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INFLUENZA IN HORSES.

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In presenting the following report on influenza, I beg to acknowledge my indebtedness to correspondents of the Agricultural Bureau for valuable information concerning the progress of the malady, and also to the various scientific men mentioned in the text, who have all responded promptly and heartily to any request for information or assistance.

While much that is of value has been secured, and especially on the question of the causation of the disease, I would respectfully submit that certain points require further investigation, and are yet capable of elucidation, inasmuch as the malady is still progressing and continually invading new territory.

I would refer especially to the observations on the amount of ozone in the air, and the disturbance of atmospheric electricity, both of which were remarkably in excess at Toronto in September, and the former at Lansing, Michigan, during the visitation. By instituting a series of experimental observations at different non-infected places, as the Southern and Western States, including the Pacific slope, and continuing these until the disease is at its height, the question could be decided as to whether these are essential accessory causes. It has been sufficiently demonstrated that they are not the true specific causes.

Another point which wants elucidation is the inoculability of the disease, or its transmissibility, by transferring the blood of a sick animal into a healthy system. The limitation of the poison to the air passages, which the failure to transmit the disease by transfusion would seem to imply, would have a very important bearing on the question of prevention and treatment.

Definition. - An epizootic specific fever of a very debilitating type, with inflammation of the respiratory mucous membrane, and less frequently of other organs, having an average duration of ten to fifteen days, and not conferring immunity from a second attack in subsequent epizootics.

Synonyms. - The corresponding disease in man was known to the older physicians as *Peripneumonia notha, P. typhoides, P. catarrhalis, Pleuritis humida, Fidris catarrahlis, Catarrhe plumonaire, Catarrhus á contagio, Defluxus catarrjalis,. Cephalagia contagiosa, Rheuma epidemicuno,* &c. As seen in animals it has received the following designations: Epizootic catarrh, catarrhal fever, gastro-catarrhal fever, mucous fever, gangrenous peripneumonia, epizootic pleuro-pneumonia, entero-pneumo-carditis, epizootic nervous fever, distemper, *blitz katarrh,* rheumatic catarrh, *la grippe, cocote, typhose, septicœmio,* &c

Past History. - The frequent co-existence of an epizootic catarrh in man and the horse, and to a less extent in other animals, lends some color to the hypothesis that they are due to closely-allied causes. The records of its prevalence in man might therefore be profitably referred to as illustrating the action of such causes at a time when veterinary records are few and imperfect.

Between 415 and 412 before Christ, Hippocrates and Livius report the extraordinary prevalence of catarrhal maladies in Greece and Rome, which Schuurrer and Hæser suppose to

have been influenza. Diodorus Siculus reports an epidemic, apparently of the same kind, in the Athenian army in Sicily in 415.

Absyrtus, a Greek veterinarian, writing about A. D. 330, describes a disease in the horse having the general characters of influenza. This appears to be the earliest record of such an affection in the lower animals, yet the reports of epidemics at an earlier date almost necessarily imply the existence of the equine malady.

Passing over a number of epidemics, we come to the next recorded equine influenza in A.D. 1299. In this year a catarrhal epidemic spread widely in Europe, (Parkes.) The equine disease is thus described by Laurentius Rusius, as it prevailed at Seville: "The horse carried his head drooping, would eat nothing, ran from the eyes, and there was hurried beating of the flanks. The malady was epidemic, and in that year one thousand horses died."

Six epidemics of influenza are recorded in the fourteenth century, but among animals nothing more than an epizootic quinsy at Rome, from which Rusius, who reports it, lost fifty horses.

We have no distinct evidence of influenza in animals in the fifteenth and sixteenth centuries, though in 1510 and 1580-'81, during the prevalence of cattarrhal epidemics in Europe, animals suffered severely, from what disease is not stated, (Saliua Diversus, Thomas Short.)

Solleysel describes an epizootic among the horses of the French army, operating in Germany in 1648, which closely agrees with influenza. It began by fever, great prostration, tears running from the eyes, and a profuse greenish mucous discharge from the nostrils. The appetite was lost and ears cold. Few recovered. This appears to have closely followed the epidemic influenza of 1647, mentioned by Hensinger.

In 1688 influenza was epidemic over the whole of Europe, spreading from east to west. In England and Ireland it was immediately preceded by a nasal catarrh, from which horses universally suffered, (Short, Rutty.) In 1693 it again prevailed over the whole of Europe and the British Isles, attacking first horses, and then, after a short time, men, (Webster, Short, Forster.). In 1698, during an epidemic catarrh in France, cattle and horses suffered from what was described as a bilious plague, (Bascom.) The year following influenza prevailed among horses in France, and severely among men and horses in England, (Webster.) In America in the same year horses were first attacked, and afterward men, (Forster.)

The year 1707, remarkable for an eruption of Vesuvius and the upheaval of a new island in the Ægean Sea, witnessed an epidemic catarrh in Franconia, (Steurlius,) and in England, where horses also suffered, (Short.) A similar eruption, with earthquakes, in 1712, coincided with an epidemic and above all an equine influenza, (Laucisi, Kanold.) In the winter of 1727-'28, horses in Great Britain suffered from epidemic catarrh; in Ireland it attacked man a little later, (Rutty.).

In 1732, seven earthquakes occurred in China, followed by pestilential diseases in man and malignant carbuncular diseases in animals. A little later influenza spread over Europe and America from east to west, (Glugo.) Arbuthnot and others who described it in England remarked upon the sulphurous vapors pervading the atmosphere, and that men and horses were attacked successively. Gibson, who furnishes a full description of the affection in the horse, says that it attacked mainly young or ill conditioned animals, and did not prove fatal. In 1736 and 1737 it again prevailed in England, attacking men and horses. Short, who records this, mentions an eruption of Vesuvius in the latter year. In 1740, 1742, and 1743 violent sore throats prevailed in man, horse, and ox, (Huxham, Rutty, Faulkener;) but whether due to in-

fluenza is not plain. In 1746 and 1750-'51 catarrh was epizootic among horses in Ireland, (Rutty, Osmer;) in 1758 in Scotland and England, attacking man as well, (Whytt, Bascom;) in 1760, after an eruption of Vesuvius, influenza appeared in Great Britain, Ireland, and elsewhere in Europe, attacking first horses, then men, (Bisset, Rutty.) In 1760 it is reported as in Denmark, attacking horses and dogs; and in 1762 in France, Ireland, and other parts of Europe, among horses and men, (Rutty, Bottain.)

In 1767 it prevailed in Europe, and above all in England, where it attacked first dogs and horses, then men, (Forster, Iteunsen;) also in America among horses. It carried off almost all the young horses and colts in New Jersey, and was very ruinous in New England, (Webster.)

In 1776, after a very severe winter and warm summer, with an earthquake in Wales, influenza spread over Europe. Fothergill, Cumming, Glass, Haggarth, and Pultney, in England, and Lorry, in France, noticed that horses and dogs suffered before it attacked human beings. Huzzard speaks of the horses suffering last. Poultry died in great numbers from an epizootic with defluxions from the eyes. In 1780, after eruptions of Vesuvius and Etna, and a terrible earthquake in Taurus, influenza appeared among horses. Huzzard describes it as seen at Paris. Gluge and Hensinger say that it broke out epidemically in September, 1780, in China, and, spreading over Asia, reached Moscow in December, 1781, gained Revel and Western Prussia in February, 1782, and Spain and Italy in August and September. Forster says it prevailed in America in the spring of 1781, and the following year in Europe. Haveman records an equine influenza at the same time in Germany, and Abilgaard leaves a monograph on the disease as it prevailed in the royal stud at Copenhagen. This year was rigorously cold all over Europe. In 1798 influenza again prevailed among horses in England, (Wilkinson, White.)

In 1800 influenza was said to have prevailed at Whampon, in China, whence it was believed to extend over Asia, reaching Europe in 1802 and England in January, 1803, (Gluge.) Though in some places man alone appears to have suffered, in others horses fell victims as well, (Hensinger.) In 1814 this affection prevailed in horses in Switzerland, (Hensinger,) and 1815, in a malignant form, in England, (Wilkinson, Youatt.) It appeared again in an epizootic form in England in 1819, 1823, (Field,) and 1828, (Brown.)

In 1833 it extended over Europe from east to west, attacking men, horses, dogs, and even cats. It prevailed in Courland from January to March, (Possart;) in Pomerania and Saxony in April, (Rhodes, Prinz;) and in France in May, (Compte Rendu de l'Ecole, Vet. d'Alfort.) In England Mr. Hayes describes it as lasting from October, 1832, to March, 1833. It was a "catarrhal fever, joined with inflammation of the lungs and liver and trachea and œsophagus and larynx and pharynx, and the mucous lining membrane of the bowels, frequently with all the symptoms of malignant catarrh, and these in an aggravated form. In some cases there was excessive diarrhœa, the fæces were black liquid mucus, bloody and exceedingly fetid, and accompanied by such extreme debility that the animal could not move without falling; there was quick pulse, injected nose, mouth and gums as red and dry as possible, and resembling a piece of lean dry beef. In some there was excessive anasarca; in others phlegmonous tumors in different parts of the body; in others again there were spasmodic jerkings and lameness in the legs, shoulders, and hips."

In 1834 it is reported in Brandenburg, (Hensinger,) and in 1835 and 1836 in France and England, (Prinz, Veterinarian.) In the spring of 1845 it again prevailed in England, and in July became complicated by a severe inflammation of the eyes and dropsies beneath the belly and on the legs. (Veterinarian.) During the great influenza epidemic of 1847, it prevailed exten-

sively among horses in Europe, and was unusually prevalent in England in the two following years as well. Since that time it has been especially prevalent in Great Britain, in 1851-'52, 1854, 1856-'57, in the early summers of 1862 and 1863, and in the latter part of 1871.

Past history of the influenza of 1872. - According to information received from Professor A. Smith, veterinary surgeon, Toronto, the first cases occurred in the townships of York, Scarboro', and Markham, about fifteen miles to the north of that city, among the last days of September. He says, "I think the first cases were noticed among horses running at pasture." Cases were seen in the city of Toronto by October 1, and in three days it had attacked nearly all the horses of the street-cars and livery-stables. On October 18 it was reported as general in Montreal and Quebec and throughout the Dominion.

Several Canadian horses were introduced into Detroit on October 10 or 11 suffering from what was supposed to be a catarrh. On arrival they were at once placed in a large stable in the city, but almost immediately transferred to a smaller one to guard against the possibility of contagion. Two days later the disease showed itself in the horses occupying the larger stable, and in three days all of these were attacked. Meanwhile it had appeared in the smaller stable as well. No other cases are known to have occurred in the city until October 20, and soon after this it became general. Two of the imported horses were well enough to work from the first, and were constantly on the streets in the business part of the town.

On October 14 it was reported in Buffalo, New York, and was general by October 21. By October 17 Rochester had half its horses ill, and West Batavia bad been attacked.

On October 19 it existed in Syracuse in newly-arrived Canadian horses; on the 22d one hundred to two hundred were sick in boarding and livery stables, and it spread with great rapidity in the country around.

As early as October 20 it was reported in Warren County, Pennsylvania; on October 21 at Depauville, Jefferson County, Attica, Wyoming County, and Steuben County, New York, and Keene, New Hampshire. On October 22 at Brooklyn, New York, Jersey City, and Boston. On October 23 it was prevalent at Newburgh and in the country round New York, in the towns situated on the New York Central Railroad, from Syracuse to Albany inclusive; in Hartford and New Haven, Connecticut; in Block Island, in Providence, and Newport, Rhode Island; in Lunenburgh, Vermont; in Bangor, Portland, and Augusta, Maine; in Washington and Carrollton, Ohio, and in Chicago, Illinois. On October 24 Lexington, Sanilac County, Michigan, and Baltimore, Maryland, were affected. On October 25 the first cases appeared in Oswego, New York, also in Clarkstown, Buckland County, and in Livingston County, New York; Westfield, Massachusetts; Lewistown, Bethel, Topsham, and South Parsonfield, Maine, (at the latter place, which is thirty miles from a city, the first case was a horse from a city stable, and a week later a colt in the same stable.) It was also reported at Corry, Pennsylvania, at this date. On October 26 it reached Sheridan, Chautauqua County, New York, and Pontiac, Michigan. On October 27 it attacked Glens Falls, Catskill, and Poughkeepsie, New York, and Rockville, Tolland County, Connecticut; in the last case it was supposed from Springfield, Massachusetts. On October 28 the Watertown street-cars were stopped, and the disease had just appeared at Binghamton, New York, Paterson, New Jersey, Philadelphia, Pennsylvania, and Washington, District of Columbia, October 28; in the last place in sick horses brought from the North.

On October 29 it was announced in Washington county, Vermont; in West Chester County, Port Jervis, and Carmel, New York; at Titusville, Pennsylvania, and Columbus, Ohio.

On October 30 it was reported for the first time in Peekskill and Nyack, New York. On the

31st it appeared in Little Genesee, in Rosendale, and Deposit, and in Ithaca, New York, having existed since the 25th in Trumansburgh, ten miles to the northwest of the place last named, and slowly reached Varna, three miles to the east of Ithaca, on November 6. Pittsburgh, Pennsylvania, and New Hope, Pennsylvania, were reached on October 31, the first of these places by five or six horses brought from New York City to the livery stables of Messrs. Moreland and Mitchell; the street-cars had to be stopped on November 5 for the lack of horses. Yet even up to this date Belmont's horses at Babylon, Long Island, and McDaniels's at Saratoga, were still reported sound.

On November 1 it reached Kingston, on the west side of the Hudson and Washington County, New York, attacking first the livery and canal horses, contrary to what occurred at Buffalo, where canal horses escaped until October 22. Is this difference to be accounted for by the fact that the canal did not extend into Canada?

At the same date it was reported at Germantown and Lancaster, Pennsylvania; Cincinnati, Bucyrus, and Etna, Ohio; Romeo, Michigan; Portsmouth and Chuckatuck, Virginia, and Newark, Delaware, starting in the last case with a horse just arrived from Baltimore, Maryland.

On November 2 it appeared at Adams, Massachusetts; on the 4th at Pittsfield; on the 5th at Great Barrington, and on the 6th at Richmond; all in the Hoosac Valley. On the same date it was observed at Charleston, South Carolina, in town and country at once.

On November 3 it broke out at Elyria, Ohio, confining itself for five days to teams which had been driven to Cleveland; at Goldsborough, North Carolina, and Columbia, South Carolina.

On November 4 it was reported at Springfield, Illinois and in Lehigh County, Pennsylvania, where "it spread like fire along the canal and into the surrounding country."

On November 5 it was reported in Tioga, Elk, Chester, and Wyoming Counties, Pennsylvania, and at Grand Rapids, Michigan.

On November 6 it reached Cooperstown, Otsego County, New York; Greensburgh, Pennsylvania, and Richmond and Campbell County, Virginia; and on November 7 Butler County, Pennsylvania.

On November 8 it had attacked Montcalm, Livingston, and Ottawa Counties, and Lincoln and Tuscola, Michigan; Ravena, Ohio, and Danville, Virginia, where it prostrated 75 per cent of the horses in twenty-four hours.

It was reported, November 9, in Hampton, Virginia, and two severe cases at Johnstown, Cambria County, Pennsylvania, where, however, it did not become general till the 24th, so that these must be considered questionable.

November 10 it existed in Sandusky, Ohio, on November 11, at Marshall, Michigan, Indianapolis, Indiana, and Savannah, Georgia.

November 13 it reached Scranton and Forest County, Pennsylvania, Hamilton and Marion, Ohio, and Wilmington and Tarborough, North Carolina, while it had reached its height at Louisville, Kentucky, and Milwaukee, Wisconsin, and was merging into dropsical and other fatal complications in Buffalo, New York, Baltimore, Washington, Philadelphia, and Raleigh, North Carolina.

November 14 it existed at Toledo, Ohio, and Lynchburgh, Virginia, and was nearly universal in Buckingham County and at Wheeling, West Virginia. November 15 it was reported in Mechanicsburg, Grampian Hills, and in Clearfield County, Pennsylvania, in Defiance, Ohio, and Madison, Wisconsin.

November 16, in Beaver County, Pennsylvania, and 17th at Cedar Springs, Clinton County, having traveled northward along the Susquehanna River. It had existed to the southeast and west for several days previously.

November 18 it broke out at Atlanta, Georgia, and Chattanooga, Tennessee. At Nashville, Tennessee, it broke out between the 15th and 20th, and spread slowly, so that exact figures are difficult to arrive it. At this time it prevailed in Giles, Rutherford, Manry, Davidson, and Sumner Counties, at points recently visited by a circus, which came from an infected district. At Memphis, Tennessee, it existed in a mild form on the 19th.

November 21 the street-cars in Augusta, Georgia, were stopped, and the first thirteen cases occurred at Martha Furnace, Blair County, Pennsylvania. November 24, fifty horses and mules were attacked at once at Johnstown, Cambria County, Pennsylvania.

November 27 the street-cars were stopped at Halifax, Nova Scotia, on account of the disorder; it was reported to be spreading rapidly in New Orleans; and had appeared in Jacksonville, Illinois, Keokuk, Iowa, and Montgomery, Alabama.

November 28 it was reported at Jacksonville, Florida; November 30 it prevailed in Fulton County, Georgia, and Newberry County South Carolina, making a westward progress.

December 2 it broke out in East Saint Louis, Missouri; December 3, in Boonville, Missouri, and Omaha, Nebraska.

December 7 it reached Havana, Cuba, attacking native and northern horses alike. On December 14 it had reached its height, many horses were dying, and Mexican horses were being imported by the Spanish government.

The outbreak has varied widely in its nature at different places. Sometimes it has spread slowly along the course of railroads or turnpikes, and its progress can be very satisfactorily connected with the intercourse between the different places attacked. In other cases it appears, from the reports, to have struck down a whole city or limited district in twelve or twenty-four hours, and in a manner which it appears impossible to account for otherwise than by some subtle and generally pervading influence. The earliest reports of the disease from many points allege that colts, mares, and other animals, running at grass, have escaped, but later intelligence seldom or never fails to report their sickness. So, too, at Scranton and other mining regions in Pennsylvania the mules working underground kept well for about six days after those on the surface were suffering. The majority of the reports testify that animals at grass in mild weather were later in being attacked, and suffered less than those in regular work and stabled. Yet some report that those at pasture and away from all other horses suffered as early and as severely as those indoors.

The percentage of horses attacked has been variously stated at from 80 to 99. As the reports are mostly written before the disease has quite passed away, it is probable that the latter number is nearest the general average.

The fatality appears to have been from 1 to 2 per cent on a general average, though it has been considerably higher than this in some of the larger cities. The highest reported was at Farmingdale, New York, where it was claimed that 10 per cent of the heavy horses had died. This was, however, drawn from too small a number of cases to be of any value as an average.

SYMPTOMS AND COURSE.

Incubation. - From the analogy it bears to other fevers influenza would be expected to

possess a period of incubation, during which the poison which had obtained access to the system should remain there apparently dormant and without giving any outward sign of its presence, but really undergoing a process of rapid multiplication and establishing its hold on the animal economy. The duration of such incubation has not been definitely ascertained, the disease not having been transmitted by experimental inoculation; but, from the observation of cases in which it has appeared in a stable after the introduction of a sick animal, it is supposed to extend from one to three days.

SYMPTOMS OF THE SIMPLE OR CATARRHAL FORM.

First stage. - The extreme suddenness of the attack is among the most remarkable features of the malady, and one which obtained for it the name of the *lightning catarrh (blitz-katarrh)* among the Germans. It often makes its onset with a sudden and extreme prostration, with intense muscular weakness and drowsiness. A horse in apparently robust and vigorous health is seen with drooping head, ears, and lips, semi-closed eyelids, expressionless countenance, and one or two legs partially flexed, as if to seek relief from his weariness. He stands in one position, or if urged to move does so with reluctance, sluggishness, and often with unsteady, swaying gait. The back is arched and rigid, the limbs carried stiffly, and the joints often crack. At the same time there may be noticed a dry staring coat, a tenderness of the skin when handled, a tendency to coldness of the nose, ears, and limbs, and in exceptional cases shivering, tremors, or even nervous jerking.

