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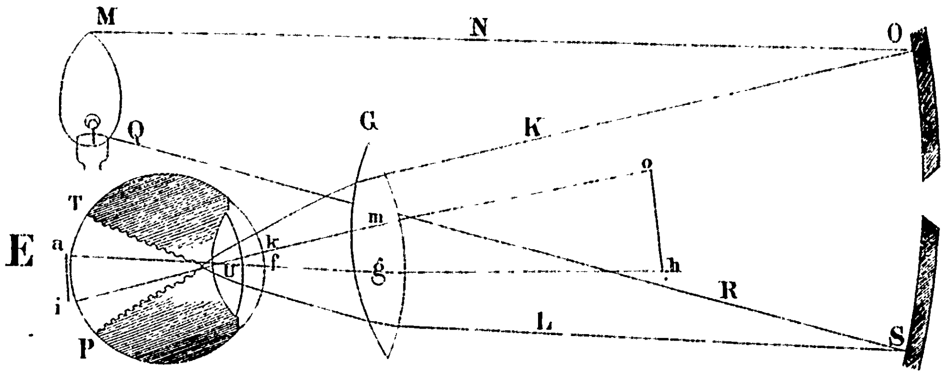


Fig. II.

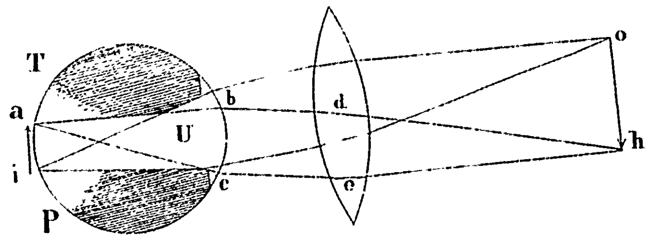


Fig I.

W.C.Chewett & Co. Lith. Toronto.

THE CANADIAN JOURNAL.

NEW SERIES.

No. L.—MARCH, 1864.

A NEW OPHTHALMOSCOPE FOR PHOTOGRAPHING THE POSTERIOR INTERNAL SURFACE OF THE LIVING EYE; WITH AN OUTLINE OF THE THEORY OF THE ORDINARY OPHTHALMOSCOPE.

BY A. M. ROSEBRUGH, M.D.

Read before the Canadian Institute, January 16th, 1864.

Before entering upon the construction and mode of using this Instrument I propose:

(1.) Dwelling briefly upon the optics of the eye, glancing at the cause of the blackness of the pupil under ordinary circumstances and the invisibility of the parts behind it, and

(2.) Giving an outline of the optics involved in the ordinary Ophthalmoscope.

In order to make the subject as plain as possible, I have at the outset summed up the leading optical principles involved, and that they may be more readily referred to, I have arranged them in the form of *Definitions*—(1), Rays of light incident upon highly polished plate glass with parallel surfaces, are partly reflected and partly refracted. If the plate glass is thin, the rays that are not reflected may practically be considered to pass through the glass unrefracted.

(2.) There is a point in every double convex lens called the optical centre, rays of light passing through which are either unrefracted or are refracted parallel to their original direction.

(3.) Parallel rays of light, incident upon a convex lens, are so refracted that they leave the second surface of the lens convergingly and meet in a focus at the principal focus of the lens.

(4.) Conversely if rays of light diverge from a focus at the principal focus of the lens, the corresponding refracted rays will be parallel.

(5.) When diverging rays of light are incident upon a double convex lens, and radiate from a point beyond its principal focus, the corresponding refracted rays are brought to a focus on the opposite side of the lens and at a point further from the lens than the principal focus.

(6.) Converging rays under the same circumstances form a focus at a point between the lens and its principal focus.

(7.) As I shall have occasion to use the word *Camera* in this paper, I will here state that I refer to the instrument used in Photographing, which consists of a darkened box, to one end of which is adapted a tube containing one or more convex lenses of such strength that the principal focus is within the box. Objects in front of the lens will form an inverted image in the box which is usually received upon a screen of ground glass near the back of the *camera*. The eye of an observer in rear of the *camera* (and not nearer than eight inches from the ground glass,) sees this inverted image distinctly depicted upon the ground glass.

(8.) If the ground glass is removed, an aerial image is seen to occupy the position from which the ground glass was just removed.

The dioptric media of the eye are made up of the cornea, aqueous humor, crystalline lens, and vitreous humor, all differing in density and consequently in their refractive power, but the effects produced by their combination resemble those produced by a double convex lens, or a single spherical refracting surface, having its convexity towards the less refracting medium. Like a double convex lens, it too has an optical centre, any ray passing through which is either unrefracted or refracted parallel to its original direction, thus :—

Let E (Fig. I.) represent a section of an eye, and C its optical centre; any ray as AE passing through C will pass on to the retina unrefracted, or at least parallel to its original direction.

