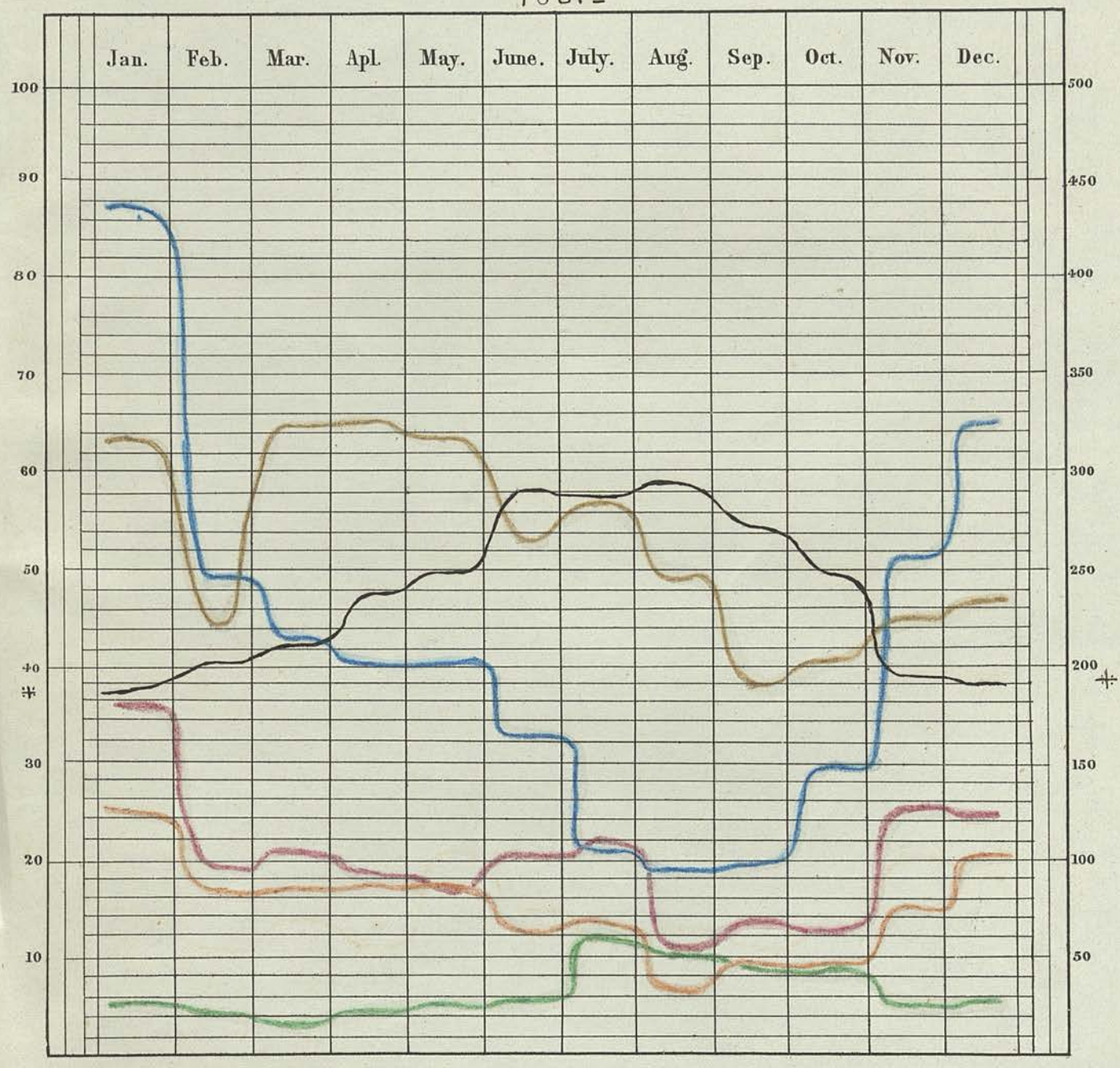
Monthly return of Mortality during the year 1861.



Phthisis – Bronchitis – Pneumonia – Age – Diarrhoea –

Monthly return of Mortality during the year

1861 –



* Mean Monthly Temperature.