A cough is always an early symptom, and in the visitation of 1872 it has been usually the first observed, as it was by far the most prominent of the early symptoms. It commenced as a short, dry, husky cough, frequently repeated, and for the first two days or more unattended by the extreme dullness and prostration above referred to. The temperature is raised to 102^{o} F., the pulse is slightly accelerated and variable in character, but usually weak and easily compressed and rendered imperceptible by the pressure of the fingers. The state of the secretions further betrays the febrile state. The urine is less abundant and higher in color than natural; the dung often rather hard and glistening on the surface from the presence of mucus; the mouth is hot, dry, and clammy, and the mucous membrane of the nose dry and red or pink, with, in many cases, a tinge of brown or yellow, the color being common also to the membrane of the eye. The breathing is slightly accelerated, and if the ear is placed on the course of the windpipe at the lower end of the neck or on the sidle of the chest behind the middle of the shoulder, the blowing sound is heard louder than common. Thirst is increased and sometimes ardent, and the appetite usually slightly impaired or dainty, though in other cases unaffected.

Second stage. - As the disease advances other symptoms appear, and those first seen are usually aggravated. In some cases, indeed, there is no manifest aggravation, the spirit and appetite remaining good throughout, the prostration and fever are all along slight, the husky cough which heralded the disease becomes looser and gurgling or rattling, with the appearance of the discharge from the nose, and a prompt recovery follows as from an ordinary and slight cold.

But usually by the third or fifth day the cough has become deep and painful, occurs in paroxysms of four or five in rapid succession, and racks the entire body with the effort. The eyelids are swollen, and tears run from the eyes. A watery fluid distills from the nose, soon giving place to a thick yellowish or yellowish-green muco-purulent discharge. The temperature

has risen to 105° F., the thirst intense; appetite variable, sometimes lost; pulse more rapid than natural, soft, weak, and easily excited by exercise; and the breathing somewhat deeper than before. The mucous membrane of the nose becomes of a deeper red until the discharge is freely established, sometimes almost purple, with patches of brown or yellow, and even *petechiæ,* or spots of blood staining in the worst cases. Swallowing is painful, the food being sometimes dropped from the mouth after it has been chewed. There is slight swelling and tenderness between the branches of the lower jaw and beneath the roots of the ear. Handling the throat causes wincing, and easily excites a paroxysm of coughing, and the cough is softer and looser if a free discharge has been established from the nose. If the ear is applied over the windpipe or side of the chest, the former harsh blowing sound is found complicated by a rattle, *(mucus râle,)* and the hand applied on the side of the chest, just behind the left elbow, detects the forcible impulse of the heart with each beat. The loins are insensible to pinching in many cases. Unless affected by treatment the dung tends to become harder, firmer, and less abundant; the urine scanty and of a deep yellowish-brown color, or quite opaque from deposited lime salts. In many cases this liquid is thick and sizy, and all specimens which I have examined have shown a neutral reaction and contained albumen in variable proportions. I did not find casts of the uriniferous tubes in a single instance. (See Dr. Caldwell's analysis of urine appended to this report.)

The supervention of a free discharge from the nose, the formation of an abscess about the throat, the occurrence of a profuse perspiration, or even a slight diarrhœa, if attended with a cooler mouth, a firmer, less rapid pulse, a lower temperature and a disposition to lie down, may be looked upon as critical, and is often followed by a prompt recovery.

Third stage. - This is the period of recovery, and is marked by the subsidence of all the morbid symptoms and the steady re-establishment of health. The cough becomes gradually less and less painful and no longer paroxysmal; the relaxed fatuous expression of the countenance ceases; the eye brightens; the spirits and appetite return; thirst diminishes; the discharge from the nose changes from a greenish to an opaque yellow or white hue, and is gradually dried up; the pulse acquires firmness; the impulse of the heart on the ribs steadily decreases, though still easily roused by excitement; the breathing gets easy, and strength and vigor are slowly restored. Considerable bodily weakness usually lasts after all other signs of illness have passed away; the horse sweats readily; flags if kept for some time at action or work, and is liable to relapse if overdone.

But all do not follow this regular and favorable course. Some exhibit a tendency to extreme violence from the first, and others, which begin mildly, soon show signs of dangerous disorder in the chest, in the abdomen, in the joints and muscles, in the subcutaneous connective tissue, or in the eyes. It is these complicated cases alone which are dangerous; the simple catarrhal affection always tends to a favorable termination.

With chest complications. - Even in the simple catarrhal form the respiratory mucous membrane is involved as far down as the lungs, but only in a slight degree. But in some cases the inflammatory action extends beyond the larger bronchial tubes, and invades their smallest ramifications, constituting the redoubtable disease known as a *capillary bronchitis,* aggravated by the debilitating fever of the influenza. The breathing becomes quick and difficult; the nostrils widely dilated; the flanks heave violently; the stupor and prostration are extreme; the mucous membranes are of a dark red or even purple hue; the cough deeper and more painful, the animal setting his feet apart, or perhaps even going down on his knees in his efforts to

dislodge the cause of irritation; the blowing sound heard over the lower end of the windpipe is still louder and harsher than in the other case; and a loud wheezing is heard when the ear is applied over the sides of the chest. The patient stands constantly in this as in all the other complications in the chest, and the fact of his having lain down, and remained so for some time, may be taken as a satisfactory sign of improvement. With this form the patient may literally die of suffocation, the thickened coats of the tubes and the accumulated exudation preventing the entrance of air to the air-sacs in the lungs. Or death may result from the increasing impurity of the blood, which renders it unfit to nourish and sustain the functions of the nervous system and other vital organs. Capillary bronchitis has been a frequent complication during the present epizootic.

If the inflammation extends to the lungs we have the typhoid pneumonia of medical writers, with a greater tendency to a liquid infiltration of the organ than to the firm consolidation (hepatization) characteristic of inflammation of the lungs in a more healthy system. In this case there is the same difficulty of breathing and the same general symptoms as in capillary bronchitis, but the wheezing sound heard over the chest is absent, or nearly so, and in place of this there is a fine crackling (crepitation) along a line circumscribing the inflamed portion, which itself gives out no sound. Percussion over the area which is destitute of murmur brings on a sound comparable to that obtained by striking a solid body, while the still previous portion gives out a more resonant or hollow sound than is natural. This may terminate fatally by complete infiltration of the lung tissue so as to unfit it for the function of respiration, by the destructive effect of extensive suppuration in its substance, by the exhaustion consequent on the excessive drain on the vital powers, or by the increasing impurity of the blood, which finally becomes unfit to sustain the healthy functions. Short of this it may leave permanent lesions on the lungs, such as consolidation of a portion, with short wind, or impaired nutrition and innervation resulting in heaves and dilatation and rupture of the air-cells. In favorable cases the exuded lymph is entirely absorbed, and a healthy state of the lung is restored. In my experience this has been less frequent in 1872 than the bronchitic complication, and has occurred chiefly in animals which have been carelessly exposed when sick, or exhausted and debilitated by work, impure air, or injudicious drugging.

Pleurisy will sometimes supervene, though I have not met with a well-marked case during the recent visitation. Yet in other years it has been so frequent as to procure for the affection the name of typhoid pleurisy. This consists in inflammation of the membranes covering the lungs and lining the cavity of the chest. It is characterized, like the two last mentioned forms, by accelerated breathing, which is, however, short and catching, the inspiration being suddenly arrested by the sharp pain before the chest is quite filled. The spaces between the ribs at the affected part are excessively tender, and at this point in the early stages a slight rubbing sound is heard, caused by the gliding of the dry roughened surfaces of the inflamed membranes on each other. In twenty-four hours this may have passed because of liquid effusion into the cavity of the chest, and in such a case the natural murmur of the lung and the resonance on striking the chest are absent up to a horizontal line corresponding to the surface of the liquid, and this is usually at the same height on both sides. Death may ensue in this case from the accumulation of water so as to fill the cavity of the chest and prevent dilatation of the lungs with air; from the debility consequent on the abstraction of so large an amount. of the blood elements from the circulation, or from decomposition of the effused products and general blood poisoning. It may cause permanent impairment of the wind, by the formation of fibrous

bands attaching the lungs to the side of the chest, by compression of the lung through the contraction of a newly-formed fibrous envelope, or by injury to the recurrent laryngeal nerve. In favorable cases an entire recovery may follow upon the absorption of all morbid products.

The pericardium or heart-sac is often involved in cases of pleurisy. All this is characterized by extreme tenderness of the chest behind the left elbow, a friction sound heard at the same point until effusion takes place, after which the heart-sounds appear more distant and indistinct. The action of the heart is often irregular throughout.

In other cases the lining membrane of the heart and its valves are the seat of disease, though usually as a complication of the rheumatic form of the affection. In this case there is irregularity of the force and intervals of the heart-beats, and the healthy heart-sounds are modified by sighing, hissing, or purring murmurs, coincident with the first or second sound of the heart-beat according to the particular valve diseased. There is breathlessness and tendency to dropsical effusions, coldness and weakness of the limbs, and a liability to faint on slight exertion. Clots of blood sometimes form on the diseased valves, or even independently of their disease in very impure conditions of the circulating fluid and weakness of the circulation, and give rise to the same class of symptoms or aggravate those already in existence. In all such cases there is great liability to sudden death, and this liability may last indefinitely even after apparent recovery.

With abdominal complications. - There is almost always some implication of the digestive organs, as evinced by the coated appearance of the dung, the yellowness of the mucous membranes, and the dangerous susceptibility to purgatives. So small a dose as two drachms of Barbados aloes has been known to prove fatal to the horse in influenza. Many cases during the recent epizootic merged into a muco-enteritis after the nasal catarrh had been already established, and in some visitations this implication of the digestive organs has been rather the rule than the exception, and the disease has been accordingly termed bilious fever, typhoid fever, gastric fever, &c.

In such cases, however, the disease usually makes its appearance as the simple catarrhal affection, and it is only after the discharge from the nose has been established that the muco-enteritis sets in, and by the violence of its manifestations virtually supersedes the original disease.

There is great torpor and stupor, and tension of the abdominal walls, which are generally tender to the touch, but especially at points occupied by the organs particularly implicated. Thus with derangement of the liver, and the more purely bilious symptoms, the tenderness is mainly over the short ribs on the right side, while with intestinal disease it is more uniformly distributed over the abdomen. The loins are insensible to pinching; there are colicky pains, with frequent looking round to the flank, or uneasy movements of the hind limbs, ardent thirst, clammy, slimy mouth, a coated or furred condition of the tongue, and unusual yellowness of the visible mucous membranes and of the urine. The urine is sometimes reddish or bloody, and passed with considerable effort. The pulse is small and weak, but with a quick beat and variable in number; the breathing is often quick and catching, as in pleurisy; the cough is weak and painful; the bowels show a tendency to constipation; the pellets of dung are thickly coated with mucus; and the membrane of the gut exposed in passing it of a dull red color. The anus will sometimes remain constantly open, air being alternately drawn into the gut and expelled. The animal strains frequently, but passes only a few pellets of dung at a time.

Improvement is often manifested in connection with a fever action of the skin, kidneys, or

bowels, the torpor and prostration disappear, the appetite and strength are increased, and a prompt recovery may be expected.

In fatal cases the torpor and prostration are augmented; the breath becomes fetid; the anus more puffy, red, and with a greater tendency to remain open; the dung passed often and in small quantities, soft and mixed with glairy reddish or bloody matter. The urine is scanty, high-colored, slimy, sometimes thick and gelatinous, fetid, and even bloody. The pulse becomes more and more rapid and weak, the eyes sunken, the surface and extremities become cold, the hairs are easily detached, and the stupor and debility extreme.

Complication in the joints, muscles, and connective tissue. - Rheumatio manifestations. – The stiffness of the body and limbs, and the general soreness in many cases, even at the outset, show how commonly the white fibrous tissues of the joints and muscles are implicated. It is only requisite that these symptoms should be unusually prominent to make the rheumatic feature of the complaint its characteristic one; and this has often been the case to a large extent in the colder latitudes, such as Northern Germany, Denmark, and Scotland. It has been a frequent complication in New York during the influenza of 1872. Cases of this kind mostly begin by showing the symptoms of the simple catarrhal malady, and often after this has made some progress in a regular, and it may be exceptionally mild form, there suddenly appears painful inflammation, with more or less infiltration and swelling of the fibrous sheaths of the muscles and tendons and of the ligaments of joints. There may be merely some swelling and tenderness of certain muscles of the face, neck, back, or limbs, or there may be thickening and shortening of the tendons and ligaments leading to distortion, and knuckling over at the knees and fetlocks, or liquid effusions may take place into the joint capsules, resulting in puffy, elastic swellings in different parts; the bones even may be involved in the disorder, or, worse still, the fibrous structures and valves of the heart. Dropsical effusions take place in some such cases from the impairment of the local nutrition processes, and weakness of the circulation, and even at times from the implication of the heart. Though the majority of rheumatic patients will entirely recover with proper care, yet a certain proportion only do so with stiffened limbs and joints, or with incurable disease of the heart, which subjects them to constant danger of fainting and sudden death.

Dropsical complications. - As already noticed, dropsical effusions sometimes ensue from pre-existing disease of the heart or suppressed secretion of the kidneys. In other cases they appear due to extreme weakness of the circulation and nutritive processes, and a watery or very impure state of the blood, the result of protracted or severe illness, unwholesome conditions of life, overwork at too early a stage of convalescence, and the like. Such œdematous swellings of the limbs, beneath the chest and belly, and in the lower part of the head, have repeatedly occurred as a prominent feature of the influenza in England, and notably in 1751, and July, 1845, apparently in connection with the extremely variable and unwholesome weather which prevailed. The dropsical cases in 1872 have been virtually unknown in this country, having been confined to Buffalo, Rochester, New York, Philadelphia, Washington, and other large cities, where the patients were in many cases condemned to draw overloaded street-cars, or other vehicles, as soon as the nasal discharge had been freely established and the fever had begun to decline; or when they were confined to damp, close, reeking, unventilated, often underground buildings; or where they had been worn out by injudicious and exhausting treatment.

These dropsies are always dangerous, implying as they do extreme exhaustion and prostration of the vital powers, saturation of the blood with waste and hurtful elements, the product

of the extensive waste of the body or complications on the part of the heart or kidneys.

Nervous complications. - The extreme muscular weakness and the occasional semi-comatose condition of the patient imply a profound prostration of the nervous centers, a condition which is, however, present to a variable extent in nearly all specific fevers. This has sometimes in the recent epizootic amounted to twitching of the muscles of the face, neck, body, or limbs, and has been known to result in delirium, and even partial or complete loss of control over the limbs. My friend and former collegian, Mr. Murray, of Detroit, has met with but three cases of extreme nervous disorder out of five hundred patients during the recent epizootic. Two of these he diagnosed as serous effusion into one ventricle of the brain, and one was a case of complete *hemiplegia.*

Inflamed eyes as a complication. - Rutty informs us that this was an almost constant accompaniment of the influenza in Ireland in 1760, and that many of the horses were left permanently blind. In that of 1845, in England, the affection of the eyes was again a prominent feature. Few cases lasted over a week, but the ophthalmia often persisted long after all other symptoms had passed away. In nearly all epizootics there is a slight implication of these organs evinced by the redness of the mucous membrane, of the lids, and the escape of tears over the face. But when the ophthalmia becomes an important feature there is excessive swelling, of the lids, a profuse purulent discharge from the inner corner of the eye, opacity of the transparent cornea, with or without a painful sensitiveness to light. In bad cases it results in permanent cloudiness of the cornea, or cataract, according to the parts involved.

Further sequelae. - In overworked or mismanaged horses other affections will sometimes wind up the malady. When the system is greatly depressed, when the vitality of the blood and tissues is greatly impaired by the presence of the fever-poison, when the vital fluid is loaded with the vast products of the rapid tissue changes due to the fever, and to over-exertion on the part of animals utterly unfit for it; when the elimination of these effete matters is almost suspended by the impaired functions' of the great excretory organs, such as the lungs, liver, bowels, kidneys, and skin, there is liable to supervene the state known to English veterinarians as *purpura haemorrhagica.* In this affection there is disorganization and breaking down of the blood particles, and extravasation of the liquid elements of the blood, and in some cases of the coloring elements as well, into the tissues surrounding the blood-vessels. Blood seems to sweat from the swellings in the skin, or from the mucous membrane, and flows from the nose, the intestines, or the urinary passages. The swellings are circumscribed and not situated, like those of dropsy, on the more dependent parts of the body; if they involve the head the whole organ may be engorged until it becomes impossible for the animal to open his mouth or eyelids, or even to breathe. If less extensive, and consisting merely of a circumscribed serous infiltration, the swellings may shift about from day to day, disappearing only from one place to re-appear in another. The blood in such cases is found to contain much free hæmatim, or coloring matter, and fragments of broken-up; red globules; it coagulates imperfectly and loosely, or not at all, but remains as a dark, tarry-looking mass, and before death contains numerous staff-shaped bodies, or *bacteria,* resembling those found in decomposing animal fluids. This affection, which existed to some extent as a sequel of the recent influenza in Boston, New York, and other cities, usually proves fatal in fifty per cent of animals attacked. I know of but two cases of this complication in Tompkins County, New York, during the recent visitation. One occurred early as the result of heroic treatment; the other after partial convalescence from hard work and exposure.

Glanders and farcy have been among. the results of the epizootic of 1872, and, like *purpura haemorrhagica,* are always liable to break out when the strength is seriously reduced and the blood impoverished and loaded with impurity, in connection with protracted and exhausting disease, impure air, and generally debilitating treatment. Whether these diseases arose *de novo,* or from preserved germs left over from the numerous cases of glanders in New York a few years ago, it will be no easy matter to decide.

The epizootic of 1872, in America, has followed mainly the simple catarrhal type, and has been by no means a fatal affection, the mortality ranging from 1 in 300 in many country districts, to 3 or 5 per cent in some towns. Yet in a number of instances the various other complications have been noticed, with the exception, perhaps, of the *ophthalmic* ones.

Post-mortem appearances. - These are mainly seen in the respiratory organs. In fatal cases the cavities of the nose, the nasal sinuses, and, still more so, the parts about the throat-fauces, pharynx, and larynx usually have their mucous membrane much tensified, livid, and softened with dark or greenish metallic tints, implying the existence of gangrene. Ulcers or masses of thick tenacious mucus are sometimes present, and the latter have been sometimes mistaken for false membranes. The guttural pouches, and the submaxillary and guttural lymphatic glands are sometimes congested and swollen.

The deep-red hue, and the puffy, softened condition of the mucous membrane are continued throughout the trachea and, above all, in the bronchia, even to their smallest divisions, and these are more or less completely filled with a frothy mucus.

In cases of unusual virulence and early fatality, or long standing, and with a very, impure condition of the blood, the pleuræ (covering of the lungs) and the heart-sac are spotted with petechiæ or blood extravasations, and usually contain effusions of a deep-red bloody aspect, containing little fibrine, and with a very little tendency to coagulation. False membranes in these cavities are far from numerous, and adhesions between the lungs and the sides of the chest rare, except as the result of a pleurisy after the primary disease has subsided. The surface of the lung and the substance of any false membranes have a tendency to a dark-red hue.

When the lungs have been implicated these are commonly found in a state of dropsical infiltration, apoplexy, or gangrene in patches, while hepatization is rare in the early stages, though frequent enough if the disease is prolonged.

The dropsical portion of the lung does not collapse like the healthy part; does not crepitate or crackle on pressure. The pressure of the finger leaves a depression, as in a dropsical limb; it seems solid, sinks in water, and gives exit to much frothy matter when pressed. This is sometimes dependent on disease of the valves of the heart, but in other cases on the altered state of the blood. The pulmonary apoplexy consists in the infiltration of blood into the lung tissue in circumscribed, rounded, or angular patches, and even sometimes in a diffuse manner. These patches are firm to the touch, black with a slight tinge of red, and rise abruptly to a variable height above the level of the surrounding healthy lung. Like dropsy, it is most frequent toward the lower borders of the lungs, and, like that, arises from disease of the valves of the left side of the heart, or the altered state of the blood, but at times also from a diseased and softened state of the pulmonary blood-vessels, which predisposes them to give way.