The position of the optical centre varies according to the focal adjustment of the eye, being further from the retina, when the eye is adjusted for near objects, than it is when adjusted for distant objects.

Its mean distance is considered to be near the centre of the crystalline lens.

For the sake of simplicity, in the accompanying diagrams, I have represented the eye as a homogenous body, possessed of a single condensing, refracting surface, which may be regarded as the optical equivalent of the various surfaces in a real eye, and may be considered sufficiently accurate for any optical conclusions involved in the present paper.*

It is well known that under ordinary circumstances the pupil of the eye appears to be perfectly black, and that all parts behind it are perfectly invisible; this was formerly thought to depend on the complete absorption of all the rays of light that fall upon the fundus or posterior internal surface of the eye, so that none of them passed out again from its interior.

That this is not the case can very easily be demonstrated by a simple experiment suggested by Wharton Jones:—"Having previously dilated the pupil of a cat's eye by a solution of Atropine or Belladonna, drop some water into the eye while the eyelids are held apart, and cover the cornea with a thin plate of glass. The optic nerve entrance and the vessels of the retina can then be distinctly seen slightly magnified."

In this experiment we in reality neutralize the refracting condensing power of the convex surface of the cornea. Here it will be seen that the water, filling up the space between the cornea and the piece of glass, forms a perfect concave lens with its concavity applied to the *cornea*, thus changing the *convex* to a plane surface. From this it is evident that as the fundus of the eye comes in view, when its refractive power is to a certain extent neutralized, therefore the blackness of the pupil and the invisibility of the parts behind it depend solely upon the refraction of the light by the ocular media.

This phenomenon of refraction may be demonstrated with any small camera obscura by simply placing a piece of pasteboard behind the ground glass so as to exclude all light from the camera except what reaches it through the lens; the ground glass being in focus, distinct images of objects in front of the lens are formed on its surface, notwithstanding which, the interior of the *camera* when viewed through the lens appears absolutely black.

* The same mode of representation has been adopted by Stellway von Carion, Vienna, and by G. Rainy, M D., Glasgow.

In the camera obscura we have an imitation of the eye, its ground glass screen representing the retina, and its lens—the cornea and lens of the eye.

If we remove the lens the back of the camera immediately becomes visible.

This phenomenon then can only be explained by the laws of refraction.

"When a properly formed eye is exactly accomodated for a luminous object, the diverging rays from this incident upon the eye are refracted by the ocular media in such a manner that they unite at a point in the surface of the retina which is the image of that object. *The retina in consequence of its transparency transmits much of this* light to the *choroid*, by which most of it is absorbed; but many of these rays are reflected in the same direction in which they entered the eye and return to the object whence they started. The object, then, and its image on the retina are reciprocal points (they may be considered conjugate foci) each being in turn object or image."* Thus, let E (fig. I.) represent an eye accommodated for the object O. In this case the diverging rays from O, falling upon the cornea of the eye E, are refracted by the media of the eye and collected at P, a point in the retina of E. This point, P, in E's retina, is the image of the object O; and since the rays, when reflected from the eye, simply retrace their steps, the rays from the retina at P will return only to the object O. These reflected returning rays cannot therefore meet the eye of a person at A, but the pupil of E will appear black. And, if the observer's eye be placed in the line OE the illuminating rays will be intercepted. From this it is apparent that without some special contrivance, one person cannot bring his eye into the direction of the rays returning from the eye under examination, without at the same time intercepting the incident rays. *This is effected by substituting reflected for direct light*, the observer placing his eye behind and looking through the mirror into the illuminated eye. This is the principle upon which is constructed the Ophthalmoscope which was invented in 1851 by Helmholtz, a German physiologist, but we are indebted to Liebreich, also a German, for the convenient little instrument now in general use by Ophthalmoscopists. This Ophthalmoscope, the theory of which is illustrated in fig. II., consists of a metallic mirror 1¼ inches in diameter and of about 6 inches focal length, pierced by a

* Hulke, Treatise on the Ophthalmoscope.

central sight hole the diameter of which is about $\frac{1}{6}$ of an inch. Let E (fig. II.) represent the eye under examination, and U its optical centre, NR are diverging rays from MQ a flame, falling upon the mirror OS which reflects them convergingly as KL towards the eye E. At a short distance from the eye the rays are intercepted by G a bi-convex lens of 2-inch focal length, which so increases their convergence that they form a focus near the optical centre and again diverge and illuminate a large portion of the fundus of the eye as at TP.

The pencils of light from any point in the retina, as *a*, fig. II., pass from the cornea, very nearly parallel* and meeting the bi-convex lens G they converge to a focus at the principal focal length of the lens, (see definition 3) at 2 inches where they form an enlarged and inverted image, which, with the rays from I, form an aerial (def. 7) image of the fundus of the eye visible to an observer's eye looking through the sight hole of the mirror OS. This aerial image may again be enlarged by placing a convex lens V in the clip which is adapted to the back of the mirror.†

In the combination which I have arranged I have succeeded in being able to receive this aerial image upon a screen of ground glass, and by substituting a "sensitized" plate for the ground glass, I have succeeded in being able to demonstrate that photographs can be taken showing the details of the fundus of the eye.