Gangrene of the lung is fortunately rare. It is recognized by the bloodless, hardened appearance of the tissue, with bluish, greenish, or other metallic tints, or it may be deliquescent, and with a most repulsive odor. Hepatization is seen mainly about the roots of the lungs or near their lower border. In its early stages the lung is consolidated by a semi-solid infiltration,

which drains out when it is cut in thin slices; later it has a firm, dry, granular appearance, like the substance of liver, easily gives way to the pressure of the finger, does not crepitate nor collapse, and sinks in water. It is mainly of a dull deep-red color, varying to a violet. If suppuration has ensued, this changes to a gray color, and drops of pus exude from the freshly-cut surface. The heart is blanched and softened, and sometimes contains clots firm enough and sufficiently adherent to the valves to imply their existence during life. In a recent post-mortem examination of a horse which had suffered from the most agonizing difficulty of breathing for thirty-six hours before death, I found the right ventricle filled with a large clot, very firmly adherent to the tricuspid valve, and composed of superimposed layers, decreasing in firmness from the valves outward. There was some infiltration around the roots of the lungs, but by no means sufficient to account for the dyspnœa. These clots are often divided into a yellow buffed and a deep-red portion, though at other times and in the more malignant cases they are comparatively diffluent, black, and tarry. The valves of the heart are sometimes found thickened, rough and contracted, as the result of inflammation, but chiefly in rheumatic cases.

In the digestive organs the right sac of the stomach and the small intestines are unnaturally vascular, and marked with numerous spots of blood extravasation or staining. The glands are often enlarged, the epithelium is easily detached, and slight punctiform erosions are sometimes met with, but no distinct ulceration. Petechiæ may also be present on the folds of the peritoneum. The intestinal contents are often mingled with excess of mucus, or even colored with blood. The liver is often enlarged, softened, and friable, and of a pale-yellow hue, with brownish spots. In all cases in which the changes in the blood have been extensive, and, above all, in cases which have merged into *purpura haemorrhagica,* the spleen is engorged with blood and increased in size and weight. The kidneys are usually healthy in aspect, though in some instances enlarged and softened.

The brain is usually found slightly congested, and effusions have been met with in the ventricles, in the arachnoid and sub-arachnoid space. So constant was this lesion during the epizootic of 1836 in London, that Charles Clark concluded, after extensive dissections of dead horses, that this was the primary seat of the disease, and that all other manifestations were simply complications. To these may be added the liquid effusions beneath the skin and between the muscles and tendons in dropsical cases, the inflammations, thickening and redness of tendons and their sheaths, and of joints with the puffy swelling of joints, and other synovial sacs in rheumatic subjects, and the blood-staining of the inner surface of the skin, the gelatinous exudations and the accumulations of blood in the limbs and beneath the skin in various parts characteristic of *purpura haemorrhagica*.

CAUSES OF THE INFLUENZA. - Unlike the majority of former epidemics whose origin has been obscure, this appears to have sprung into existence in the center of the North American continent, and in a distinct locality, which can be definitely pointed out. It has spread rapidly and steadily in nearly every direction, from this as a center, and, thanks to facilities afforded by railroads and telegraphs, its course has been traceable with ease. The following is intended as a contribution toward securing the lessons which may be learned from the visitation.

The old doctrine of an epidemic constitution of the atmosphere has of late years been gradually waning, as cholera, small-pox, typhoid fever, and other epidemics and epizootics have been traced to more tangible causes, and placed more under human control. More than any other epidemic malady, perhaps, has influenza retained its claim on an atmospheric causation.

It has been described as falling simultaneously on all parts of a given district or country, as breaking out in islands a considerable distance from the shore, and without having had any communication with the mainland, and as having attacked the crews of ships in mid-ocean after they had been twenty days at sea. No wonder that we should have had all imaginable general conditions of the earth, water, and air invoked to explain its occurrence; that at one time it has been attributed to the lowness and dampness of a locality, at another to the height, exposure, and coldness; at a third to crowding of population with the resulting impurities of soil, water, and air; in a fourth case to the vicissitudes of weather in late spring, autumn, or winter, or of some unusually variable season; to a persistent low temperature, or sudden variation of temperature; to the prevalence of damps, acrid or fetid fogs, and mists; to excessive rain-fall and unusual humidity of the atmosphere; to an unusually high or low density of the atmosphere; to an excess of ozone in the air; to the telluric emanations attendant on great earthquakes and volcanic eruptions, or to a modified condition of the atmospheric electricity.

The epizootic of 1872 affords but the slenderest appearance of support to any of these hypotheses. Neither soil nor elevation has materially affected it. The prevalence and mortality have been almost the same in the mountains of Vermont and New Hampshire as in the flat malarious sea-coast of New Jersey, Maryland, and Virginia. The district where it originated, according to the report of Professor A. Smith, is very variable. In the township of York, near Mimicu, Canada West, it is partly "heavy clay and partly a sandy soil, intersected with swamps. In another part of the township of York the soil is formed of clay, intermixed with sand, and the subsoil generally is not porous. In Scarborough and Markham the land is good and the farms well cultivated, the buildings, stables, &c., generally comfortable and well ventilated, and the horses well fed, and otherwise carefully attended to."

The temperature has not exerted any marked influence. The disease bas been general wherever it has reached; and the mortality bas averaged 1 per cent or a little over. Indeed, in some cases the comparison has been altogether in favor of the more northern and colder localities. Thus in Fulton County, Georgia, it is reported as universal, and the mortality up to the date of the report had been 1 per cent; in Dodge County, Wisconsin, on the other hand, although, after the outbreak of the affection, there had been a sudden transition in a single night from a pleasant Indian summer to the rigorous and persistent cold of winter - the thermometer sometimes marking 8^{o} below zero - yet the losses in the country districts are estimated at 1 in 300.

Overcrowding, its concomitants of hot, damp, vitiated air, has unquestionably been a main cause of the severity and complications of the disease in large cities, the pneumonias, pleurisies, *purpura haemorraghias*, &c., but the malignancy of all specific febrile diseases, occurring with such unwholesome surroundings, forbids that we should attach any importance to these in estimating the causes of this particular disorder. Influenza in man shows a similar malignancy and fatality in unwholesome localities, and in overcrowded portions of cities where hygienic arrangements are imperfect. The observations of Pearson, Parks, Baker, Gray, and the English registrar-general have sufficiently established this fact. And equine influenza, when more circumscribed than at present, has often confined. its ravages to exposed stables, opened and swept by draughts of cold air, or closed and without ventilation, light, or drainage, but with an impure, damp, and stifling atmosphere. Yet such conditions can only retard or prevent the elimination effete matter from the system, favor the introduction of the deleterious products of the composition in animal and vegetable matters, saturate blood with impurities,

and by impairing or suspending nutrition and other important functions lay the system open to the access of disease. But while they facilitate the development and increase the severity of all zymotic maladies, they do not determine which specific affection shall be developed in a particular case. That is determined by the prevalence of influenza, glanders, or other specific disorder in the locality at the time. And it is noticeable in this connection that the equine influenza of 1872 did not originate in a crowded city, as is generally supposed.

Sudden changes of weather and temperature. - Nasal and bronchial catarrhs often prevail extensively among horses, as among men, in connection with sudden and extreme variations of temperature, and especially in spring and autumn. These are liable to be confounded with influenza, and hence the idea that this disease is but a simple result of such climatic vicissitudes. In the case of the horse the changeable seasons are often aggravated by the weakness and susceptibility of the system in connection with the spring and autumn changes of coat, the transition from the hot stable to the cool field, or from the clear atmosphere of the pasture to the close, hot, impure air of the stable, the changes from green to dry food, or *vice versa,* and the substitution of work for idleness, or the reverse. That the effect of sudden changes of temperature is very severe on the animal system which has not become habituated to the new condition of life by a gradual transition from one to the other, is well shown in W. Edwards's experiments on cold-blooded animals. Though subjected to a very low temperature in winter the heat of their bodies declined barely four-tenths of a degree, whereas exposure to a cold temperature in summer insured a depression of body-heat to the extent of 3° and even 6° Cent. So it is with warm-blooded animals transferred from a warm to a cold climate. The French cavalry horses, sent from the shores of the Mediterranean to the northern parts of the country, suffer to a great extent from catarrhal and pulmonary affections. But such catarrhal attacks do not spread as an epizootic, nor extend from the newly-arrived horses to those which are permanent residents. Catarrhal symptoms exist, indeed, but the *contagium* which secures an extension and general prevalence of the malady is wanting. Such vicissitudes, therefore, operate like other unwholesome conditions of life; they predispose the system to the disease, or even increase its severity, but they cannot apparently generate the morbid poison.

The first reported cases of the recent epizootic occurred near Toronto in the last days of September. It is, therefore, of the greatest importance to ascertain what was the state of the weather in that locality during the month of September. Through the kindness of Professor Kingston, of the Magnetic Observatory, Toronto, I am enabled to introduce here tables giving the meteorological register for the month of September, in 1871 and 1872, at Toronto, and a third table giving the records of the same month for the last twenty-eight years at the same place.

MONTHLY METEOROLOGICAL REGISTER AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO, SEPTEMBER, 1871.

Latitude 43° 39′ 4″ north. Longitude 5h. 17m. 33s. west. Elevation above Lake Ontario, 108 feet.

Day.	Barometer at temp. of 32°.				Temperature of the air.				Excess of mean above normal.	Tension of vapor.				Humidity of air.				Direction of wind.				Velocity of wind.					Rain, in inches.	Snow, in inches.
	6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Mean.		6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Resultant.	6 a. m.	2 p. m.	10 p. m.	Resultant.	Mean.		
					°	°	°	°	°												°							
1	29.835	29.876	29.877	29.8753	47.5	66.6	55.1	57.72	— 4.83	.293	.363	.396	.353	89	55	91	75	Calm.	S.E. by S.	Calm.	S. 19 E.	0.0	2.2	0.0	1.30	1.35	......	..
2	.942	.885	.842	.8847	52.6	70.6	63.0	63.13	+ 0.88	.334	.399	.413	.391	84	53	71	69	Calm.	S.E. by S.	S.S.W.	S. 19 E.	0.0	11.5	0.8	3.35	3.53	......	..
3	......	.803	......	......	......	73.8	......	......	......	......	.605	......	......	......	72	......	......	S.S.W.	S.	N.E. by E.	S. 40 E.	0.8	6.0	1.8	1.36	2.05	......	..
4	.751	.067	.642	.6823	62.7	75.7	64.1	67.78	+ 6.10	.544	.653	.550	.578	95	73	92	86	Calm.	S.E.	Calm.	S. 26 E.	0.0	6.8	0.0	1.87	1.94	......	..
5	.619	.576	.540	.5727	62.3	80.7	65.9	70.58	+ 9.20	.472	.636	.500	.543	84	61	78	73	S. by W.	S.	Calm.	S. 9 W	0.5	12.0	0.0	5.30	5.43	......	..
6	.457	.326	.507	.4608	67.0	76.7	60.5	67.83	+ 6.78	.581	.550	.271	.465	87	60	50	66	S.S.W.	W.	N.W. by W	N. 86 W	4.8	14.0	14.2	8.41	10.43	......	..
7	.697	.757	.836	.7743	47.9	64.5	53.3	55.95	— 4.77	.250	.218	.271	.267	74	35	67	61	W.N.W.	N. by E.	N. by W.	N. 18 W	3.5	5.5	11.8	4.33	5.63	......	..
8	.951	.930	.852	.9132	48.6	63.0	60.5	57.97	— 2.34	.230	.294	.372	.296	67	50	70	61	N.N.E.	E.	E. by S.	S. 70 E.	3.2	11.5	5.6	6.14	7.37	......	..
9	.831	.764	.830	.8037	52.6	73.1	65.2	65.07	+ 5.08	.342	.498	.458	.440	86	62	74	72	Calm.	S.	N.N.W.	S. 59 W	0.0	12.6	8.8	2.45	8.49	.050	..
10	......	.925	......	......	......	64.5	......	......	......	......	.239	......	......	......	39	......	......	N.E. by N.	N.N.E.	N.	N. 2 W	5.6	6.6	7.8	6.28	7.83	......	..
11	30.029	.998	.987	30.0018	50.8	66.6	56.9	58.08	— 0.52	.283	.353	.286	.315	76	54	61	64	N.	S.S.E.	N. by W.	N. 57 E.	6.3	2.6	8.8	1.16	4.43	......	..
12	29.991	.926	.869	29.9195	51.8	67.4	56.1	58.42	— 0.40	.207	.280	.375	.290	53	42	87	61	N. by E.	Calm.	Calm.	S. 62 E.	4.0	0.0	0.0	0.41	0.87	......	..
13	.815	.803	.923	.8583	46.4	69.2	52.9	55.50	— 2.92	.269	.234	.174	.212	85	32	43	51	Calm.	N.W. by W	N.	N. 25 W	0.0	15.5	3.4	6.81	6.89	......	..
14	30.060	30.034	.941	.9945	39.2	51.1	51.5	48.42	— 9.60	.139	.208	.264	.220	57	55	69	62	N. by E.	E.	E. by S.	N. 82 E.	3.8	6.8	9.0	5.31	5.93	inap.	..
15	29.788	29.676	.567	.6703	54.0	52.6	52.9	52.75	— 4.87	.333	.353	.371	.344	80	89	92	86	E. by S.	E. by S.	N.W.	S. 76 E.	7.6	9.5	1.2	4.34	7.28	.425	..
16	.563	.562	.548	.5563	52.9	60.9	57.6	57.02	— 0.20	.348	.379	.353	.373	89	71	74	80	N.W. by W	S. by W.	Calm.	N. 70 W	1.9	5.2	0.0	2.42	2.84	.100	..
17	......	.794	......	......	......	52.9	......	......	......	......	.221	......	......	......	56	......	......	W.	N.W. by N.	Calm.	N. 44 W	8.3	26.0	0.0	10.16	10.42	......	..
18	.944	.793	.508	.7220	37.4	53.3	53.6	49.55	— 6.82	.170	.250	.340	.267	76	62	83	74	N.N.E.	E.S.E.	Calm.	S. 54 E.	3.0	3.2	0.0	3.53	4.90	.005	..
19	.401	.474	.619	.5117	55.4	57.6	47.5	53.87	— 2.07	.418	.330	.216	.316	94	69	65	74	Calm.	N.W.	N. by W.	N. 49 W	0.0	17.0	10.2	7.71	8.21	......	..
20	.727	.760	.888	.8070	36.3	49.0	40.3	42.70	—12.85	.160	.169	.184	.174	75	48	73	65	Calm.	N.W.	N.W. by N	N. 30 W	0.0	9.0	5.8	5.44	5.76	......	..
21	.929	30.006	.954	.9752	34.5	50.0	37.8	41.85	—13.27	.136	.212	.191	.179	67	58	82	67	N. by W.	S. by W.	Calm.	N. 33 E.	3.2	3.6	0.0	0.81	2.00	......	..
22	.914	29.762	.596	.7410	37.4	50.4	47.5	50.87	— 3.92	.188	.307	.293	.276	83	60	80	74	N. by E.	S.E. by S.	Calm.	S. 9 E.	6.0	6.6	0.0	3.15	3.73	......	..
23	.455	.353	.365	.3847	58.7	68.8	64.5	64.30	+10.03	.408	.462	.467	.450	82	65	76	74	S.W. by S.	S. by W.	W. by S.	S. 42 W	7.0	10.2	11.0	6.77	7.19	......	..
24	......	.420	......	......	......	67.7	......	......	......	......	.175	......	......	......	25	......	......	S.W. by W	W. by N.	Calm.	N. 76 W	2.7	24.0	0.0	7.54	7.59	......	..
25	.595	.521	.489	.5205	42.8	62.3	53.6	53.80	+ 0.38	.240	.236	.351	.287	87	41	85	72	Calm.	W. by S.	W.N.W.	S. 82 W	0.0	7.2	4.0	2.13	3.00	.050	..
26	.353	.338	.357	.3408	47.9	51.8	43.9	47.93	— 5.05	.312	.249	.235	.263	93	64	82	79	Calm.	W. by S.	W.S.W.	S. 77 W	0.0	15.0	4.2	5.91	5.96	.030	..
27	.335	.308	.367	.3333	42.5	50.8	45.7	46.87	— 5.73	.244	.330	.268	.273	89	69	68	84	S.W.	S. by W.	Calm.	S. 66 W	3.5	5.8	0.0	5.34	5.68	.030	..
28	.426	.530	.710	.5715	39.6	49.7	42.8	44.28	— 7.90	.220	.236	.213	.226	90	65	77	77	Calm.	N.W. by W	W.N.W.	N. 60 W	0.0	16.0	12.4	10.24	10.35	......	..
29	.825	.901	.952	.9608	38.1	55.6	41.0	44.02	— 7.73	.179	.192	.210	.196	77	48	82	69	W.N.W.	N.W.	W. by N.	N. 55 W	4.5	15.0	0.8	5.90	6.05	......	..
30	.971	.942	.912	.9390	38.8	58.7	40.8	48.46	— 2.98	.203	.305	.223	.244	86	62	70	73	W.	S.E. by S.	Calm.	S. 66 W	2.2	2.8	0.0	1.23	1.99	......	..
	29.7423	29.7131	29.7107	29.7200	47.88	61.64	53.06	54.82	— 2.43	.289	.334	.317	.317	81	59	76	71	....	....	....	....	2.75	9.66	4.05	.....	5.50	1.290	..

MONTHLY METEOROLOGICAL REGISTER AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO, SEPTEMBER, 1872.

Latitude 43° 39′ 4″ north. Longitude 5h. 17m. 33s. west. Elevation above Lake Ontario, 108 feet.

Day.	Barometer at temp. of 32°.				Temperature of the air.				Excess of mean above normal.	Tension of vapor.				Relative humidity.				Direction of wind.			Resultant.	Velocity of wind.					Rain, in inches.	Snow, in inches.
	6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Mean.		6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.		6 a. m.	2 p. m.	10 p. m.	Resultant.	Mean.		
					°	°	°	°	°												°							
1																		N. W.	N. W.	Calm.	N. 57 W.	10.0	19.0	0.0	10.64	10.77	.....	..
2	29.602	29.640	29.731	29.6703	65.0	70.1	54.2	62.08	− 0.17	.439	.322	.308	.305	71	44	49	53	N. W.	N. W.	N.	N. 31 W.	10.4	15.2	12.6	12.13	13.00	.....	..
3	.821	.752	.710	.7622	44.8	60.0	50.3	52.05	− 9.93	.214	.281	.230	.220	72	53	63	59	N.	S. W.	N.	N. 12 W.	1.0	3.4	4.2	2.07	3.77	.....	..
4	.750	.644	.592	.6515	45.9	60.7	55.0	55.07	− 6.62	.249	.349	.402	.330	80	66	93	76	Calm.	S.	Calm.	S. 1 E.	0.0	5.1	0.0	1.72	1.98	.150	..
5	.450	.416	.412	.4273	54.6	66.5	62.9	61.60	+ 0.22	.407	.506	.547	.506	95	87	95	92	N. E.	E.	E.	S. 72 E.	2.5	1.0	1.5	1.34	1.62	.050	..
6	.416	.452	.457	.4463	62.5	73.7	65.1	66.73	+ 5.68	.560	.675	.585	.598	100	81	94	91	Calm.	S.	Calm.	S. 67 E.	0.0	1.2	0.0	1.57	1.75	.190	..
7	.510	.477	.513	.4985	61.4	82.0	73.0	72.85	+12.13	.513	.727	.684	.651	94	67	84	81	Calm.	S. W.	Calm.	S. 37 W.	0.0	12.7	0.0	3.29	3.35	.....	..
8																		Calm.	W.	N.	N. 87 W.	0.0	14.5	8.8	2.90	3.90	.010	..
9	.713	.738	.751	.7352	64.0	63.6	61.8	63.48	+ 3.50	.507	.512	.469	.500	85	87	85	85	N. E.	E.	E.	N. 77 E.	4.4	8.6	8.2	6.14	6.39	.200	..
10	.750	.713	.751	.7382	61.4	72.6	63.2	65.27	+ 5.67	.512	.601	.451	.519	94	75	78	83	N. E.	Calm.	N.	N. 77 E.	2.4	0.0	1.0	2.76	3.01	Inap	..
11	.768	.609	.614	.6822	63.2	71.9	66.5	67.62	+ 8.42	.569	.654	.593	.609	98	84	91	90	Calm.	E.	S. E.	S. 82 E.	0.0	6.0	1.4	1.92	2.02	.....	..
12	.505	.301	.391	.4110	66.5	72.6	63.6	67.50	+ 8.68	.580	.631	.537	.596	89	78	92	88	E.	S.	N. W.	S. 30 E.	3.2	10.2	2.5	0.84	3.21	.400	..
13	.423	.667	.848	.6645	62.5	61.4	52.4	58.17	− 0.25	.526	.412	.327	.393	93	76	63	80	W.	N. W.	N. W.	N. 46 W.	13.2	22.4	4.2	12.47	12.68	.050	..
14	.916	.918	.924	.9117	45.6	63.6	53.1	54.88	− 3.13	.260	.243	.317	.273	85	41	78	66	Calm.	N.	N.	N. 2 E.	0.0	5.5	8.6	5.14	5.25	.....	..
15																		N.	S.	Calm.	N. 88 E.	3.4	5.3	0.0	1.21	2.76	.....	..
16	.718	.584	.548	.6045	45.6	61.8	56.8	56.10	− 1.12	.241	.384	.379	.346	79	70	81	76	N.	S.	N. E.	S. 59 E.	1.2	1.0	3.0	0.51	1.69	.....	..
17	.554	.537	.562	.5495	53.5	64.7	50.3	56.22	− 0.57	.355	.418	.321	.366	86	68	88	81	N.	S. W.	Calm.	N. 68 W.	2.0	5.6	0.0	0.39	1.71	.....	..
18	.500	.360	.276	.3702	43.0	59.3	54.2	53.85	− 2.52	.256	.405	.389	.364	92	80	92	87	Calm.	S.	S. W.	S. 27 W.	0.0	12.9	4.2	3.05	3.57	.500	..
19	.234	.387	.510	.3568	49.9	60.4	52.4	53.52	− 2.35	.336	.353	.358	.347	93	67	91	85	N. W.	N. W.	N. W.	N. 61 W.	0.2	16.0	11.4	7.60	8.09	.508	..
20	.657	.707	.721	.7020	49.8	61.1	52.1	54.42	− 1.13	.294	.276	.297	.291	82	51	76	70	N. W.	N. W.	Calm.	N. 54 W.	1.0	8.3	0.0	7.12	7.51	.....	..
21	.646	.524	.486	.5450	48.4	64.3	57.5	57.12	+ 2.00	.294	.387	.418	.381	86	64	88	82	Calm.	E.	N. E.	S. 87 E.	0.0	4.8	0.2	1.19	1.27	.....	..
22																		W.	S. W.	Calm.	S. 55 W.	0.8	4.6	0.0	1.73	1.96	.050	..
23	.741	.686	.708	.7005	59.3	66.9	60.7	62.30	+ 8.03	.503	.518	.497	.505	90	79	93	90	N. E.	E.	Calm.	N. 79 E.	3.5	5.7	0.0	2.68	2.98	.030	..
24	.733	.693	.561	.6550	60.4	72.3	66.1	67.33	+13.50	.488	.531	.504	.511	93	67	79	77	Calm.	E.	S. E.	S. 58 E.	0.0	3.0	4.4	1.65	1.82	.....	..
25	.428	.406	.587	.4985	67.6	65.0	53.1	61.62	+ 8.20	.484	.414	.349	.430	72	67	86	78	S.	S. W.	W.	S. 25 W.	12.5	8.4	2.2	7.30	9.13	.028	..
26	.578	.470	.343	.4613	42.7	63.6	50.3	56.15	+ 3.17	.234	.337	.394	.325	85	57	78	72	Calm.	S.	N. W.	S. 26 W.	0.0	13.6	17.0	6.75	7.15	.060	..
27	.511	.575	.632	.5912	44.5	56.8	46.3	48.82	− 3.78	.237	.235	.251	.235	80	50	79	69	W.	W.	Calm.	N. 82 W.	5.6	13.8	0.0	5.25	5.69	Inap	..
28	.754	.718	.590	.6860	39.1	56.4	53.5	50.68	− 1.50	.206	.260	.288	.256	86	57	70	70	N. W.	S. E.	E.	S. 61 E.	0.6	5.6	12.0	2.25	4.15	.....	..
29																		E.	S. W.	S. W.	S. 8 W.	9.8	13.8	13.5	7.93	11.98	.220	..
30	.432	.512	.602	.5292	49.9	57.1	49.5	52.23	+ 0.85	.274	.286	.301	.282	76	62	84	72	S. W.	W.	Calm.	S. 77 W.	2.2	10.3	0.0	8.85	9.18	.....	..
	29.6044	29.5838	29.5940	29.5937	54.05	65.13	57.32	59.11	+ 1.96	.382	.431	.404	.406	87	67	83	78	....	....	....	....	3.00	8.58	4.03	.....	5.24	2.526	..

Comparative table for September.

Year.	Temperature.					Rain.		Snow.		Wind.		
	Mean.	Excess above average.	Maximum.	Minimum.	Range.	Number of days.	Inches.	Number of days.	Inches.	Resultant. Direction.	Resultant. Velocity.	Mean velocity.
	°	°	°	°	°					°		
1844.....	58.6	+ 0.6	81.8	28.2	53.6	4	Impr..	.....	.....	.....	.....	0.26 lbs.
1845.....	56.0	− 2.0	79.6	34.0	45.6	16	6.245	.....	.....	.....	.....	0.34
1846.....	63.6	+ 5.6	84.3	37.3	47.0	11	4.595	.....	.....	.....	.....	0.33
1847.....	55.6	− 2.4	74.5	35.0	39.5	15	6.605	.....	.....	.....	.....	0.33
1848.....	54.2	− 3.8	80.4	28.1	52.3	11	3.115	.....	.....	N 71 W	2.38	5.81 mls.
1849.....	58.2	+ 0.2	80.1	32.7	47.4	9	1.480	.....	.....	N 75 W	0.69	4.23
1850.....	56.5	− 1.5	76.0	29.5	46.5	11	1.735	.....	.....	S 65 W	1.02	4.78
1851.....	60.0	+ 2.0	86.3	32.0	54.3	9	2.665	.....	.....	N 14 E	1.03	5.45
1852.....	57.5	− 0.5	81.8	35.8	46.0	10	3.630	.....	.....	N 17 W	0.53	4.60
1853.....	58.8	+ 0.8	85.5	33.9	51.6	13	5.140	.....	.....	N	1.06	4.33
1854.....	61.0	+ 3.0	93.6	35.8	57.8	14	5.375	.....	.....	N 22 W	1.33	4.04
1855.....	59.5	+ 1.5	82.6	33.0	49.6	12	5.585	.....	.....	N 20 E	1.29	7.61
1856.....	57.1	− 0.9	78.4	35.0	43.4	13	4.105	.....	.....	S 79 W	1.98	6.53
1857.....	58.6	+ 0.6	82.0	34.1	47.9	11	2.640	.....	.....	N 68 W	1.61	6.55
1858.....	59.1	+ 1.1	81.4	35.6	45.8	8	0.735	.....	.....	S 74 W	1.53	5.69
1859.....	55.2	− 2.8	75.4	35.7	39.7	15	3.525	.....	.....	N 44 W	1.60	6.36
1860.....	55.3	− 2.7	75.8	28.7	47.1	14	1.950	.....	.....	N 71 W	2.63	5.79
1861.....	59.1	+ 1.1	78.8	37.1	41.7	17	3.607	.....	.....	N 71 W	1.39	4.81
1862.....	59.6	+ 1.6	79.4	39.0	40.4	9	2.344	.....	.....	N 59 W	1.07	5.11
1863.....	55.9	− 2.1	80.0	31.4	48.6	8	1.235	.....	.....	N 16 W	1.92	6.46
1864.....	56.4	− 1.6	73.0	37.8	35.2	11	2.508	.....	.....	N 38 W	1.89	7.06
1865.....	64.5	+ 6.5	90.5	42.0	48.5	12	2.450	.....	.....	S 56 E	0.47	4.12
1866.....	55.2	− 2.8	80.0	34.4	45.6	15	5.657	.....	.....	N 33 W	1.45	4.63
1867.....	57.9	− 0.1	87.0	31.8	55.2	9	1.226	.....	.....	N 37 W	1.48	5.43
1868.....	56.6	− 1.4	75.5	36.0	39.5	16	4.239	.....	.....	N 74 W	0.88	6.68
1869.....	60.7	+ 2.7	81.0	34.4	46.6	8	4.027	.....	.....	N 53 W	1.16	4.89
1870.....	61.8	+ 3.8	78.0	45.8	32.2	11	6.794	.....	.....	N 29 E	2.26	5.04
1871.....	54.8	− 3.2	81.8	34.0	47.8	8	1.290	.....	.....	N 74 W	1.72	5.50
1872.....	59.1	+ 1.1	84.4	38.2	46.2	16	2.526	.....	.....	N 70 W	1.47	5.24
Results to 1871.....	58.04	.....	80.88	34.58	46.30	11.06	3.716	.....	.....	N 52 W	1.06	5.44
Excess for 1872.....	+1.07	.....	+3.52	+3.62	−0.10	+4.94	−1.190	.....	.....	.....	.....	−0.20

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR SEPTEMBER, 1871.

NOTE.—The monthly means do not include Sunday observations. The daily means, excepting those which relate to the wind, are derived from six observations daily, namely at 6 a. m., 8 a. m., 2 p. m., 4 p. m., 10 p. m., and midnight. The means and resultants of the wind are from hourly observations.

Highest barometer .....30.090 at 10 a. m. on 14th } Monthly range=0.790.
Lowest barometer .....29.300 at 2 p. m. on 27th }

Self-registering ther.:
- Maximum temperature.....81°8 on 5th } Monthly range=47°8.
- Minimum temperature .....34.0 on 21st }
- Mean maximum temperature .....64°53 } Mean daily range=17°63.
- Mean minimum temperature .....46°90 }
- Greatest daily range.....31°5 from p. m. of 13th to a. m. of 14th.
- Least daily range..... 6°4 from a. m. to p. m. of 15th.

Warmest day, 5th.....mean temperature 70°58 } Difference=28°73.
Coldest day, 21st.....mean temperature 41°85 }

Maximum radiation { Solar .....92°4 on 6th } Monthly range=67°4.
Terrestrial .....25°0 on 21st }

Aurora observed on 4 nights, viz, 4th, 6th, 7th, and 19th.
Possible to see aurora on 20 nights; impossible on 10 nights.
Raining on 8 days; depth, 1.290 inches; duration of fall, 27.7 hours.

WIND.

Resultant direction, N. 74° W.; resultant velocity, 1.72.
Mean velocity, 5.50 miles per hour.
Maximum velocity, 26.0 miles, from 1.30 p. m to 2.30 p. m of 17th.
Most windy day, 6th; mean velocity, 10.41 miles per hour.
Least windy day, 12th; mean velocity, 0.87 mile per hour.
Most windy hour, 1 p. m.; mean velocity, 9.55 miles per hour.
Least windy hour, 4 a. m.; mean velocity, 2.34 miles per hour.
Fog on 1st, 4th, 5th, 13th, 16th, and 19th.
Dew on 12 occasions.
First frost of season on 18th.
Ice on 21st and 22d.
Thunder on 3d and 18th.
Lightning on 18th.

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR SEPTEMBER, 1872.

NOTE.—The monthly means do not include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 a. m., 8 a. m., 2 p. m., 4 p. m., 10 p. m., and midnight. The means and resultants of the wind are from hourly observations.

Highest barometer	29.942 at 8 a. m. on 14th	Monthly range, 0.728.
Lowest barometer	29.214 at 7 a. m. on 29th	
Self-registering ther. Maximum temperature	84°4 on 7th	Monthly range, 46°2.
Self-registering ther. Minimum temperature	38.2 on 28th	
Self-registering ther. Mean maximum temperature	68°68	Mean daily range, 18°17.
Self-registering ther. Mean minimum temperature	50°51	
Greatest daily range	27°5 from a. m. to p. m. of 1st.	
Least daily range	9°0 from a. m. to p. m. of 9th.	
Warmest day	7th; mean temperature 72°85	Difference=24°03.
Coldest day	27th; mean temperature 48°82	
Maximum radiation Solar	149°0 on 1st	Monthly range=121°6.
Maximum radiation Terrestrial	27°4 on 3d	

Aurora observed on 4 nights, viz, 2d, 3d, 9th, and 29th.
Possible to see aurora on 18 nights; impossible on 12 nights.
Raining on 16 days; depth, 2.526 inches; duration of fall, 43.4 hours.
Mean of cloudiness, 0.58.

WIND.

Resultant direction, N. 79° W.; resultant velocity, 1.47 miles.
Mean velocity, 5.24 miles per hour.
Maximum velocity, 29.0 miles, from 9 to 10 a. m. of 13th.
Most windy day, 29th; mean velocity, 13.98 miles per hour.
Least windy day, 21st; mean velocity, 1.27 miles per hour.
Most windy hour, 1 p. m.; mean velocity, 9.16 miles per hour.
Least windy hour, 5 a. m.; mean velocity, 2.93 miles per hour.
Fog on 6th, 11th, and 18th.
Dew on 6th, 15th, 21st, and 24th.
Frost on 3d, 14th, 16th, 26th, 27th, and 28th. Ice on 27th.
Thunder or lightning on 5th, 6th, 7th, 8th, 12th, 18th, 19th, 22d, 23d, 26th, and 29th.
Hail of large size and to a considerable amount fell in the storm of the 19th.
Solar rainbow on 12th. Lunar rainbow on 19th at 8 p. m.

From these tables it is manifest that there was no extraordinary state nor extreme changes in the weather during the whole of the month, the last days of which witnessed the outbreak. The mean temperature was in excess of that of September, 1871, but considerably below that of this month in many previous years. Both maximum and minimum temperature are slightly above those of 1871, but the maximum is less, and the minimum more than those of several previous non-influenza years. The monthly range of temperature was nearly 2° less than [redacted] of 1871, and 11° under that of 1854, which was not an influenza y[redacted] It may be added that the greatest daily range for September, 1872, [redacted] 27°5, while for September, 1871, it was 31°5. The greatest veloc[redacted] of the wind in September, 1872, was 2.24 miles on the 13th, wind in the northwest, and temperature 61°4. The highest velocity in September, 1871, was 26°0 miles on the 17th, with wind northwest by north, and temperature 52°9. Appended are the tables for October, 1871 and 1872, which show that month to have been no more remarkable through the period of the greatest prevalence of the influenza.

MONTHLY METEOROLOGICAL REGISTER AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO, OCTOBER, 1871.

Latitude 43° 39' 4" north. Longitude 5h. 17m. 33s. west. Elevation above Lake Ontario, 108 feet.

Day.	Barometer at temp. of 32°.				Temperature of the air.				Excess of mean above normal.	Tension of vapor.				Humidity of air.			
	6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Mean.		6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Mean.
					°	°	°	°	°								
1	......	29.789	......	......	......	65.2	......	......	......	......	.297	......	......	......	48	......	......
2	29.711	.550	29.444	29.5497	47.1	65.9	56.2	56.29	+ 5.70	.291	.399	.360	.343	90	62	80	76
3	.308	.310	.196	.2598	54.4	58.0	53.6	55.83	+ 5.60	.385	.336	.319	.343	90	70	78	77
4	.345	.444	.536	.4523	48.2	62.8	46.1	53.25	+ 3.40	.264	.229	.244	.244	73	39	78	63
5	.427	.348	.385	.3795	48.2	66.3	56.2	56.72	+ 7.20	.286	.324	.300	.324	86	50	80	72
6	.332	.468	.659	.5057	54.0	55.5	44.3	50.05	+ 1.32	.335	.201	.212	.244	80	45	72	65
7	.733	.762	.793	.7735	31.3	45.4	36.7	39.00	— 9.76	.151	.188	.163	.163	86	61	75	71
8	......	.774	......	......	......	58.7	......	......	......	......	.273	......	......	......	55	......	......
9	.746	.613	.557	.6327	45.0	66.3	54.7	56.16	+ 8.05	.258	.419	.347	.343	86	65	81	76
10	.495	.347	.475	.4388	52.9	63.4	51.8	55.86	+ 8.07	.306	.369	.237	.302	76	63	61	66
11	.630	.083	.707	.6738	42.1	50.8	46.8	46.53	— 0.97	.222	.208	.249	.244	83	63	79	77
12	.728	.787	.912	.8175	38.9	53.3	43.5	45.16	— 2.00	.168	.200	.186	.202	70	63	66	66
13	30.018	.956	.826	.9282	36.0	58.0	50.0	48.72	+ 1.82	.197	.229	.251	.238	93	47	69	71
14	29.741	.709	.567	.6775	51.8	56.2	54.4	54.07	+ 7.47	.311	.382	.395	.360	81	84	93	86
15	......	.535	......	......	......	53.6	......	......	......	......	.216	......	......	......	52	......	......
16	.747	.615	.686	.6848	40.7	55.8	42.5	45.77	— 0.30	.214	.184	.199	.202	83	41	73	67
17	.735	.670	.623	.6772	34.9	47.9	43.9	42.40	— 3.38	.169	.202	.235	.208	84	60	82	77
18	.731	.834	.816	.6013	39.2	43.2	34.5	39.03	— 6.50	.198	.120	.144	.157	83	45	72	66
19	.621	.235	.546	.4670	40.7	56.9	45.0	48.85	+ 3.38	.214	.253	.175	.207	84	54	58	61
20	.875	.995	30.036	.9747	36.3	43.2	33.1	38.62	— 6.43	.168	.146	.131	.157	78	51	70	67
21	.904	.682	29.626	.7297	34.5	56.0	51.5	47.92	+ 3.12	.174	.253	.274	.237	88	57	71	71
22	......	.507	......	......	......	71.0	......	......	......	......	.244	......	......	......	32	......	......
23	.499	.504	.708	.5788	55.8	62.3	50.8	55.98	+ 11.67	.332	.420	.233	.331	75	75	63	71
24	.802	.852	.924	.8697	41.4	46.4	43.2	43.10	— 0.95	.204	.203	.198	.196	78	64	70	70
25	.673	.772	.715	.7207	39.6	50.0	51.1	47.27	+ 3.47	.150	.294	.341	.264	62	81	90	78
26	.638	.435	.496	.5202	50.4	60.9	51.5	53.53	+ 9.95	.320	.390	.347	.354	86	74	91	86
27	.459	.254	.303	.3367	43.5	53.3	40.3	44.87	+ 1.52	.241	.271	.201	.233	65	66	80	78
28	.413	.521	.651	.5462	36.3	42.5	40.3	39.58	— 3.52	.160	.155	.184	.165	75	57	73	68
29	......	.675	......	......	......	45.0	......	......	......	......	.184	......	......	......	61	......	......
30	.859	.672	.606	.7793	41.7	49.3	45.3	45.43	+ 2.82	.192	.232	.217	.211	72	65	71	69
31	.878	.711	.389	.6217	40.7	46.8	46.1	44.70	+ 2.98	.187	.216	.282	.235	73	67	91	79
	29.6638	29.6050	29.6308	29.6329	43.29	54.48	46.67	48.28	+ 1.99	.234	.266	.249	.250	81	60	76	72