This instrument consists of a small photographic camera, to which are adapted two brass tubes (A and B) which meet each other at right angles (fig. 1), $1\frac{1}{2}$ inches in diameter, being respectively 4 and $2\frac{1}{2}$ inches in length. The longer tube B moves freely in the aperture of the camera and the shorter tube A is turned towards the source of light.

A tube of the same width C, $1\frac{1}{2}$ inches in length is joined to the side of the outer extremity of the tube B, opposite to and in a line with the tube A. The outer extremity of the tube B extends $\frac{1}{4}$ of an inch beyond its juncture with the tubes A and C, and is termi-

* When the accommodation of the eye is paralyzed by a strong solution of Atropine the eye is adjusted for parallel rays, or rays that are very slightly convergent.

† There is another mode of examining the fundus of the eye, with this instrument, called the direct method. The mirror and eye of the observer are brought within one or two inches of the eye under examination. If the eye under examination is a normal eye and has its accommodation paralized by Atropine, the rays of light that are reflected from the eye are parallel, and are brought to a focus on the retina of the observed eye if its refractive media are normal. But if either eye is myopic a concave lens is placed in the clip at the back of the mirror in order to give the reflected rays the necessary parallelism or divergence.

nated by a thin brass diaphragm having a central circular aperture of ⅜ of an inch in diameter.

CONSTRUCTION :—THE TUBES.

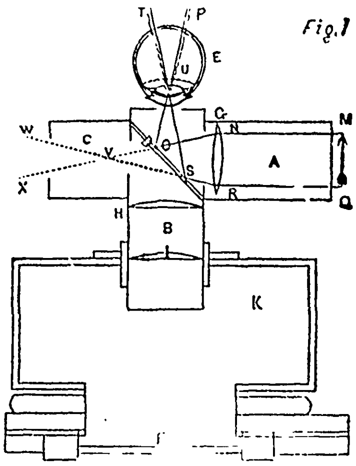


FIG. 1.

At the juncture of the tube A with B there is a circular aperture of one inch diameter, and between C and B an aperture of ½ inch diameter—affording a communication between A and C through B.

THE PLATE GLASS.

At the juncture of the tubes there is placed an elliptical piece of highly polished thin plate glass with parallel surfaces, which is inclined at such an angle to the tubes that a portion of a ray of light falling upon it through the centre of the tube A from the direction M Q is reflected at right angles to its original direction, and in the same plane with the centre of the tube B which will be through the centre of the aperture in the diaphragm. A portion of the ray will be refracted by the plate glass and pass through the tube C parallel to its original direction.

THE LENSES.

At the inner extremity of the tube A and as close as possible to its juncture with the tube B, a double convex lens G is placed 1¼ inches in diameter, and having a focus of 2½ inches. In the corresponding position of the tube B, or close to the plate glass reflector, the lens H is placed convexo-plane, of 5 inch focal length: 1⅗ inches from this is another lens also convexo-plane, and having a focal length of 5 inches, and having the same diameter, viz: 1¼ inches.

THE CAMERA.

The camera consists of a mahogany box 3 inches square and 7 inches high, having (to secure steadiness) a base 6 inches square.

At the aperture in the centre of the anterior side there is a brass collar fitted, through which slides the tube containing the lenses. At the opposite side of the camera is a central aperture 2½ inches square, behind which is a slide with a piece of ground glass 2½ inches square. This slide moves in grooves for the purpose, and can be removed to make way for a slide containing a sensitized plate also about 2½ inches square.

PHOTOGRAPHING.

As yet I have not attempted a photograph of the retina of the human eye, but have confined my experiments to the lower animals, and I have used solar light only in order to shorten the time as much as possible, but I do not doubt that diffused light, particularly that reflected from a bright cloud, would, with a longer "exposure," answer very well. In using the instrument for this purpose, a table of the ordinary height is placed near a window where the light of the sun falls upon it. It is well to have the shutters closed, and a beam of solar light admitted of the size of the illuminating tube, but this is not absolutely necessary, if precautions are taken to prevent diffused light entering the camera, and the ground glass is shaded while examining the image on its surface.

The camera is turned at right angles to the source of light, and the tube A or illuminating tube turned so that the light falls full into the tube, and is incident upon the whole of the lens G.