Day.	Direction of wind.			Resultant.	Velocity of wind.					Rain, in inches.	Snow, in inches.
	6 a. m.	2 p. m.	10 p. m.		6 a. m.	2 p. m.	10 p. m.	Resultant.	Mean.		
				°							
1	Calm.	S. S. W.	W. S. W.	S. 31 W.	0.0	10.3	3.3	3.46	3.65	Inap	..
2	Calm.	S. by E.	S. by E.	S. 10 W.	0.0	16.0	4.5	4.79	5.21	.100	..
3	S. W. by S.	W. by S.	S. W. by S.	S. 71 W.	5.5	16.5	9.5	8.43	9.22	Inap	..
4	W.	W. by S.	N. N. E.	S. 88 W.	8.6	18.2	1.0	5.69	8.68	......	..
5	E. by N.	S. S. W.	N. by E.	S. 26 W.	3.0	13.0	3.0	4.14	5.54	Inap	..
6	W. by S.	W. N. W.	W. N. W.	N. 61 W.	0.6	19.8	6.2	10.79	11.03	......	..
7	Calm.	S. by W.	W. by S.	S. 20 W.	0.0	5.6	1.0	1.64	2.42	......	..
8	W. S. W.	S. by W.	S. W.	S. 25 W.	0.8	15.0	5.0	5.19	5.44	......	..
9	Calm.	S. S. W.	S.	S. 18 W.	0.0	15.0	0.5	7.76	7.82	......	..
10	S.	S. S. W.	W.	S. 37 W.	4.5	8.2	20.0	8.90	9.26	.115	..
11	S. W. by W.	W. by N.	E. by N.	S. 80 W.	2.0	5.9	1.0	2.47	2.87	Inap	..
12	N. N. W.	S. W. by S.	W. by N.	S. 83 W.	3.8	9.0	4.0	1.91	3.15	......	..
13	W. N. W.	S. by E.	S. by E.	S. 19 E.	1.8	8.8	7.2	4.97	5.06	......	..
14	S. S. W.	S. S. W.	E. S. E.	S. 15 W.	4.0	10.4	4.0	8.29	8.97	.035	..
15	S. W. by S.	W.	W. S. W.	S. 77 W.	23.2	23.4	2.7	14.66	15.26	......	..
16	W. S. W.	W. S. W.	W. by N.	S. 69 W.	1.8	18.8	3.4	6.56	7.62	......	..
17	W. N. W.	S. by W.	W.	S. 73 W.	1.8	6.8	9.0	5.62	7.76	Inap	..
18	N. W. by W.	N. W.	Calm.	N. 62 W.	14.2	22.0	0.0	7.40	9.25	.060	..
19	S. by E.	S. W. by S.	W.	N. 88 W.	7.6	15.0	11.5	13.47	17.41	......	..
20	N.	N. W.	N. N. E.	N. 27 W.	9.6	13.0	4.6	4.26	8.55	......	..
21	S. S. E.	S. by W.	S. W.	S. 35 W.	3.3	8.2	5.5	5.60	6.31	......	..
22	S. S. W.	S. W. by W.	S. W.	S. 45 W.	5.8	21.5	11.6	9.47	9.64	......	..
23	W. by S.	S. S. W.	N.	N. 48 W.	10.8	5.0	10.0	4.64	7.81	......	..
24	N. N. E.	E.	N. E. by E.	N. 62 E.	6.0	7.4	11.5	6.11	6.72	......	..
25	N. E. by E.	E. N. E.	E. by S.	N. 72 E.	9.8	13.2	7.5	10.30	10.52	.050	..
26	E. by S.	E. by S.	W. by S.	S. 3 E.	7.4	8.0	9.6	3.73	7.89	.510	..
27	S. W. by S.	S. W.	W. by N.	S. 68 W.	4.2	13.0	2.7	7.72	9.32	.065	..
28	W. by S.	W. by S.	W. by S.	S. 84 W.	13.5	23.8	14.6	11.69	12.43	......	..
29	N. W.	N. by W.	N. N. E.	N. 23 W.	4.0	10.0	4.3	1.87	5.15	......	..
30	S. E.	E. by N.	N. W. by W.	N. 78 E.	10.4	4.0	5.8	1.44	4.91	......	..
31	N. W. by N.	E. by N.	E.	N. 66 E.	2.8	8.6	16.6	4.83	7.64	.250	..
	......	......	......	......	5.53	12.73	6.49	......	7.84	1.185	..

MONTHLY METEOROLOGICAL REGISTER AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO, OCTOBER, 1872.

Latitude 43° 39' 4" north. Longitude 5h. 17m. 33s. west. Elevation above Lake Ontario, 108 feet.

Day.	Barometer at temp. of 32°. 6 a.m.	2 p.m.	10 p.m.	Mean.	Temperature of the air. 6 a.m.	2 p.m.	10 p.m.	Mean.	Excess of mean above normal.	Tension of vapor. 6 a.m.	2 p.m.	10 p.m.	Mean.	Humidity of air. 6 a.m.	2 p.m.	10 p.m.	Mean.	Direction of wind. 6 a.m.	2 p.m.	10 p.m.	Resultant.	Velocity of wind. 6 a.m.	2 p.m.	10 p.m.	Resultant.	Mean.	Rain, in inches.	Snow, in inches.
					°	°	°	°	°												°							
1	29.620	29.607	29.650	29.6253	45.9	52.8	42.7	47.13	− 3.85	.256	.267	.234	.248	64	66	85	77	Calm.	N.	Calm.	N. 40 W.	0.0	17.2	0.0	4.76	4.94	Inap	.....
2	.643	.528	.494	.5467	40.2	58.2	48.1	48.83	− 1.75	.220	.226	.230	.227	92	46	68	68	Calm.	N. W.	Calm.	N. 63 W.	0.0	9.4	0.0	3.52	3.69	.....	.....
3	.401	.321	.403	.4083	44.5	60.7	48.4	51.08	+ 0.83	.255	.349	.246	.279	87	65	71	74	Calm.	N. W.	N.	N. 57 W.	0.0	22.2	1.2	4.49	5.16	Inap	.....
4	.631	.675	.688	.6628	41.6	55.7	47.0	49.35	− 0.50	.240	.250	.242	.255	91	56	75	74	Calm.	S. E.	Calm.	S. 67 E.	0.0	3.4	0.0	0.40	1.25	.....	.....
5	.587	.536	.557	.5560	50.3	61.8	55.3	56.63	+ 7.12	.331	.407	.397	.363	91	74	91	84	E.	E.	Calm.	S. 89 E.	4.4	3.0	0.0	3.79	3.85	.....	.....
6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	N.	Calm.	N.	N. 6 W.	4.6	0.0	1.4	2.06	2.97	.580	.....
7	.505	.602	.684	.6300	51.3	57.8	48.1	51.53	+ 2.77	.332	.331	.259	.310	93	60	73	81	N. W.	N.	N. W.	N. 25 W.	2.8	4.9	8.0	5.17	5.27	.100	.....
8	.760	.746	.732	.7497	40.2	55.0	43.8	46.43	− 2.02	.220	.269	.200	.234	88	62	70	75	N. W.	S.	Calm.	N. 75 W.	1.0	5.0	0.0	0.73	1.73	.....	.....
9	.604	.525	.466	.5452	43.0	63.6	55.7	54.95	+ 6.82	.248	.498	.359	.345	89	60	80	79	Calm.	S. W.	S. W.	S. 35 W.	0.0	13.9	6.8	4.13	4.46	.....	.....
10	.485	.554	.668	.5850	48.8	48.8	38.4	43.72	− 4.10	.320	.172	.173	.213	93	50	73	74	N. W.	W.	N. W.	N. 57 W.	10.5	19.1	8.8	10.06	10.45	.010	.....
11	.779	.822	.806	.8078	48.0	42.7	36.9	38.88	− 8.63	.186	.168	.184	.173	81	61	84	73	N W	W.	Calm.	N. 46 W.	3.0	7.4	0.0	3.96	4.27	.....	.....
12	.708	.546	.450	.5528	32.2	49.2	44.1	42.80	− 4.38	.162	.225	.224	.210	89	64	77	76	Calm.	S.	Calm.	S. 26 W.	0.0	5.4	0.0	2.54	2.66	.060	.....
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Calm.	S.	N. W.	N. 30 W.	0.0	0.6	6.2	1.19	1.53	.240	.....
14	.298	.290	.456	.3375	30.8	44.5	36.2	39.87	− 6.73	.188	.173	.159	.170	77	58	74	69	N.	N. W.	W.	N. 33 W.	12.6	26.8	1.0	14.81	15.19	.....	.....
15	.473	.354	.252	.3423	31.9	38.7	42.0	39.03	− 7.32	.164	.202	.251	.205	91	86	94	96	Calm.	S.	Calm.	S. 34 W.	0.0	4.4	0.0	2.21	2.62	.010	Inap
16	.298	.716	.897	.6762	43.0	47.0	38.6	41.12	− 4.95	.256	.158	.164	.123	92	49	89	72	N. W.	N. W.	Calm.	N. 35 W.	16.0	18.6	0.0	9.26	9.67	.....	.....
17	.809	.637	.612	.6948	33.3	41.8	43.4	41.08	− 4.70	.163	.253	.260	.228	86	96	93	88	E.	N. E.	W.	N. 87 E.	5.0	0.4	3.4	1.21	2.52	.308	.....
18	.674	.695	.737	.7057	36.9	52.8	41.2	43.20	− 2.33	.208	.216	.234	.227	95	54	87	83	Calm.	N. W.	Calm.	N. 55 W.	0.0	6.6	0.0	1.75	1.84	.020	.....
19	.723	.777	.834	.7885	34.4	43.4	33.0	37.72	− 7.55	.174	.125	.160	.162	88	43	85	73	Calm.	N. W.	Calm.	N. 26 W.	0.0	13.4	0.0	5.94	6.15	.....	.....
20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Calm.	S.	Calm.	S. 5 E.	0.0	0.4	0.0	0.03	0.15	.....	.....
21	.615	.593	.625	.6160	40.7	61.1	51.7	52.02	+ 7.22	.268	.355	.312	.306	83	66	81	79	S. W.	S. W.	Calm.	S. 49 W.	2.0	8.0	0.0	2.45	2.47	.....	.....
22	.633	.637	.862	.7265	47.0	62.5	48.1	50.67	+ 6.10	.283	.363	.278	.293	88	64	83	80	Calm.	S. W.	N. W.	N. 45 W.	0.0	5.9	4.2	3.06	4.42	.010	.....
23	.970	30.062	30.141	30.0725	42.3	50.3	39.4	44.00	− 0.33	.230	.170	.168	.188	85	47	69	66	N.	N.	N.	N. 10 W.	7.8	5.0	5.0	5.69	5.89	.....	.....
24	30.154	30.120	30.030	30.0940	35.5	49.5	36.9	41.67	− 2.38	.176	.221	.184	.196	85	62	84	75	N. E.	E.	Calm.	N. 56 E.	3.0	6.0	0.0	2.25	3.20	.....	.....
25	29.940	29.816	29.694	29.8012	45.6	52.1	48.8	49.25	+ 5.45	.291	.320	.330	.318	95	82	95	90	N. E.	E.	N. E.	N. 71 E.	0.6	8.6	7.8	5.57	5.07	.160	.....
26	.471	.361	.341	.3828	50.6	51.0	48.5	49.97	+ 6.38	.361	.372	.324	.352	98	99	95	98	N. E.	N. E.	N.	N. 36 E.	9.4	4.2	4.4	6.63	6.32	1.290	.....
27	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	N.	N.	N.	N. 7 E.	4.6	11.8	7.4	6.26	6.29	.200	.....
28	.875	30.000	30.104	30.0115	36.9	47.7	37.6	40.45	− 2.65	.192	.186	.183	.186	87	56	81	75	N. E.	S. E.	N. E.	N. 50 E.	6.4	7.3	4.6	3.70	4.48	.....	.....
29	30.166	30.173	30.149	30.1638	35.1	47.0	44.8	42.53	− 0.32	.182	.223	.224	.198	89	68	75	72	N. E.	E.	E.	N. 72 E.	5.0	7.6	6.5	4.59	5.34	.....	.....
30	30.068	29.976	29.860	29.9542	39.4	40.9	46.3	45.32	+ 2.68	.202	.204	.204	.213	83	56	64	70	N. E.	E.	S. E.	S. 81 E.	0.4	7.0	9.0	5.75	5.84	.....	.....
31	29.779	.696	.651	.7012	40.9	47.4	36.2	40.47	− 1.95	.211	.190	.167	.179	82	58	78	72	S. E.	E.	Calm.	S. 47 E.	1.1	5.0	0.0	1.38	1.50	.....	.....
	29.6981	29.6798	29.7010	29.6940	41.31	51.59	43.53	45.55	− 0.74	.235	.252	.235	.240	88	64	81	77	....	....	....	....	3.23	8.42	2.76	.....	4.50	3.298	Inap

Comparative table for October.

Year.	Temperature.					Rain.		Snow.		Wind.		
										Resultant.		
	Mean.	Excess above average.	Maximum.	Minimum.	Range.	Number of days.	Inches.	Number of days.	Inches.	Direction.	Velocity.	Mean velocity.
	°	°	°	°	°					°	°	
1844	43.3	− 2.6	71.6	15.9	55.7	7	Inap...	4	12.0	.....	.....	0.43 lbs.
1845	46.4	+ 0.5	64.0	19.7	44.3	11	1.760	1	Inap.	.....	.....	0.26
1846	44.6	− 1.3	70.1	20.7	49.4	14	4.180	2	Inap.	.....	.....	0.44
1847	44.0	− 1.9	64.6	20.4	44.2	13	4.390	2	Inap.	.....	.....	0.19
1848	46.3	+ 0.4	61.8	24.5	37.3	11	1.550	0	0.0	N 54 W	1.24	4.60 mls.
1849	45.3	− 0.6	58.9	24.2	34.7	13	5.965	1	Inap.	N 12 W	1.27	7.76
1850	45.4	− 0.5	66.7	22.4	44.3	10	2.085	0	0.0	N 66 W	1.10	5.30
1851	47.4	+ 1.5	66.2	25.2	41.0	10	1.680	2	0.3	S 72 W	1.06	4.39
1852	48.0	+ 2.1	70.7	23.8	46.9	12	5.280	0	0.0	N 5 E	1.19	4.47
1853	44.4	− 1.5	64.7	23.4	41.3	10	0.875	2	Inap.	S 88 W	1.74	4.77
1854	49.5	+ 3.6	75.4	26.4	49.0	15	1.495	3	Inap.	N 45 W	1.52	4.57
1855	45.4	− 0.5	68.0	22.6	45.4	14	2.485	5	0.8	N 82 W	4.91	9.88
1856	45.3	− 0.6	71.4	23.0	48.4	10	0.875	2	0.1	N 76 W	2.15	6.07
1857	45.4	− 0.5	64.0	26.5	37.5	10	1.040	2	0.2	N 19 W	2.93	6.24
1858	48.8	+ 2.9	76.3	31.5	44.8	17	1.797	1	Inap.	N 34 W	0.36	5.26
1859	43.0	− 2.9	69.8	22.3	47.5	11	0.940	4	Inap.	N 68 W	5.04	8.12
1860	47.3	+ 1.4	68.0	28.4	39.6	15	1.618	1	Inap.	N 9 W	2.00	6.93
1861	48.7	+ 2.8	71.0	29.0	42.0	15	1.903	1	Inap.	N 61 W	1.06	5.96
1862	48.7	+ 2.8	76.6	26.2	50.4	19	2.684	2	0.5	N 78 W	2.89	6.53
1863	45.9	0.0	66.4	30.5	35.9	16	2.522	0	0.0	S 71 W	0.48	6.16
1864	45.2	− 0.7	67.0	28.0	39.0	22	3.321	1	Inap.	N 60 W	3.17	6.66
1865	44.5	− 1.4	71.4	21.6	49.8	17	2.705	3	4.5	N 36 W	3.35	7.26
1866	49.1	+ 3.2	71.0	31.8	39.2	11	2.470	1	Inap.	N 30 W	0.84	5.53
1867	49.9	+ 4.0	75.4	31.0	44.4	11	1.970	0	0.0	N 45 W	1.51	5.73
1868	42.4	− 3.5	67.6	24.0	43.6	10	1.365	2	2.0	N 89 W	1.27	7.10
1869	42.3	− 3.6	69.8	18.7	51.1	8	0.962	7	2.3	N 89 W	3.72	6.73
1870	50.0	+ 4.1	68.5	30.2	38.3	16	2.690	0	0.0	N 85 W	1.86	7.11
1871	48.3	+ 2.4	72.2	28.6	43.6	13	1.185	0	0.0	S 66 W	3.75	7.84
1872	45.6	− 0.3	70.0	25.2	44.8	14	3.288	1	Inap.	N 18 W	2.22	4.50
Results to 1871	45.86	.....	68.90	25.02	43.88	12.50	2.389	1.81	0.87	N 64 W	1.62	6.20
Excess for 1872	−0.31	.....	+1.10	+0.18	+0.92	+1.50	+0.899	−0.81	−0.87	.....	.....	−1.61

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR OCTOBER, 1871.

NOTE.—The monthly means do not include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 a. m., 8 a. m., 2 p. m., 4 p. m., 10 p. m., and midnight. The means and the resultants for the wind are from hourly observations.

Highest barometer.....30.042 at 8 a. m. on 13th } Monthly range = 0.879.
Lowest barometer.....29.163 at midnight on 3d }

Self-registering thermometer.
- Maximum temperature.....72° 2 on 22d } Monthly range = 43°6.
- Minimum temperature.....28° 6 on 31st }
- Mean maximum temperature.....58° 26 } Mean daily range = 17° 50.
- Mean minimum temperature.....40° 76 }
- Greatest daily range.....30° 8 from p. m. of 18th to p. m. of 19th.
- Least daily range.....8° 3 from a. m. to p. m. of 6th.

Warmest day, 5th.....mean temperature 56° 72 } Difference = 18°10.*
Coldest day, 20th.....mean temperature 38° 62 }

Maximum radiation
- Solar.....92° 2 on 22d } Monthly range = 62°4.
- Terrestrial.....19° 8 on 7th }

Aurora observed on 3 nights, viz: 6th, 16th, and 17th.
Possible to see aurora on 15 nights; impossible on 16 nights.
Raining on 12 days; depth, 1.185 inches; duration of fall, 30.2 hours.
Mean of cloudiness, 0.68.

WIND.

Resultant direction, S. 66° W.; resultant velocity, 3.75 miles.
Mean velocity, 7.84 miles per hour.
Maximum velocity, 36.0 miles, from 8 to 9 a. m. of 15th.
Most windy day, 19th; mean velocity, 17.41 miles per hour.
Least windy day, 7th; mean velocity, 2.42 miles per hour.
Most windy hour, 2 p. m.; mean velocity, 12.73 miles per hour.
Least windy hour, 1 a. m.; mean velocity, 4.40 miles per hour.
Fog recorded on 9 occasions during month.
Solar halo, 9th; lunar halo on 24th and 30th.
Thunder-storms on 5th and 26th; rainbows on 1st and 18th.
21st, large meteor in W. at 8.30 p. m., color bright blue.
Particles of snow are reported to have fallen on the afternoon of the 17th in the university grounds.

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR OCTOBER, 1872.

NOTE.—The monthly means do not include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 a. m., 8 a. m., 2 p. m., 4 p. m., 10 p. m., and midnight. The means and resultants for the wind are from hourly observations.

Highest barometer	30.194 at 8 a. m. on 20th	Monthly range = 0.668.
Lowest barometer	29.226 at midnight on 15th	
Self-registering thermometer.	Maximum temperature	70°0 on 6th — Monthly range = 44°8.
	Minimum temperature	25°2 on 20th
	Mean maximum temperature	54°11 — Mean daily range = 16°98.
	Mean minimum temperature	37°13
	Greatest daily range	25°6 from a. m. to p. m. of 3d.
	Least daily range	5°0 from a. m. to p. m. of 26th.
Warmest day, 6th	mean temperature 56°63	Difference = 18°91.
Coldest day, 19th	mean temperature 37°72	
Maximum radiation	Solar	125°0 on 3d — Difference = 108°0.
	Terrestrial	17°0 on 20th

Aurora observed on 9 nights, viz: 1st, 2d, 3d, 5th, 7th, 14th, 16th, 28th, and 29th.
Possible to see aurora on 21 nights; impossible on 10 nights.
Raining on 14 days; depth, 3.288 inches; duration of fall, 73.8 hours.
Mean of cloudiness = 0.51.
Snowing on 1 day; depth inappreciable; duration of fall, 0.5 hour.

WIND.

Resultant direction, N. 18° W.; resultant velocity, 2.22 miles.
Mean velocity, 4.59 miles per hour.
Maximum velocity, 29.2 miles, from 7.30 to 8.30 a. m. of 16th.
Most windy day, 14th; mean velocity, 15.19 miles per hour.
Least windy day, 20th; mean velocity, 0.15 miles per hour.
Most windy hour, 2 p. m.; mean velocity, 8.42 miles per hour.
Least windy hour, 11 p. m.; mean velocity, 2.54 miles per hour.
First snow of the season on 14th.
Fog on the 5th, 9th, 18th, and 20th.
Thunder on the 6th and 15th.
Lightning on 6th.
Lunar halo on 11th.
The auroral display on the 14th, was very brilliant, and accompanied by considerable magnetic disturbance.

Fogs. - Remarkably acid or fetid fogs have been observed to proceed or accompany some epidemics of influenza. Dr. Arbuthnot remarks on the prevalence of fogs, not only in England but in France and Germany as well, in connection with the influenzas of 1727 and 1732-'33. In the latter year there had been a severe drought, wells were dry, and from November 4 till Christmas there prevailed stinking fogs, a higher temperature than usual, great storms of wind from the southeast, and lightning without thunder. It was further observed by surgeons that wounds showed a great disposition to mortify. But in the great majority of influenza epidemics and epizootics there has been no such co-incidence. The present equine affection has neither been preceded nor attended by any such phenomenon. Fogs appeared on but three days, 6th, 11th, and 18th of September, 1872, whereas they existed on six days, 1st, 4th, 5th, 13th, 16th, and 19th of September, 1871. Fogs and vapors, impregnated with sulphurous gases or other bad smelling or putrefying elements, would undoubtedly undermine the general health, and favor the diffusion of such a disease as influenza; but the origin and course of the present epizootic, like that of the majority on record, shows clearly enough that no such condition is essential to its development.

Rainfall and humidity - The rainfall for September, 1872, at Toronto, was but 2.526 inches, as compared with 1.290 inches in September, 1871, and 6.794 inches in September, 1870. The rainy days were sixteen in 1872, against eight in 1871, and seventeen in 1861. The total rain in September, 1872, was 1 inch below the average of the twenty-eight preceding years.

The average relative humidity of the air, in Toronto, in September, 1872, was 78, against 71 for the same month of the previous year. Though greater than in the former year, this is by no means an excess of moisture, and any assumed importance of this excess will be destroyed by a reference to the following table giving the relative humidity of the air at other places, where

influenza did not appear during September, 1872. For part of this table, and for other facts in connection with the weather, I am indebted to Brigadier-General Myers, Chief Officer of the Signal Service, who kindly furnished the monthly meteorological reports:

Relative humidity per cent for September, 1872

Weeks.	Toronto.	Montreal.	Quebec.	Detroit.	New York.
First	73.7	76.5	78.5	70.7	64.4
Second	80.6	79.7	83.0	79.0	79.7
Third	79.5	76.8	82.6	72.0	75.5
Fourth	77.8	74.7	76.0	66.4	81.0
Average for four weeks	77.9	76.92	80.02	72.02	75.15

The barometer had a low average for September, 1872, at Toronto - 29.5937, against 29.7200 of the same month in 1871. Its range, too, was less, 0.728, against 0.799 in September, 1871. The average heights of the barometer, at Toronto, in June, July, and August, 1871, were respectively 29.5431, 29.5552, and 29.5780.

Ozone. - It has been strongly contended that this agent is in excess in the atmosphere during epidemics of influenza. Since Shöuleim placed a rabbit for an hour in an atmosphere artificially charged with ozone, and found a resulting inflammation of the mucous membranes, and death of the subject a few hours later, the potency of this agent in causing influenza has been largely assumed. Additional weight was given to the theory by the observations of Bœckel, of Strasburg, who found that an excess of ozone in the atmosphere, if associated with cold east or northeast winds, or snow, was capable of inducing inflammation of the air-passages. Breckel further found that when he compelled animals to breathe strongly ozonized air, lobular pneumonia was produced. (Levy.) But there is no evidence that the catarrhs and pneumonias thus produced were capable of extending and assuming the character of an epidemic. It is found, indeed, that ozone does not exist in an atmosphere loaded with organic impurities, the product of putrid decomposition, or of animal respiration. Bêrigny could find no indication of the presence of ozone in the surgical, fever, and venereal wards of the military hospital at Versailles, though it was abundant in the court-yard of the hospital. James found a great deficiency in the military hospital at Sedan as compared with the garden of the hospital. Bœckel found it in abundance on the platform of the cathedral at Strasburg during the prevalence of cholera in that city; but he rarely found a trace in the streets of the town. He further asserts, as the result of his observations, that in air charged with paludal emanations ozone is not produced. He was moreover unable to develop ozone to any extent in a cholera ward.

But these are precisely the conditions in which influenza assumes its greatest severity and shows the highest death-rate. In the large cities, where the air contains an excess of carbonic acid, given off by fires and animal lungs, and an abundance of organic matter, the products of wash and decay in organized bodies, this is unquestionably the case. And just in proportion to the squalor, the filth, the impurity, and the absence of a proper hygiene, so does the affection prove more severe and fatal. So it is in the close, unventilated, and undrained, or underground stables of cities, with air loaded to suffocation with the products of respiration and putre-

faction. In these the mortality proves far in excess of that of the horses in the better-appointed stables, or in the country. A review of the whole subject shows very conclusively that an excess of ozone in the atmosphere cannot be accepted as the one cause, or the main cause, of influenza.

Again, it is difficult to estimate the amount of ozone in the air. Nitrous acid, which often exists in great amount near the surface of the earth, which, like ozone, is produced in large quantities during thunder-storms, and like it decomposes organic matter in the air, has precisely the same reaction with ozone on iodized starch papers. Ozone, moreover, is always present in larger amount at the higher altitudes, but influenza shows no such predilection for the hills. It has, on the other hand, during the recent epizootic, shown a decided preference for the valleys, along which run the great railroad-tracks, as evinced by its earlier *debut* in such places. Again, the amount of ozone varies constantly on the sea-shore from the great evaporation and the ever-changing condition of the electricity, and a sea-side residence has been accordingly advised as a safeguard against the evil effects of an excess of ozone.

But the recent epizootic had its origin near the border of a large lake, and has in the main prevailed earlier and more severely in the large towns on the Atlantic sea-board than in inland districts. As examples, may be mentioned New York, Brooklyn, Jersey City, and Boston, attacked on or about October 22; Portland, Maine, Newport, Rhode Island, and New Haven, Connecticut, October 23; Portsmouth, Virginia, November 1; and Charleston, South Carolina, November 2; whereas it only appeared in Washington County, and Kingston, New York, on November 1; Cooperstown on November 6, and in Scranton, Forest County, Clearfield County, and elsewhere in Pennsylvania about November 14. Dropsies and other dangerous complications were also very prevalent in these sea-board cities.

Through the favor of Professor Kedzie, of the Michigan State Agricultural College, I am enabled to present the following letter, embodying his observations on the amount of atmospheric ozone before and during the prevalence of the disease :

MICHIGAN STATE AGRICULTURAL COLLEGE,
Chemical Department, Lansing, December 16, 1872.

DEAR SIR: Your favor of 11th instant, asking information in regard to the amount of atmospheric ozone observed at this place in connection with the influenza in horses, is received, and it gives me great pleasure to comply with your request.

The observations on atmospheric ozone have been taken at this college only during two years - a narrow ground for any broad generalizations. The observations are taken twice a day, viz, from 7 a.m. to 2 p.m., the day observations; and from 9 p. m. to 7 a. m., night observations. They are taken by exposing a slip of Schonbein's test-paper (moistened) to the air in a shady place, but freely exposed to the air. At the close of the observation the paper is again moistened with distilled water and compared with the scale. The scale has for its extremes the slightest perceptible shade of purple, which is marked 1, and the deepest purple-blue characteristic of iodide of starch, marked 10, the space between 1 and 10 being toned to give gradation of the scale. The place of observation is such as gives pure country air. The night observations give a larger amount of ozone for two reasons: 1st, the greater length of time, and 2d, the larger amount of atmospheric moisture.

Immediately preceding the epizootic, a marked increase of ozone was observed - so marked as to call special attention to the fact. During September the average amount of ozone by day was 1.40, and by night 1.86; for October, 1.93 by day, and 3.18 by night, with *a rapid increase during the last three days of the month.* Early in November the disease made its appearance, and during this month the average of ozone by day was 4.60, and by night 6.17. The average of December to this date is 5.56 by day, 6.66 by night. A comparison of the amount of ozone during corresponding periods of 1871 is as follows: September, by day 1.58, by night 2.65; October, by day, 1.64, by night 1.96; November, 3.70 by day, and 4.06 by night; December to the 16th instant, by day, 1.91,

and by night 3.16. The excess of ozone for November, 1872, over November, 1871, is .90 by day and 2.11 by night; and for corresponding periods of December, 1872, over December, 1871, is, by day, 3.65, and by night, 3.50.

The disease is rapidly closing up business here, apparently for want of raw material.

Very respectfully, yours, &c.,

R. C. KEDZIE.

Professor LAW.

In view of this extraordinary excess of ozone at Lansing during the influenza period, it is much to be regretted that comparative observations are not obtainable from all parts of the continent. That the ozone has been generally in excess is possible, and that it lays the system open to the attack of the specific poison is not at all unreasonable, but it cannot be looked upon as the one and essential cause of the disease. If it were, why has the soliped been the only victim, since man has often shared the calamity on previous occasions? And, above all, why has the disease in every instance pursued a regular progress over the land in keeping with the facilities for rapid transit? The proofs of contagion furnished below entirely destroy the doctrine of the pathogenisis of the disease by a general excess of ozone. If ozone is in excess everyhere, and has any connection with the disease, it must either be a result of the propagation of the poison, or only an accessory cause, operating by weakening the system and laying it open to the attack of a poison which would otherwise remain powerless.

Electricity. - No reports of the state of the atmospheric electricity are to hand, but, like ozone, if potent at all, it could only be so in producing the first case or cases. It might be conceived of as affecting the nutrition or the animal body, so as to produce from its elements a morbid poison capable of indefinite reproduction, and of communicating the disease from animal to animal. But to conceive of the same electrical condition spreading by slow and steadily advancing steps over the continent for the space of three months, in all the varied phases of altitude and the opposite; of rain, snow, and fair weather; of clouds and sunshine; of atmospheric moisture and dryness; of storm and calm, in city and country, on the inland table-land, and valley, and on the sea-shore, is not in keeping with what we know of this agency.

According to Peltier, the electricity of the earth is always *negative,* and that of a dry atmosphere *positive.* Gay-Lussac and Biot found that the greater the altitude they attained in a balloon, the stronger was the positive electricity. Becquerel and Breschit found no evidence of positive electricity in the six feet nearest to the surface of the earth, in close-sheltered places, in the court-yards of houses, in the streets of cities, or in narrow valleys. In a calm, pure atmosphere the electricity is uniformly disseminated, and therefore little marked, but with a lowering of temperature and the condensation of the contained watery vapor into more or less dense clouds, the electricity concentrates itself around the watery particles and leads to extensive disturbances of the equilibrium. The action of the earth renders these clouds more negative in their upper than in their lower parts. Water falling in rain is as often positive as negative; falling as snow, it is positive four times in every five. Slight rains do not modify the atmospheric electricity, while heavy rains increase it positively or negatively. The approach of a hail-storm determines great inequalities in the electric tension of the air; strong winds also seriously disturb the equilibrium. It has been stated that rains occurring during south, southeast, and southwest winds are mostly negative, while those with north, northeast, and northwest winds are more frequently positive. (Levy.) Setting aside the regular diurnal variations, it follows that in the same latitude – location - the proximity of trees or buildings, the force and

direction of the prevailing winds, the existence or non-existence of clouds, and the occurrence of heavy rain, hail, or snow, mainly affect the atmospheric electricity. Some approximation to the electrical disturbance might, therefore, be attained by noting some of these conditions during the month. The resultant direction of the winds during September, 1872, at Toronto was north 79° west, and in September, 1871, north 74° west. The mean velocity for the month was 5.24 miles per hour in 1872, and 5.50 miles per hour in 1871. The maximum velocity in September, 1872, was twenty-nine miles; in 1871, twenty-six miles. In September, 1872, twenty days had each a less average than six miles per hour, while ten days each averaged from six to ten miles. In September, 1871, eighteen days individually averaged under six miles per hour, while twelve days had averages ranging from this up to ten miles. Rain fell on sixteen days of the month in 1872, the total duration of fall being 43.4 hours. It fell on eight days in 1871, the duration of fall being 27.7 hours. The observations made thrice daily in September, 1872, at Toronto, report the weather in twenty-nine instances cloudy, three times hazy, one time foggy, three times threatening, five times a light rain, and one time a heavy rain. It is twenty-six times reported clear. It was marked calm on twenty-eight occasions, seven times calm and clear, fourteen times calm and cloudy, and seven times calm and foggy.

It is manifest, from these data, that there must have been considerably more disturbance of the electrical tension during September last, in Toronto, than during the same month of 1871, and the frequency of thunder and lightning testifies to the same truth. September, 1872, had thunder or lightning on the 5th, 6th, 7th, 8th, 12th, 18th, 10th, 22d, 23d, 26th, and 20th. September, 1871, had thunder reported on the 3d, and thunder and lightning on the 18th. I have not before me the report of the thunder storms at Toronto for the earlier months of 1872, but for 1871 there are but six storms reported for July, six for August, and three for June. Altogether, there appears to be testimony to an existence of an unusual amount of disturbance of the electrical equilibrium in September, 1872; but whether this is sufficient to account for the *origin* of influenza may still be disputed. It is needless to deny how man and beast often suffer during the prevalence of the electrical disturbances, and especially just before the bursting of a thunderstorm. And considering how the nuclei (nutritive centers) of the different animal tissues have their functions arrested or perverted by inflammatory action; and considering further the varied development of many of the lowest organisms, when placed in different circumstances, it does not seem very irrational to assume that under varying conditions of electrical action, and of other attendant circumstances, there may be developed from these ultimate living particles of the animal body, or from vegetable organisms, new organic particles, with novel and pathogenic properties, and capable of multiplying indefinitely and disseminating a specific disease. But there is no evidence that this is really the case. We have merely the coincidence of extensive electrical disturbance, and the outbreak of the influenza of 1872. With regard to former epidemics, Dr. Parkes says that "no evidence has been collected which shows any connection with conditions of telluric magnetism or atmospheric electricity, and, indeed, the peculiar spread and frequent localization of influenza seem inconsistent with general magnetic conditions." And how often do we see thunderstorms occurring day after day for a length of time without the supervention of influenza. It is not at all improbable that this electric condition of the atmosphere had something to do with the development of the epizootic; but in view of all the known facts, and of our experience of the past, we can only look on it as predisposing the system to the attack of a poison which previously existed, but had remained latent for want of a receptive subject. Considering the feverish condition of the

system in times of great electric tension, the amount of ozone resulting from electric discharges, and the known action of ozone on the respiratory mucous membrane, the doctrine is at least plausible that the diseased condition and lowered vitality of this membrane at such a time laid it open to the attack of the poison. But in support of this theory as universally operative, we must assume either a supervention of this electrical derangement at each place whenever an animal is attacked, or that the reception of the poison into the animal body changes its character and intensifies its virulence. This gradual march of the electric tension over the continent seems an extravagant and unwarrantable assumption. The acquisition of increased potency or virulence, by passing through an animal body, is not altogether incompatible with what we know of the varied development of some of the lower forms of life in different media.

It will be observed that this hypothesis of the etiological importance of electricity and ozone does not touch the question of the primary origin of the poison. It assumes the poison to be already in existence, and that these agencies merely lay the system open to receive it, as do impure air, exhaustion, unsuitable food, and other health-depressing causes. Whatever the significance of the electrical disturbances at Toronto in September, the fact ought to be recorded for the guidance of future observers.

Progress from east to west or from west to east - The old doctrine was that influenza always extended from east to west, as it had been repeatedly traced over Asia into and through Europe. The epidemics of 1781, 1800, and 1833, were remarkable examples of this. Yet it has often followed an opposite course. The epidemic of 1768 prevailed in America before it reached Europe, and Webster claims the same course for those of 1757, 1761, and 1781. Gluge, from an induction of all the epidemics known to have occurred for three hundred years, concluded that the general course was from west to east. The recent equine influenza has spread from Toronto in a direction east, west, and south, and indeed any conclusions based on the direction pursued by the malady must be given up.

Contagion - Is there a specific *contagion?* This is manifestly a question of vital importance with reference to the influence of the above alleged causes. If there is a *contagion* which may exist in the body of the sick animal, increase there, and be the means of communicating the malady to an indefinite number of sound stock, all our theorizing on noxious gases and putrid fogs, inclemencies and extreme vicissitudes of the weather, excess of ozone, magnetic disturbance, and the like, will be of small account. Indeed no one of the conditions we have been considering, nor all of them put together, can explain the regular progress of such as the recent epizootic, step by step, from a given point of origin, over the whole Atlantic slope of the continent, extending over a period of three months, and without being materially influenced by locality, soil, altitude, weather, or climate. No such condition will explain the fact that horses only have suffered, while all the animal creation beside have escaped. In other great epizootics man has often suffered at the same time with the horse. If these resulted from atmospheric changes alone, how comes it that man has escaped now? The explanation would be easy if the equine and the human malady were alike due to specific *contagia,* distinct from each other, but closely allied in their manifest results and in the conditions which favor their development or reproduction. Were the morbific element a simple gas, it would be excessive in amount and easily appreciable at the point of origin; it would continue to exert its influence at this point if its production lasted; it would expend its power there, and advance by successive steps over newly conquered territory, each to be as promptly relinquished in its turn; and unless uniformly

diffused through the atmosphere and in all parts of the globe, it would be speedily diluted and rendered inert as it spread from its center of origin. The same remarks would apply to putrefying organic matter in the atmosphere. This would soon be changed by the action of oxygen into new compounds, and lose its original properties. It would be easily appreciable in the atmosphere, and would soon expire by its own limitation, and by the completion of the putrefactive process. The only theory that will accord with the history of the malady and its steady increase and extention is that which recognizes the existence of a *contagion,* capable, like other specific disease poisons, of assimilating its appropriate food, of reproducing its elements, and of thereby increasing the area of the disease.