When the camera and tube are in proper position, a cone of light issues from the end of the camera tube through the centre of the aperture in the diaphragm, which is the condensed light from the lens G, reflected from the plate glass D. This cone forms a focus about ½ inch outside the diaphragm which can be seen by holding a thin piece of white paper near the diaphragm. In photographing the eye of a cat, I found it necessary to put it under the influence of chloroform, but the image of the optic nerve, vessels, &c., upon the ground glass is so very bright and clear that I do not doubt if the most sensitive process be adopted, the impression could be taken instantaneously, thus rendering anesthesia unnecessary.

POSITION.

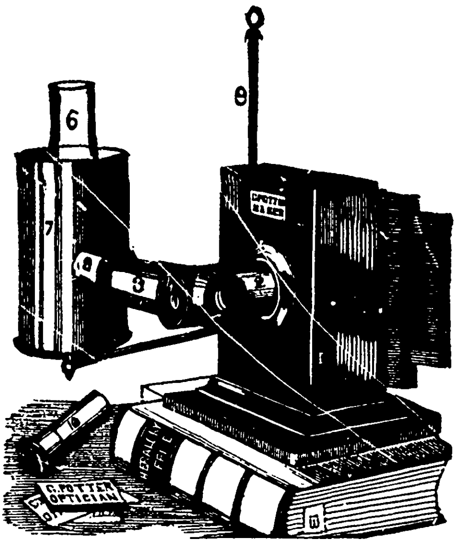
In either case the eye is brought to the proper position, and the eye-lids held apart by an assistant. If it is the eye of a patient to be photographed the instrument is mounted upon its case, 8 inches high, which, for most persons, gives it the right height. The patient being seated upon a chair, as close as possible to the table, leans forward towards the camera, and brings his eye as near as possible to the aperture in the diaphragm, the brow rests lightly against the end of the tube, and by bringing the elbow upon the table he, with the palms of his hands, extemporizes a very good rest for his chin.

The pupil of the eye to be photographed must be previously dilated with atropine.

PROCESS.

When the instrument is in its proper position, and the light from the plate glass enters the dilated pupil, the fundus of the eye is brilliantly illuminated, and its reflection passes out of the eye and through the plate glass and lenses, and forms an inverted image upon the ground glass at the back of the camera, where the observer in the rear can see the optic nerve entrance, distribution of the arteries and veins, &c., beautifully depicted, but magnified about 4 diameters. If the details of the image are not perfectly defined the camera tube is moved backward and forward until the proper focus is obtained. This image can be seen by the observer again very much magnified by placing to his eye a lens of say 6 inch focal length, and bringing his eye with the lens to within 6 inches of the ground glass, but the image will be seen even better by moving the ground glass to one side—the observer will then see the *aërial* image of the reflection from the eye which will occupy the same position as the ground glass previously occupied, (see Definition 8). In photographing, the slide containing the ground glass is removed and a slide substituted containing a plate glass "prepared" by the ordinary collodion process. An "exposure" of about 5 seconds is sufficient. If the "developing" proves that a good "negative" has been obtained, it is "fixed," and used for printing the photographs; if not, other plates are used until a more satisfactory result is obtained.

AS AN OPHTHALMOSCOPE.



The position of the instrument when the light is supplied by a lamp:—1 the camera, 2 camera tube, 3 illuminating tube, 4 diaphragm with central aperture, 5 slide with ground glass, 6 glass chimney of lamp, 7 brass tube four inches in diameter which acts as a shade and from which projects 8 a brass collar opposite the flame of the lamp and to which is adapted 3 the illuminating tube of the instrument, 9 upright of the lamp stand, 10 eye-piece containing a camera lens of three inch focus to be adapted to the free extremity of the camera tube, when the eye-piece is used the camera is dispensed with.

In using this instrument as an ophthalmoscope, that is, for examining the interior of the eye, artificial light is used. The light from a kerosine oil lamp answers very well, but the best light for ophthalmoscopic purposes is from the gas-argand-burner, and the most convenient is the moveable table lamp, supplied with gas through a flexible tube. The evening is the best time for making these examinations; if in the day time, the room is darkened. The instrument is placed in the same position in regard to the light as when solar light is used, but the flame of the lamp is brought within 2 or 3 inches of the entrance of the illuminating tube, and the two are placed on the same horizontal line. A screen, to shade the ground glass and the observer's eyes, is placed between the light and the back of the camera; or what I have found to be much better, a metallic tube or shade is placed around the lamp, from an aperture in which, projects a collar somewhat resembling that of a magic lantern, of the right size to allow the illuminating tube of the instrument to fit closely. Indeed with this apparatus the camera can be dispensed with, that is, in making examinations of the eye simply, but when the object is to demonstrate the fundus of the eye to a number of persons the camera is used both with and without the ground glass.

Since this paper was read before the Institute, Mr. Potter has constructed for me a modification of the above instrument which I find to be very convenient.

It shews the fundus of the eye of the cat or dog beautifully, but it remains to be seen whether the illumination is sufficient for examining the fundus of the human eye.