The present visitation has shown an unmistakable tendency to progress most rapidly along the great lines of commerce and travel. It broke out near Toronto in the latter part of September; was reported in the city on October 1, and a fortnight later had reached Montreal and Quebec. Before the 13th October it had reached Detroit, by the 14th Buffalo, and by the 17th Rochester. By the 19th it existed in Lockport, Canandaigua, Geneva, Syracuse, and Albany, and a few days later in Auburn and Utica; by the 22d it had reached Boston and Revere, Massachusetts; Lewiston, Maine; and New York, Brooklyn, and Jersey City; on the 23d it had appeared in Hartford and New Haven, Connecticut; Providence and Newport, Rhode Island; Lunenburgh, Vermont; and Bangor, Portland, and Augusta, Maine. Yet it only reached Kingston, on the opposite side of the Hudson from that occupied by the railway, on November 1, and Cooperstown, Otsego County, New York, well removed from all railroad privileges, on November 6, though apparently in the direct line of the atmospheric wave, had such been the grand cause of the disorder. It followed, in short, the course of the New York Central and Hudson River Railroads and their various connecting lines, while sparing the towns at some distance from the track. Passing south, we find it in Philadelphia, Baltimore, and Washington by October 28, while the places already referred to in New York were still sound, though for some time past surrounded on all sides by the disease. It soon gained Goldsborough, North Carolina, and Columbia, South Carolina, on November 3, three days before its advent at Coopers town, New York, ten days before its appearance at Scranton, eighteen days before it pervaded Blair County, Pennsylvania, and at the same dates when the malady was making its way down the Hoosic Valley, Massachusetts. Taking the course of the Erie Railroad from Buffalo, we find the affection prevailing in Wyoming and Steuben Counties, New York, on October 21, Elmira and Binghamton by October 28, and Warren County, Pennsylvania, by October 20, while Ithaca, New York, only suffered on October 31, and the country to the east of it a week or two later. It is needless to follow this subject farther. In the West the same truth is equally manifest. Not only do we find a tendency to follow the great lines of rail, but in many cases a temporary avoidance of many of the small towns on the track, whose commercial relations are less active, and their danger of infection correspondingly small.

It only remains to be determined whether the disease will spread in a new locality from a newly imported sick animal as a center. If it can be introduced in this way into a new locality, well out of the former area of the disease, and spread promptly from the imported sick animal as a center, it must be possessed of a specific *contagium.* Were the body merely charged with noxious gases, with decomposing organic matter, or with electricity, it could never become the center for a wide diffusion of a specific disease. These agents would soon pass from the system and lose their noxious qualities by diffusion or decomposition. The presence of the sick animal would be no more injurious than a chemical laboratory, a putrid carcass, or an electric

machine.

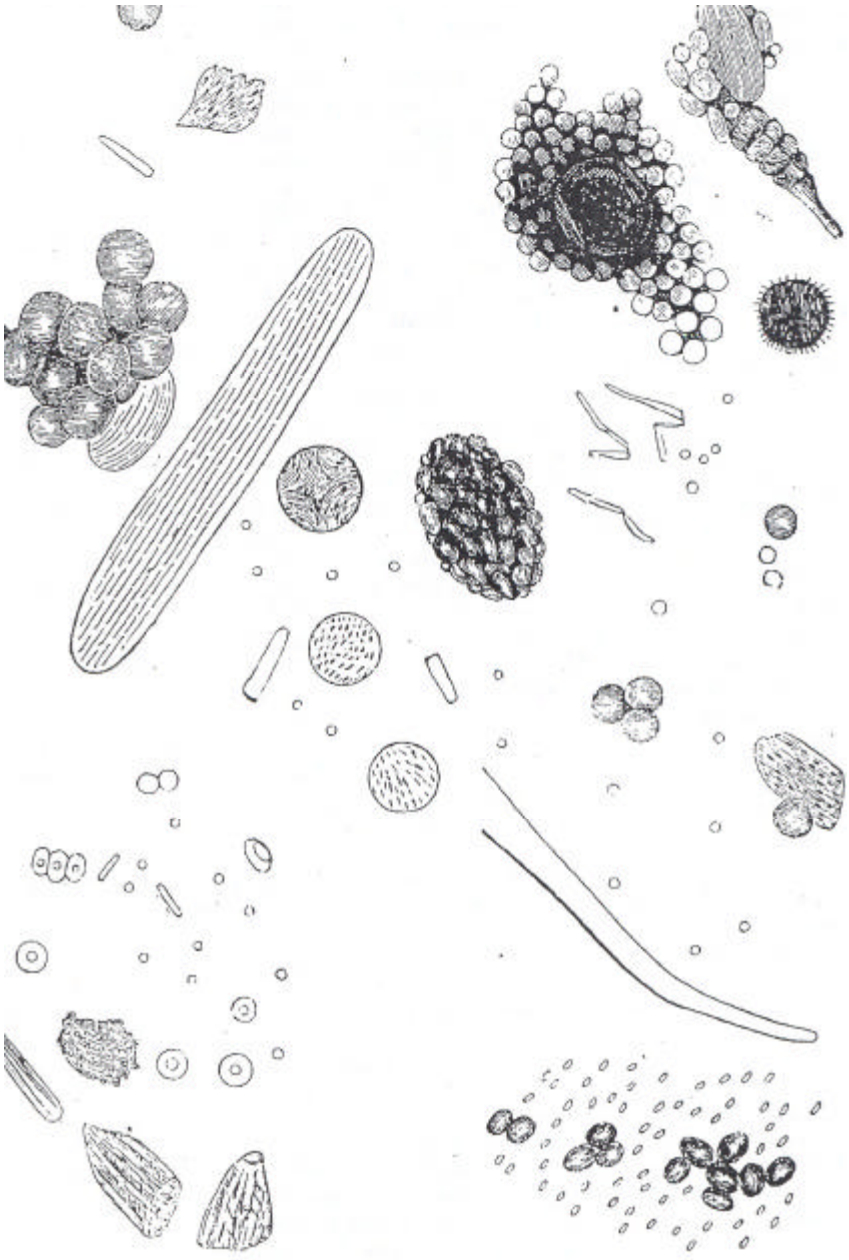
Attention is called, then, to the following facts: The first cases in Detroit were several sick horses brought from Canada, about the 10th or 11th of October; others were attacked in less than two days, and the malady appears to have been confined for nearly a week to the two stables into which the Canadian beasts were brought. The first cases in Syracuse were in newly arrived Canadian horses, and the malady spread promptly in city and country. The earliest cases which I have been able to trace in Ithaca were in the livery-stables of Mr. Jackson, who had just returned from running a mare in a more northern part of the State. In Pittsburgh the disease first appeared in the stables of Messrs. Moreland & Mitchell after the arrival of five or six horses from New York, when the epizootic was then at its height. In every instance it spread rapidly in the new locality. From Washington the first note of alarm was sounded on October 28th, to the effect that sick horses had been brought into the city from the North, and on November 31 it was reported to be generally prevalent. In Lehigh County, Pennsylvania, the malady appeared about November 4, and spread like fire along the canal and into the surrounding country. On November 19 it prevailed at points in Giles, Rutherford, Maury, Davidson, and Sumner Counties, Tennessee, which had been recently visited by a circus, coming from an infected locality, and while the general district was free. At Newark, Delaware, the first case was in a horse just arrived from Baltimore, and others speedily followed. At Elyria, Ohio, it was confined for five days, and for five days only, to teams just back from Cleveland.

Most of these were instances of the appearance of the disease in an entirely new locality, far beyond the limits of the region formerly pervaded by the disorder, and from such new points the infection spread widely before the general country, or even many of the towns in the interval between this and the former diseased area were involved.

Instances of the same kind could easily be adduced from the history of former epizootics. In influenza in man similar observations have been made by such authorities as Barker, Haygarth, Williams, Padres, and Sir Thomas Watson. Persons just arrived from an infected place have so frequently proved the center for a new diffusion of the poison that some have attempted to trace all cases to contagion alone.

It will be objected to this doctrine that Hertwig's inoculations, and even the transfusion of blood from a sick to a healthy horse, has failed to transmit the disease. In the face of such testimony as is furnished above, the conclusiveness of this evidence may be safely denied. Every individual is not susceptible. I can point to horses which have been freely exposed in the streets, and have even stood in the stalls just vacated by the sick horses, and have yet completely escaped the disease. The argument from transfusion is no more. conclusive than was the failure of the blood of cholera patients to induce that disease in healthy men. It does not disprove the existence of a poison, but merely that the subject was an unsusceptible one, or that the poison is not present in the blood.

Fig. 39



Nature of the contagion. - The existence of a contagion being acknowledged, the question next arises as to its nature. We are left to choose between two, theories: First, that which recognizes in fungi and other low organisms the specific poison; and, second, that which seeks the pathogenic element in the infinitesimal granules of organic matter, found floating in the infecting atmosphere, as well as in the solids and fluids of the animal body.

Fig. 40

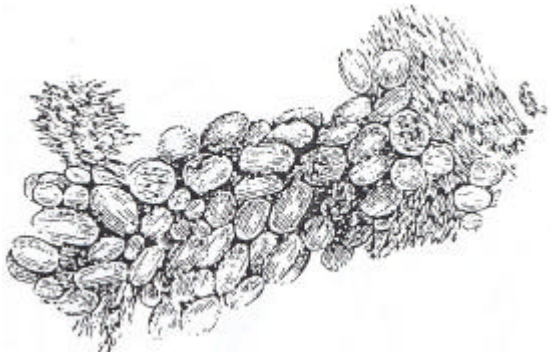


Fig. 41

The first-named theory is open to the objection that no specific vegetable germs have been found in the air, blood, or nasal discharges during the prevalence of influenza. Before the advent of the recent epizootic at Ithaca I subjected the floating elements in the air obtained in stables and field to microscopic observation, and repeated the observations while the affection was advancing to its climax. Spores were found abundantly, of the forms represented in Fig. 39; but the same were found before and after the arrival of the disease. The mucus from a sick horse's nose contained similar spores, and the dust obtained by shaking a handful of hay taken from the interior of a hay-mow, after the influenza had subsided, showed them in great abundance. The objects in the air were obtained by drawing it through an aspirator and directing the current on a drop of glycerine on a glass slide. The mucus and blood from diseased horses were received on a glass slide, and immediately covered. The dust from hay was allowed to fall on a glass slide, with a drop of glycerine, and immediately covered. The objects shown in Fig. 40 were deposited on a glass slide, with a drop of glycerine, exposed for a night in a field near a house.

I append the report of observations conducted by Mr. Taylor, microscopist to the Department of Agriculture; and another of observation: made by Dr. Jackson, Columbia, South Carolina.

REPORT ON OBSERVATIONS BY THE MICROSCOPIST OF THE DEPARTMENT OF AGRULTURE.

To the Commissioner of Agriculture :

SIR: In accordance with your instructions, I have made a microscopic examination of the mucus flowing from the nostrils of several horses suffering from the prevailing horse influenza.

On the 4th instant I collected mucus from the nostrils of five horses suffering from the malady, and submitted a portion of each to a power of about 50 diameters, when the entire field appeared covered with spore-like germs, gelatinous and semi-transparent. Under a power of about 600 diameters they appear as disks, some of which, under favorable conditions, may be seen moving on their edges. Perfect and imperfect cells were combined in a mass. All exhibited dotted markings. After the application of various tests, I came to the conclusion that they were mucus cells in combination with normal mucus.

A few fungi spores were frequently seen during my investigation, combined with mucus cells and normal mucus; but as its gelatinous character prevented minute observations, I decided to submit portions of the mucus of each horse to the action of caustic-potash for several hours, at a temperature of about 100° Fahrenheit. By this process all the animal matter (normal mucus and mucus cells) was dissolved. I next added aqua ammonia to the solution to render the mass more liquid, and placed it aside to settle. In the course of twenty-four hours a

sediment appeared at the bottom of each test tube. The alkalies were removed in some cases by washing, and in others I secured the sediment by evaporation. Portions of the sediment of the mucus of the five horses were submitted to various powers of the microscope, but that of about 600 diameters gave, generally, the most satisfactory results. Fig. 41 represents the character of the fungi and mucus cells.

Some pollen cells were also observed. Each portion of mucus sediment prepared as described, and no larger than the head of the smallest pin, contained twenty to fifty spores of fungi.

My attention was next directed to the detection of the floating germs, if any, in the stable atmosphere of the horses affected. For this purpose I devised the following plan: I first prepared a very limpid varnish, by dissolving one ounce of copal varnish in two pints of benzene, a part of which I poured over a sheet of glass 15 by 15 inches, the superfluous portion being instantly drained off. The varnish dries quickly, yet retains a sufficient degree of adhesiveness to retain dust of any kind which may fall on it. A plate of glass thus prepared was secured over the head of one of the sick horses in the Department stable, where three other horses were confined, all of which were affected with influenza. The glass was placed horizontally, with varnish side up, and about 9 feet from the floor. After the lapse of twenty-four hours it was removed, cut into slides 3 by 1 inch, and examined with gum and glycerine solution. In each case the objects prepared for observation were covered with the usual form of microscopic discs. The objets brought into view in this way, under the microscope, proved to be very similar, generally, to those found in the mucus, only much more numerous.

Fig. 42 represents the forms of the spores found in the stable atmosphere.

A second plate of glass 15 by 15 inches, varnished as described, was placed in the center of one of the large grass-plats of the Department grounds and allowed to remain in the open atmosphere twenty-four hours. The plate was then cut into slips 1 by 3 inches and examined by the microscope; but I failed to discover a single fungi spore, or a vegetable germ of any kind. I think it probable that nearly all the fungi spores found in the mucus and stable atmosphere had the origin in the food provided for the horses. The torula cells may have had another source.

Fig. 43 represents the class of forms in the atmosphere of the lawn.

Fig. 42

Fig. 43

I diluted a portion of diseased mucus with water in the proportion of about two parts water to one of mucus, and set it aside for eight days. On the ninth and subsequent days it gave the infusorial forms and fungi cells. (See Fig. 44.)

THOMAS TAYLOR, *Microscopist.*

MICROSCOPIC EXAMINATION BY Dr. E. E. JACKSON, OF COLUMBIA, SOUTH CAROLINA.

1st. A stabled horse; large quantity of mucus and pus. Examination of discharge showed filaments of fibrino and organized bodies.

2d. Horse passing on street; thin discharge; same organized bodies seen through microscope.

3d. Early stage; thin discharge; same organized bodies.

Fig. 44

4th. Very thick discharge; much coughing; no organisms apparent.

5th. Thin discharge, early stage, organized bodies in abundance; seven in one field of the instrument.

6th. Mule; thin discharge, numbers of organized bodies, with mucus or pus.

7th. Similar to above, (mule.)

8th. Mule; thin discharge, in one field of view one very large organism; in another six of ordinary size.

9th. Thin discharge from an ox examined; no organisms.

10th. Horse; numerous organisms.

11th. Horse; thick discharge; no organisms.

12th. Horse; thin discharge; no organisms; no motion visible .

In all the cases were found vegetable spurs or hairs from grain or rough food. Have seen similar organisms in stagnant pools and in decomposing vegetable matter. Microscope used, 750 magnifying power.

Fig. 45 - represents the vegetable spores.

The similarity of the spores seen by Mr. Taylor and myself will be manifest to the reader. In my case they had the same orange-brown color which he has so well depicted. In my observations there was no opportunity for the growth of mycelium, so that the differences in this respect are of no significance. The fact that these germs were more abundant in the hay than in any other medium testifies strongly enough as to their true origin. Then the results of Dr. Jackson's observations, in showing an entirely different organization, would seem to indicate that these are merely different manifestations of vegetable life under varied climatic conditions, and are of no significance in connection with influenza.

And to this effect is the testimony of Dr. J. J. Woodward, of the Medical Department of the Army, who says:

> Within the last few days I have collected the organic forms from a quantity of the air in a stable in this City, in which were a number of sick horses, and submitted them to the highest powers of the microscope, without finding any which are not usually encountered when no epidemic is prevailing, and have also subjected the mucus discharge from the nostrils of several of the horses to the same examination, with like negative results.

The other doctrine is the most reasonable one, and is one which appears to explain all the pathological phenomena. It recognizes in the granules which exist abundantly in the diseased organs the morbid agent capable of transmitting the disease. These granules, which are merely microscopical particles of variable size and form, often possess many of the characters of the ultimate nutrient centers, (nuclei, germinal matter of Beale,) even to the power of rapidly absorbing coloring matter, and which seems to imply a capacity to appropriate other material for the increase and multiplication of their substance. These nuclei or granules are reproduced with extraordinary rapidity in the substance of the diseased mucous membrane and at the

expense of the vital elements, liquid and solid, of the body, so that Beale and others have concluded that they either constituted the virulent principle or contained it. Yet nuclei or granules increased to an extraordinary extent in parenchymatous organs, the seat of simple inflammation. These, of course, cannot be considered as pathogenic. And yet there is no greater reason for assuming a similarity of developmental power in these nuclear products of a simple inflammation, and those of an influenza or rinderpest, than for assuming equal powers of growth in the nuclei of different healthy organs and structures. If nuclei, apparently indistinguishable from each other in all respects except their position, never fail to build up the substance of that particular tissue to which they belong, the nuclei of bone invariably producing bone; those of gristle, gristle; those of fibrous tissue, fibrous tissue; those of muscle, muscle; and those of nervous matter, nervous matter; and if we can ingraft the nuclei of bone and other tissues so as to build up such textures in unusual situations, is there any insuperable objection to the conclusion that one class of such morbid granules are harmless, while another class invariably develop influenza, and that alone; a third class small-pox, and that only; a fourth class glanders, and nothing else; a fifth class, rinderpest only, a sixth class the contagious lung-plague of cattle, etc. The physiologist has learned to realize that living particles, which are almost infinitesimal in their minuteness, have characters as constant and a power of development as certain and definite as the genera of animals from which they were derived. There is no valid objection, therefore, to the theory which recognizes in those products of a specific disease the virulent elements by which the affection is perpetuated and transmitted. And this is the theory which appears at the present time to be most in accordance with the history of influenza.

In taking this position, it is sought to deny the conveyance of the disease by atmospheric means. The numerous instances of horses having been attacked in the open fields, apart from all roads, and from other horses. and the rapid diffusion of the disease over a city or district, seem to imply the intervention of atmospheric agency. But our position by no means precludes such an agency. It only assumes that there is a specific virulent element, which finds in the body of a susceptible animal the material essential to its growth, its unlimited reproduction, and extensive diffusion. The air may still be invoked as an important medium through which the dried and drying virus or *bioplasm* (Beale) may be carried to long distances, and infect new animals and localities. It is further in keeping with the theory that the skin and clothing of human beings, and solid objects of nearly every kind, may become the medium through which the disease is conveyed from place to place, and will thus explain many outbreaks which would otherwise appear to be spontaneous.

This theory further explains the outbreak on islands near the shore simultaneously with its appearance on the mainland, and all well-authenticated cases of the infection of the ships' crews at sea. Thus the equine influenza is alleged to have appeared in Block Island, about ten miles at sea, on the same day that it broke out on the Connecticut shore. Were it proved (which, however, has not been attempted) that there had been no recent communication between this island and the shore, there would be nothing in the fact to overthrow the position taken in this paper. A similar case is that of the Stag frigate, recorded by Watson. In 1833 this ship was coming up the English Channel, and when off Beechy Head, in Devonshire, the wind blew strongly from the shore at 2 o'clock, at which time all the men were healthy, (and it is presumed, but not affirmed, that there had been no communication with the shore;) at half past 2 forty men were suddenly attacked with influenza; at 6 o'clock sixty men were ill, and by the

next day one hundred and sixty. The instances of Admiral Kempenfeldt's and Lord Howe's squadrons, attacked while cruising at different parts of the same channel, in 1782, after they had been from twenty-two to twenty-seven days at sea, are no more difficult to explain. Indeed, the fact that a squadron had been technically a number of days at sea is no proof that officers and men had not availed of their near proximity to pay frequent visits to the shore.

Pathology. - Influenza has been thought to be a simple catarrhal disease, with a special prostrating or debilitating tendency, because of some unknown condition of the atmosphere, or something else vaguely referred to as epidemic influenza. Some color was lent to this by the irregular and sometimes dangerous course of the disease occurring during an influenza epizootic. But this influencing of other diseases is common to other epizootics the specific nature of which is unquestionable. During the cholera epidemic, for example, not only men but animals show a special irritability of the digestive organs and tendency to diarrhœa. In marshy regions nearly all other affections are modified in character and course by the malarious poison, and, indeed, the history of influenza is that of a disease propagated by a specific poison, and advancing in the face of all circumstances and obstacles, and entirely independently of those conditions which cause the development of catarrhs.

That a specific poison exists is fairly established by an impartial review of the epizootic in 1872. But this poison does not produce in all cases the same phenomena. The symptoms of nasal catarrh are the most constant, but they are often slight, and, at an early stage of the disease, even overshadowed or superseded by those of intestinal catarrh or rheumatism; and if the poison may thus localize itself in unusual situations without apparent cause, how much more likely if some organ, or system of organs, is already the seat of disease and consequent weakness and susceptibility.

The theory of the existence of a fungus, which multiplied in the atmosphere, or in the diseased body, or in both, has long been a favorite one, and would fully explain the phenomena of the disease and its progress. But no such fungus has been found, and those found in the more northern part of the continent differ from those found in the south. They are moreover found in great abundance in the dust of fodder, and as plentifully after the disease has long passed as during its prevalence. This doctrine is therefore at present in want of facts to sustain it. The only other tenable hypothesis appears to be that of a true contagium. Particles of the living body (granules or bioplasm) are given off in myriads, are carried widely by the air, and infect other animals.

How, then, does such poison operate? Hertwig's experiments seem to show that it is not conveyed from animal to animal by the transfusion of blood, and cannot therefore be present in the circulating fluid. It would follow that the various nervous, rheumatic, and cardiac symptoms were produced by nervous sympathy, owing to the presence of the poison on the mucous membranes, or by the absorption of some noxious products formed in the mucous membrane by reason of its presence. Yet this fails to explain satisfactorily the early and profound prostration before the poison could be developed to any extent on the mucous membrane, the extreme weakness and inability for active exertion which remains after the animal has apparently recovered, and the liability to one or other of the dangerous complications which exhaustion or maltreatment at such periods is liable to bring on. It will be a matter of sincere regret if the transfusion and inoculation experiments are not put to a crucial test before the epizootic shall have disappeared. At present the question cannot be definitely answered as to whether the poison is received into the blood and acts directly on the different organs, or is

confined to the mucous membranes and affects the other parts of the system indirect1y.

The state of the blood and of the tissues affected throws little light on this subject. The respiratory mucous membrane, as in simple catarrhal inflammation, is the seat of congestion and blood stasis, with exudation, cloudiness, and softening of the membrane, and an excessive production of granular matter and cells of mucus and pus. But it shows at the same time a great tendency to assume the deeper shades of red, and presents in many cases *petechiæ* as indications of the presence of some potent blood poison, or at least of a highly impure and disorganized condition of the blood. The inflammation of the lungs, too, is manifested rather by that semi-liquid infiltration which characterizes the contagious lung fever of cattle than the firm consolidation of a strong type of inflammation. The blood in the early stages contains an excess of fibrine, and coagulates with a large amount of buffy coat, and a cupped surface, as in simple inflammatory affections. Later, however, and especially in the most malignant and fatal case, it becomes diffluent, and comparatively incoagulable, as is seen in cases wherein a potent and destructive poison has been present, and in the advanced stages of deadly fevers, where the blood is in a highly impure and disorganized condition. It is not easy to explain the morbid phenomena without assuming the presence of a poison in the blood, and it is still possible that there was some source of fallacy in the transfusion experiments; but here the subject must be left in anticipation of further developments.

Treatment. - All debilitating or depressing treatment must be sedulously avoided. Bleeding, purging, severe action on the kidneys, depressing sedatives and violent blistering are alike to be deprecated. In the regular and incomplicated form of the disease, nearly all will recover under good nursing and fresh air, and independently of all medicinal agents. Place the patient in a cool, dry, well-ventilated, and well-littered box; clothe him comfortably, so as to avoid all tendency to chill, bandage his legs loosely, and change the clothes, and curry or brush the skin twice or thrice a day; keep quiet and still, although usually a little exercise in hand, in the shelter and sunshine, will be rather beneficial than otherwise. Feed on bran mashes, boiled oats or barley, turnips, carrots, or other roots, in small quantities, and often, so as not to clog the appetite, and supply at frequent intervals a quart or two of water, nearly cold, or cold oatmeal or linseed gruel.

It is important to favor depuration of the blood by moderate but never excessive action of the kidneys or bowels. Costiveness will oftentimes be best met by abundant and frequent injections of water, blood warm, (three or four quarts at a time,) or by one half pound of molasses, or three ounces of sulphate of soda added to the drink. If a laxative is absolutely necessary, it should rarely exceed one-third of the ordinary dose, on account of the dangerous susceptibility of the digestive organs. The author has seen a large Percheron die of superpurgation, after taking but three drachms of Cape aloes. During the recent visitation an instance came under his notice in which half a pint of linseed oil came nigh proving fatal. This susceptibility of the digestive organs, however, varies widely in different epizootics, and in some mild laxatives proves highly beneficial, yet their possible danger should always be present to the mind.

Mild febrifuge diuretics may be used with advantage. Spirits of nitrous ether, in half-ounce doses, may be given twice a day, or liquor of the acetate of ammonia, in ounce doses, four times a day in the water gruel drank. If the fever runs high, or effusions threaten to take place, these may be increased as far as the strength will allow, but always with the greatest caution and judgment.

When the cough proves especially violent and painful, the addition of anodynes, such as belladonna and camphor, is advisable. A drachm of each may be added to the diuretics already advised.

The cough may be further relieved, and the relaxation of the mucous membranes and the appearance of the discharge hastened, by causing the animal to inhale warm water vapor several times a day, for an hour at a time. This is most conveniently done by saturating chaff bran or other simple agent with boiling water, placing it in a nose-bag, which is then hung on the patient's nose by means of a strap crossing behind the ears. This proves especially beneficial, as the moderation of the fever is usually a concomitant of the appearance of the discharge. Burning a pinch of flowers of sulphur, more or less, according to the size and nature of the building, so as to impregnate the air to an extent just short of causing irritation and coughing, has a very soothing and beneficial effect on the mucous membrane. It is best done by laying a piece of paper bearing the sulphur on a shovel, and setting fire to it. It is superfluous, perhaps, to say that it must be done behind the patient, and not beneath his nose. The fumes of vinegar from a red-hot brick, of burning leather, and the like, are cruelly irritating, and occasionally induce fatal results.

Counter-irritants are often useful from the first. If, however, inflammation and sore throat seem extreme, a poultice may be advantageously applied for a day previously, or the throat may be well fomented with warm water for an hour and then wrapped in a sheep-skin with the wool turned inward. When, however, there appears little danger of even temporarily aggravating the local inflammation, the throat or chest, where the disease has been localized, it may be well rubbed with a thin pulp made of the best ground mustard and tepid water, and then covered up. This may be replaced by the soap liniment, made with six ounces of soap, three of camphor, and a pint, each, of proof-spirit liquor, ammonia, and linseed oil. This liniment may be applied repeatedly at short intervals and well rubbed in. If a more active blister is wanted an ointment may be used composed of a drachm and a half of powdered cantharides, a scruple of camphor, ten drops of spirits of wine, and an ounce of lard. The hair should be cut off and the ointment well rubbed in, in a direction contrary to that of the hair. After it has acted, the skin should be kept soft and pliant by rubbing it with fresh lard. Oil of turpentine, which has been largely used as a counter-irritant during the present epizootic, is only objectionable on the ground of its causing so much local irritation without blistering as to drive some excitable horses to distraction.

In using anyone of these counter-irritants it is best to apply them over a limited space only, not exceeding the bounds of the inflammatory action, as we can thus secure the best results from the intimate nervous sympathy existing between the deeper-seated organ and the skin which covers the corresponding part of the surface, and at the same time avoid the depressing and debilitating effects of a blister. For this reason a careful examination, of the chest especially, should always be made before making such an application.

As the mouth becomes cooler and more moist, and the pulse softer and less frequent, a more stimulating treatment is desirable. At first two drachms each of gentian, powdered cinchona, niter and sal ammoniac, may be given night and morning, or if the debility is very great the last-named agent may be replaced by four drachms of carbonate of ammonia made into a bolus, with linseed meal, or dissolved in a half pint of water, and repeated three or four times a day. In cases marked by a daily remission, I have found a dose of 30 grains of sulphate of quinia to prove effectual in preventing the paroxysm, if given au hour or two before the period

when it was in the habit of appearing.

During convalescence gentian, cinchona, and other tonics, are desirable, with alcoholic, ammoniacal, or other stimulants, if there is much debility or prostration. The diet should be tempting and nutritious, supplied often, fresh and frequently varied, and care should be taken at all times to counteract any sudden suppression of the secretions of the bowels or kidneys, or even the nasal discharge. In this connection I may mention the statement of Mr. Murray, of Detroit, that all the cases of dropsy that came under his notice occurred in animals which had taken for a few days "condition powders," consisting largely of sulphate of iron, and had had the nasal discharge suddenly dried up. Improvement followed promptly on the withholding of the powders and soliciting the action of the kidneys and bowels.

Should the prostration become extreme, stimulants must be resorted to even more frequently than is recommended above; five, or even six times a day. In some instances, however, the system seems to lose all power of reaction, and almost the only remaining hope lies in the transfusion of blood from the veins of a healthy animal to those of the sick. The blood may be obtained from a healthy horse, or more conveniently from oxen or sheep intended for slaughter. It may be transferred through an elastic tube without exposure to the air, or it may be drawn off into a vessel and thence transferred to the veins of the sick horse, unchanged or defibrinated.

The first-named mode, which was practiced by the late Mr. Farral, of Dublin, is in many respects the most convenient. The operator must furnish himself with a caoutchouc tube about a yard and a half long, and with a silver tube four inches long, and a third of an inch in diameter, fitted into each end. The jugular veins of the two animals are now opened with fleam or lancet, the pressure being maintained below the orifice so as to obviate the entrance of air into the vein and to facilitate the introduction of the tube. The tube having been filled with tepid water, is now inserted from below upward toward the head into the jugular of the sound animal, and from above downward, toward the chest into the jugular of the sick. The middle of the tube is passed through a vessel containing water at the temperature of the animal body. The tube, hitherto compressed between the finger and thumb, is now relaxed and the blood is allowed to flow slowly into the system of the patient. Any indication of nausea or vertigo, turning up of the upper lip, jerking upward of the head, or unsteadiness of the limbs, is to be accepted as a warning, and the current of blood must be stopped or reduced until the animal has rallied. After a sufficient amount appears to have been transferred, the tube is withdrawn and the wounds pinned up as after ordinary bleeding. About three quarts will usually be borne, and the results will be seen in increased firmness and fullness of the pulse, and a more healthy hue of the mucous membranes.

In the second mode there is introduced into the vein of the patient a tube, which is dilated at its free end into a funnel about an inch in diameter, and furnished with a wooden plug accurately fitted to the bore of the tube. A little blood having been withdrawn from the sound animal into a dish standing in water of the temperature of the body, and the funnel having been quickly filled, the plug is pulled out and the blood allowed to flow in. Before the funnel is quite empty, the plug is again inserted, the funnel refilled, and the process repeated. In this way all danger of the introduction of air is obviated.

The third mode differs from the second only in the removal of the fibrine from the blood. The blood having been received into a vessel set in another containing warm water, is whipped with a bunch of twigs until all the fibrine bas been coagulated and withdrawn, after which the

liquid is transferred into the vein of the sick animal with the same precautions as by the second mode. The loss of the fibrine is of no moment, and the defibrinated blood is found to be equally restorative with the pure blood.

The main dangers to be guarded against are the entrance of air into the circulation, the introduction of clots of fibrine, which by blocking the vessels would produce local inflammation and abscess, and the too rapid transfusion which leads to vertigo and fatal fainting.

If the abdominal organs are especially involved the counter-irritant is to be applied over the region of the liver, bowels, or kidneys, as the case may demand. With yellow or brownish appearance of the mucous membranes and tenderness over the short ribs, this point should be selected for its application. With general tenderness of the abdomen, colicky pains, frequent straining, and the passage of a white, thick mucus forming a pellicle over the dung, or collected in masses, it should be applied generally to the surface of the belly. If there is tenderness and swelling of the loins, stiffness of the hind limbs, frequent straining, the passage of water in small quantities and highly colored, and above all if the urine contains microscopic fibrinous casts, it should be applied over the loins. In the last case it may be preceded by a bag of hot scalded bran, or a fresh sheep-skin with the fleshy side turned in.

The shivering, which usually attends the onset of such complications, may be counteracted by friction to the skin, clothing, a warm drink containing a stimulant - four drachms carbonate of ammonia - and injections of warm water or well-boiled gruel, given to the extent of three or four quarts at a time, and repeated every hour until shivering ceases.

In cases affecting the liver or bowels, I have found excellent results from guarded laxatives. Two, three, or even four drachms of aloes in different cases, with a drachm of gentian, and thirty drops of hydrocyanic acid, or an ounce of laudanum, will usually promptly relieve the colic, secure an action of the bowels, and remove the deadly prostration which characterizes this type. It has manifestly the effect of relieving the inflamed surface by a free secretion from its turgid blood-vessels, of benefiting the portal system and liver by a direct local depletion, and of eliminating poisonous material, which was being pent up to the great injury of the system at large. Little more is wanted than the free use of demulcents, such as slippery elm, well-boiled linseed, and the like, great care to secure a continuous moderate action of the bowels, and a tonic treatment as in other cases of convalescence. Turpentine has been strongly recommended by some, and acts beneficially as a local and general stimulant. An ounce of the crude drug, or half an ounce of the oil, may be made into a ball with linseed meal, or beaten up with the yolks of two eggs, and given twice daily.

The affection of the kidneys may demand gentle laxatives, (oleaginous,) anodynes, (laudanum) emollient injections, counter-irritants, stimulants, and later gentle diuretics.

The nervous symptoms will sometimes demand the application of cold wet cloths to the head, counter-irritants to the sides of the neck and limbs, the guarded use of laxatives and diuretics, with drachm doses of bromide of potassium, and if there is great depression, ammoniacal stimulants.

The rheumatic complication is to be met like ordinary rheumatism. Liquor of the acetate of ammonia two ounces, and colchicum wine one ounce, may be given twice a day, diluted in water; tonics, warm clothing, the frequent application of a hot smoothing iron over the affected part of the body, with the intervention of a thin cover, and even counter-irritants are among the agents especially demanded. When the heart is implicated in rheumatic cases the same treatment is necessary, but the blisters are to be applied behind the left elbow.

When there is reason to suspect the existence of clots in the heart, alkaline remedies are recommended, particularly the preparations of ammonia and iodide of potassium, attention being meanwhile given to support the system by tonics and stimulants, and to encourage the elimination of deleterious products from the blood.

If dropsical manifestations appear they must be treated according to their apparent causes; if disordered function of the heart or kidneys, these must be met by appropriate measures; and if from weakness of the circulation; an anæmic or debilitated state of the blood and imperfect nutrition, gentle action of the eliminating organs, with stimulants, tonics, a nourishing diet, (embracing in some cases strong beef soup or tea,) or even transfusion of blood, will be necessary.

Purpura haemorrhagica, is to be met by similar supporting and eliminating treatment, with the addition of oil of turpentine in half ounce doses, or pure carbolic acid in drachm doses, and cinchona in half ounce doses, repeated thrice a day. The skin over the engorgements should be rubbed frequently with a solution of carbolic acid, containing one part of the acid to every hundred of water, and a similar lotion should be applied frequently to the sores when these form.

In short the various complications and sequilæ of simple influenza are to be treated like similar lesions occurring independently of this affection, but with due regard to the great debility attending this disease. The great majority of cases will recover without any treatment; and indeed many require no medical treatment, but a certail number will demand the greatest care of the educated medical attendant.

Prevention. - Many have attempted to ward off the disease by the use of tobacco, camphor, vinegar, tar, asafœtida, &c., and others more rationally by bromo-chloralum, carbolic acid, permanganate of potash, sulphurous acid, and the hyposulphites, but in no case with permanent success.

With a *contagium* like that at present under consideration, so easily diffused through the atmosphere, absolute prevention will always be difficult, though not necessarily impossible. With a disease, too, the tendency of which is almost invariably to a favorable termination, it is scarcely politic to shut up an animal for a month in a disinfected atmosphere, until the disease has subsided, with the probability before us that he would still contract the disease from the remnants of the poison when exposed at the end of this period. Thorough cleanliness and disinfectants are to be highly commended, not with the view of absolutely preventing the disease, but rather with intent to retard and moderate it. The comparatively non-volatile disinfectants, such as permanganate of potash, chloride of lime, bromo-chloralum, and carbolic acid, may be used for the solid structures of the stable, drains, manure, and the like, while sulphurous acid is above all to be commended for disinfection of the air. This agent, when used frequently and in small amount, so as to be non-irritating, has the double advantage of soothing and giving tone to the diseased mucous membrane, and of destroying organic germs, including perhaps the morbific elements in the respiratory organs.

DR. CALDWELL'S ANALYSIS OF THE URINE.

The following analysis, conducted by my colleague, Dr. Caldwell, is that of the urine of a horse in the last stages of influenza, and which proved on post-mortem examination to have a large clot occupying the right ventricle and firmly attached to the lower surface of the tricuspid

valve.

The characters are those of highly febrile urine. The acidity no doubt results from the fact that the animal had been able to assimilate nothing for some days, but was consuming his own tissues to sustain the vital functions. The density, 1.08, is double that of the healthy horse's urine, 1.04. The urea, 4.81 per cent is at least four times the amount found by Von Bibra in healthy equine urine, 0.83 to 1.24, and nearly double that found by Dr. Marcet in a case of rinderpest in a cow, 2.472. The extraordinary waste of tissue necessary to produce this amount goes far to explain the extreme weakness which characterizes the disease. This was an extreme case, it is true, yet the instance mentioned in the report of two non-fatal cases having lost each 7½ pounds daily, is another illustration of this general tendency of the disease. The presence of albumen is but of secondary significance, as it is a constant constituent of urine in pneumonia, bronchitis, and other inflammatory affections.

The liquid had a sizy consistency, as is commonly the case in albuminous equine urine, and poured like a dense oil from one vessel into another. I found no specimen of influenza urine from which albumen was entirely absent, though often only present in traces, and in one instance a sick mare, on the day before she died, passed it as a solid mass like a thin jelly and streaked with blood.

CHEMICAL LABORATORY, *Cornell University, December 24, 1872*

DEAR SIR: The following are the results of the chemical examination of the sample of horse-urine that you left with me:

Re-action	Acid.
Specific gravity	1.08
Albumen, per cent	0.35
Urea, per cent	4.81
Total dry substance, per cent	8.5
Ash, per cent	1.04
Phosphoric acid, per cent	0.13

METHOD OF ANALYSIS

Albumen. - This was precipitated by digestion of a weighed quantity of the urine at 100° C., and the addition of a drop or two of acetic acid; the precipitato was collected on a dried and weighed filter, washed with hot water, dried at l00° C., and weighed.

Urea. - The albumen was precipitated from a weighed quantity of the urine, the filtrate made up to 500^{cc} to 50^{cc} of this liquid, 25^{cc} of a mixture of saturated solutions of baric nitrate and hydrate added, and the urea was estimated in the filtrate from the precipitate by these re-agents, according to Liebig's volumetric method, with a standard solution of mercuric nitrate. As only traces of chlorine were present, no estimation of it was made, and no correction of the results of the determination of the urea was necessary except for the dilution of the solution.

Total dry substance - This was estimated by keeping a weighed quantity of the urine at l00° C. in a tube, while a current of washed and dried air was passed over it, and afterward through a measured quantity of standard acid, in order to absorb the ammonia. This operation was continued as long as there was any loss of weight on the part of the residue in the tube; the amount of ammonia absorbed by the acid was then estimated by the usual tituration, and the weight of the same, calculated as carbonate, was added to the weight of the residue in the tube. The amount of ammonia was, however, very small.

The ash - A weighed quantity of the urine was carefully charred, the coal was exhausted with distilled water, the aqueous extract filtered out, the coaly insoluble residue burned at a red heat, its ash added to the aqueous extract, the whole evaporated to dryness, and the residue gently ignited.

Phosphoric acid. - This was estimated in a portion of the filtrate from the albumen that was prepared for the determination of the urea, by the volumetric process, with a standard solution of uranic acetate.

No sugar could be detected in the urine, by digestion with Fehling's solution.

Yours, respectfully,

G. C. CALDWELL,
Professor of Agricultural Chemistry.

Professor LAW.