The light is supplied by an ordinary coal oil lamp which is placed in a box about six inches square and fifteen inches high. Opposite the flame of the lamp there is an aperture in one side of the box from which projects a brass tube or collar to which is adjusted the illuminating tube of the instrument.

In the outer or camera tube is a double convex lens of 2 inch focus instead of the two lenses of 5 inch focus each. At the outer extremity of this tube a moveable eye piece is attached three inches in length, and containing a convex lens of three inch focus.

OPTICS.

1st. *Illumination*:—Let MQ (fig. 1) represent parallel rays of solar light incident upon the double convex lens G: at the points NR they are refracted and emerge from the lens convergingly towards a focus V in the tube C, but at O and S they are intercepted by the plate glass D, a portion of the rays are reflected by its polished surface in the direction E, and rays not reflected or absorbed are transmitted and pass to form a focus at V—the principal focal distance of the lens G, and again diverge in the direction WX. The rays reflected from the surface of the plate glass form a focus at U (which is also the focal centre of the eye E), at the same distance in front of the plate glass D as V is behind it; these rays again diverge and illuminate a portion of the fundus at TP.

2nd. *Reflection*:—Let E (fig. 2) represent the same eye illuminated as just described; D the plate glass; and HI the lenses in the camera tube. Rays from any portion of the illuminated fundus as *a*, are reflected from the fundus and emerge from the cornea at *bc*, the width of the dilated pupil, and proceed to the plate glass D, parallel, where some of its rays are reflected from the plate glass through the lens G in the direction of the source of illumination, but other rays proceed to *de*, where they are incident on the lens H by which they are refracted, and they would proceed to a focus at the principal focal distance of the lens H (viz., at P at five inches) but they are again intercepted at *fg* by the lens I, which refracts them to an earlier focus, at *h*. In the same way rays from *i*, on E's retina, proceed from the cornea parallel to the axis *ikm* and are also refracted by the lenses H and I, and are brought to a focus at *o*. In like manner all points intermediate between *i* and *a*, on E's retina, are reflected from the fundus, and refracted by the lenses forming an inverted image of *ia* at *oh*, which is received upon the ground glass placed at F.

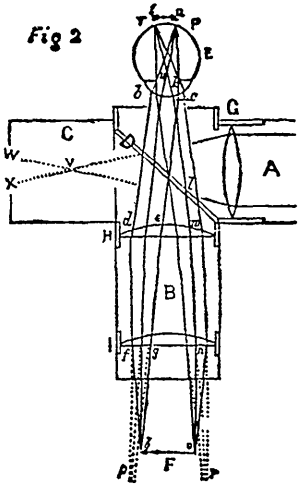


FIG. 4.

ADVANTAGES.

The advantages I claim for this instrument are:—

1st. The simplicity of its construction, taking into consideration its twofold purpose, namely, as an ophthalmoscope and as a photographing instrument. My friend Dr. Noyes, of the New York Eye Infirmary, constructed an instrument for photographing the fundus oculi, and which was, I believe, to a considerable extent successful, but its construction was too complicated and the instrument too expensive to be generally adopted. Dr. Noyes' instrument is constructed somewhat on the principle of the binocular microscope. Any good optician can construct this new instrument. The one I exhibit to the Institute was made by Charles Potter, No. 20, King-street East. They can be had complete for $10.

2nd. The limited experience necessary in order to use it successfully. The ordinary Ophthalmoscope requires months of practice before it can be used satisfactorily.

3rd. Being able to see the aërial image free from reflections from the object lens, which reflections are serious obstacles to beginners.

4th. Being able to receive the image either of a healthy or diseased fundus upon a screen of ground glass, which can be seen by a number of persons at the same time, and can be taken advantage of by gentlemen lecturing upon the physiology of the eye, or upon the pathology of its deep structures.

5th. With it, artists will be enabled to make coloured diagrams of the internal eye, which, with the instruments now in use, has never yet been effected; thus Mr. Hulke, in his Treatise on the Ophthalmoscope, and Jabez Hogg in the preface to his Manual of Ophthalmoscopic Surgery, June, 1863, apologising for the imperfections of the diagrams illustrating their works, state that it is impossible to procure the services of artists having the requisite knowledge of the use of the Ophthalmoscope.

6th. With this instrument I have demonstrated that photographs can be taken showing the details of the fundus of the eye.

In conclusion, I would express the hope that the invention of this instrument will contribute something towards popularizing Ophthalmoscopy, as, in investigating diseases of the eye, the Ophthalmoscope is undoubtedly even more essential than the Stethoscope in diagnosing diseases of the heart or lungs; and I trust its use will aid in banishing from ophthalmic nomenclature the indefinite term of amaurosis, where, as Walther observed, "the patient and physician are both blind."

ON INSCRIBED SLING-BULLETS.*

BY THE REV. JOHN M'CAUL, LL.D.,

PRESIDENT OF UNIVERSITY COLLEGE, TORONTO, AND OF THE CANADIAN INSTITUTE.

The leaden bullets, which were thrown from slings, were called in Greek μολύβδαιναι, and in Latin *glandes;* the former indicating the material, "lead," the latter, the shape, "acorns." As an interesting and well-prepared account of the use of such mis-

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* Mommsen, *Corpus Inscriptionum Latinarum*, i. Berlin, 1863.
Ritschl, *Prisc. Lat. Mon. Epig. ad archetyporum fidem exemplis lithographis repræsentata*, Berlin, 1862.
Boeckh, *Corpus Inscriptionum Græcarum*, ii. Berlin, 1833.
Franz, " " " iii. Berlin, 1853.
Curtius, " " " iv. Berlin, 1856.
De Minicis, 'Sulle antiche ghiande missili e sulle loro iscrizioni,' *Atti della Pontif. Accad. d'Archeol.* xi. Rome, 1844.
Hawkins, *Archæologia*, xxxii. London, 1847.

siles, in military operations, is given, in the *Archæologia*, vol. xxxii., by Mr. Walter Hawkins, it is unnecessary for me to discuss the subject in this aspect, especially as my object is to treat them not so much historically as epigraphically. A few preliminary remarks, however, may be useful before entering on the examination of the inscriptions. The bullets, which we are considering, were cast in a mould, and bore letters or devices, or both, on two sides or on only one. In form they were more like an almond than an acorn, but many are pointed at both ends; in size, they are generally about one inch and a half in extreme length, and under one inch in extreme breadth; and in weight they are stated* to vary from one and a half to three and half ounces. As slings were frequently employed in sieges,† by both parties, the greater number of the extant specimens have been discovered in or near towns which were besieged.

Those that bear Greek inscriptions have been found chiefly in Sicily, but also in Cephallenia and Corcyra, and at Athens, Marathon, and Corinth. The following are the principal varieties of inscription :—

(1) The name of a man :

‡ΚΑΛΛΙΣΤΡΑΤΟΥ, §ΕΥΒΟΥΛΙΔΑΣ.

(2) The name of a place, or of a people :

§ΚΑΤΑΝΑ, ||ΕΛΛΕΝΙ.

(3) The name of a deity :

||ΗΡΑΚΛΕΙ.

(4) The name of a man in connection with "victory."

**ΑΘΗΝΙΩΝΟΣ ΝΙΚΗ.

(5) The name of a deity in connection with "victory."

||ΔΙΟΣ ΝΙΚΗ, ||ΝΙΚΗ ‡‡ΜΗΤΕΡΩΝ.

(6) Words conveying orders, jokes, or sarcasms :

††ΔΕΞΑΙ, ‡‡ΕΥΣΚΗΝΟΥ, ‡‡ΤΡΩΓΑΛΙΟΝ.

There are also different devices, as a thunderbolt, a leaf, a scorpion.

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* *Archæologia*, xxxii. p. 104.

† Livy, xxxviii. 29; Sallust, *Jugurtha*, 57; Appian, *de bello Mithridat.* 32, 33 Tacitus, *Annals*, xiii. 39.

‡ Boeckh, *Corp. Inscrip. Græc.* n. 1806.

§ Franz, " " " nn. 5570, 5687.

|| Curtius, n. 8530*d*.

** Franz, nn. 5570, 5748.

†† Curtius, n. 8529.

‡‡ Curtius, nn. 8530*a*, 8530*b*.

The *glandes*, that bear Latin inscriptions, have been found* chiefly at *Enna*, *Asculum*, *Firmum*, and *Perusia*. They have nearly the same varieties as those which I have already noticed.

(1) †L·PISO·L·F COS, †Q·SAL IM.
(2) ‡FIR, OPITERGIN.
(3) §MAR
VLT.
(4) **C·CAESARVS
VICTORIA.

(6) ††FVGITIVI PERISTIS, ††FERI, ††ESVREIS ETME CELAS.

There is a peculiar class inscribed with the designation of legions, as

(7) ‡‡L·V·M P FEL, ‡‡L·XII SCAEVA PR·PIL, ‡‡L·MAENIVS PR·L·XII X·MILLIA.

(1) The names of men inscribed on these objects were those of the chiefs, or commanding officers, or persons who ordered the casting of the bullets. On one|| we have the maker's name clearly stated, *scil.* T. FABRICIVS FECIT.

L·PISO·L·F·COS, *i.e. Lucius Piso, Lucii filius, consul*, on a *glans* found at Enna, is *Lucius Calpurnius Piso*, who was consul in 133 B.C., and led an army in that year against the slaves under Eunus, in Sicily. Enna, near which this bullet was found, was not captured by him but by his successor, *Rupilius*. We may infer, however, from this and similar inscriptions, as Mommsen suggests, that he had attempted to take it. Q·SAL IM stand for *Quintus Salvidienus* [*Rufus Salvius*] *Imperator*, who had a command at Perusia, in 41 B.C. He was on his way to Spain with six legions, when he was

* Mr. Hawkins, *Archæol.* p. 105, observes: "Specimens of sling-bullets with Roman characters, are far more scarce than those with the Greek letters. The largest number have been found at Florence, where (as conjectured) there was formerly a Roman arsenal." I am not aware of the authority on which these statements have been made. A considerable number have been found in Tuscany, at *il Castellare*, not far from Pisa. See Targioni Tozzetti, *viaggi in Toscana*, i. p. 352.

† Mommsen, *Corp. Inscrip. Latin.* nn. 642, 689.

‡ nn. 652, 710.

§ n. 686

** n. 685.

†† nn. 647, 649, 692.

‡‡ nn. 695. 700. 701.

|| Mommsen. n. 711.

recalled by Caius Cæsar, to take part in the siege. Eckhel, v. 299, notices a denarius having on one side the head of Cæsar, with the legend C·CÆSAR·III·VIR·R·P·C, *i.e. Caius Cæsar Triumvir Reipublicæ Constituendæ:* and on the other a winged thunderbolt, also found on this *glans*, with the legend Q·SALVIVS·IMP·COS·DESIG, *i.e. Quintus Salvius Imperator Consul Designatus.* The date is almost certainly determined to the year 41, for in the year following *Quintus Salvius* was killed, as we learn from Dio, xlviii. 33. On a *glans*, which is a memorial of Cæsar's hostilities with the sons of Pompey in Spain, we have a similar inscription: CN·MAG IMP, *i.e. Cneius Magnus Imperator, scil.* Cneius the son of Pompey the Great. From Mommsen's account of it, n. 681, it does not appear whether it was found at *Munda*, where the decisive battle was fought, or at *Attegua*, which was besieged during this war.

ΚΑΛΛΙΣΤΡΑΤΟΥ, on a bullet found in Corcyra, seems to be the name of the *Prytanis eponymus*, in whose year the missiles bearing the name were cast. See Boeckh, nn. 1865, 1866.

The last two inscriptions in (7) have the names of the centurions, who ordered the casting of the *glandes, scil. Scæva* and *Lucius Mænius*, of the 12th legion. Mommsen regards them both as *primipili*. Of the first there can be no doubt, as the letters PR·PIL prove his rank; but as the latter is designated merely by PR·, I am inclined to think that he was *Princeps*.

X·MILLIA, 10,000, of course, gives the number of bullets that were ordered.

In the *Journal of the Archæological Institute*, 1863, p. 198, we find another example of the *primipilus*, on a *glans*, (in the possession of Mr. Fortnum), which was also found at Perusia. It bears the inscription,—ATIDI·PR·PIL·LEG·VI, *i.e. Atidii Primipili legionis sextæ.*

(2) The names of towns may have indicated the places where the bullets were made, or from which those who used them came, or in defence of which they were thrown; and the names of peoples were of those by whom or for whom they were thrown. FIR· in n. (2) is inscribed on a *glans* found* on the bank of the river *Truentus.*

* Mr. Rich states that this bullet was "found at the ancient Labicum." This is a mistake, probably derived from Ficoroni, who makes the same statement. See Mommsen, n. 652.

Mr. Rich, in his "Companion to the Latin Dictionary," under *glans*, observes that 'the letters are for *firmiter*, "Throw steadily," or *Feri Roma* (Inscript. *ap.* Orelli, 4932), "Strike, O Rome!"' I much prefer Mommsen's suggestion, that FIR· are the first three letters of FIRMO, in the sense "thrown from Firmum," and that the allusion is to the siege of that town, whilst occupied by Cn. Pompeius Strabo, during the Social war, in 90 B.C.

The bullet bearing ΕΛΛΕΝΙ, *i.e.* Ἑλλήνων, or Ἑλληνίκων, is said to have been found on the plains of Marathon, but its genuineness is *justly doubted. †ITAL, *i.e. Italicorum*, is on *glandes* which were thrown on the side of the *Socii Italici;* and those which are inscribed OPITERGIN belonged to the *Opitergini*, who were warm allies of Cæsar.

(3) The names of deities are most probably of those gods and goddesses, whose aid was specially invoked by the combatants on either side, or to whom the missiles were consecrated, as MAR·VLT, *Marti Ultori.*

(4) The names of men in connection with "victory," of course indicate the wish that those who are named may succeed. The inscription ΑΘΗΝΙΩΝΟΣ ΝΙΚΗ, on μολύβδαιναι found in the *campus Leontinus*, shows that such bullets were thrown by the slaves in the Servile war in Sicily, 102–99 B.C., for Athenio was a leader in that insurrection. The *glandes* found near Perusia, which bear the words C·‡CAESARVS·VICTORIA, were thrown by the besiegers, partisans of Octavianus.

(5) The inscriptions, in which the names of deities are used in connection with "Victory," indicate the gods or goddesses who were believed to be specially interested in favour of each side, or who had been chosen as patrons. Thus ΔΙΟΣ ΝΙΚΗ may have been on the Roman missiles, and ΝΙΚΗ ΜΗΤΕΡΩΝ (otherwise ΝΙΚΗ ΜΑΤΕΡΩΝ) on the Sicilian. That the *Deæ Matres* were worshipped in the island, appears from the statements of Diodorus Siculus, iv. 79, 80, and Posidonius, in Plutarch, *Marcellus*, c. 19, independently of the evidence supplied by this inscription. Another of these Sicilian bullets is inscribed with the words ΝΙΚΗ ΜΑΤΕΡΟΣ, from which

* Some, however, have been found there, which seem to be unimpeachable. See Dodwell's *Tour*, ii. 161. Those found at Athens were probably thrown during the siege by Sylla.

† Ritschl, Pl. viii. nn. 20, 21.

‡ In *Cæsarus* we have the archaic termination of the genitive of the third declension. Thus *Cererus*, in n. 566, *hominus*, in n. 200, *patrus*, in n. 1469, &c.

we may derive confirmation of the statement of Cicero, *Verr*, iv. 44, that there was a temple of the *Magna Mater* amongst the *Enguini*.

The inscriptions, classed under (6), are generally addresses to the missile or to the enemy. FERI, "strike," is as a direction to the *glans* not to miss. Mommsen aptly cites, in illustration, a passage from the *Marcellus* of Plutarch, c. 8,—ἐν ταῖς μάχαις, ὅταν διώκωσι τοὺς πολεμίους, πυκνὸν τὸ φέρι, τουτέστι παῖε, παρεγγυῶσιν ἀλλήλοις. Orelli, n. 4932, on the authority of Cardinali, gives another form in which *feri* is used:—ROMA FERI, which he explains—"O dea Roma, feri hostem!" The reading of this inscription is doubtful: the first letter seems to be P not R and the final A resembles an imperfect P. As the two words are on different sides of the *glans*, it might appear uncertain with which we should begin. There can be little doubt, however, that *feri* is the commencement, as in another similar inscription, FERI PIC, *i.e. feri Picentes*. This consideration should lead us to prefer, with Mommsen, either *Pomp*[eium], *scil.* the general in command of the Romans in *Picenum*, or *Roma*[nos]. ΔΕΞΑΙ, "take this," was imitated by the Latin *accipe*. This latter word appears on a bullet, exhibited by the Count d'Albanie, at a meeting of the Archæological Institute, in 1863. It is in reversed letters, and has but one C. The cause of the inversion in this and in other similar examples, is that the letters as cut in the mould were not inverted, as they should have been, in order that the impression might be read in the usual direction.

It is worthy of remark, that the bullet, exhibited by the Count, was "stated to have been found amongst the scoria of an extensive ancient lead-working in the kingdom of Granada. It is believed that the mine was worked by the Romans and also by the Celtiberians, and the scoria are still smelted in order to extract portions of silver."

The letters ΦΑΙΝΕ appear on the bullet presented by Mr. Hawkins to the Society of Antiquaries of London, and described by him in the article in the *Archæologia*, that I have mentioned in p. 93. In that paper he gives the following account of the inscription:

It appears to exhibit on one side the characters ΦΑΙΝΩ or ΦΑΙΝΕ, commencing at the smaller or taper end, and extending to the larger, where they are slightly defaced in consequence of the forcible compression of the pellet from impact. If the word be ΦΑΙΝΟΥ, or in the Ionic dialect ΦΑΙΝΕΩ, it will mean "Appear," or "Show yourself."

From these remarks it appears if I understand them correctly, that Mr. Hawkins is dissatisfied with the use of ΦΑΙΝΕ in the sense, "appear," or "show yourself;" and thinks that if this had been the meaning, we should have had the passive or middle ΦΑΙΝΟΥ; and yet in another place, p. 105, he translates ΦΑΙΝΕ "appear." Again, he seems to doubt whether the word was ΦΑΙΝΩ, or ΦΑΙΝΕΩ, which latter he believed to be the Ionic form of ΦΑΙΝΟΥ. On reference to the representation of the bullet in his drawing, it is plain that the word is neither ΦΑΙΝΩ nor ΦΑΙΝΟΥ, but ΦΑΙΝΕ; after which there may, perhaps have been another letter. What that other letter was is of course doubtful, but it certainly was not Ω. ΦΑΙΝΕΟ, not ΦΑΙΝΕΩ, is another form of ΦΑΙΝΟΥ. Mr. Hawkins had, I think, some reason to be dissatisfied with the use of ΦΑΙΝΕ in the sense "appear," "show yourself;" but the passive or middle ΦΑΙΝΟΥ, is not necessary, as φαίνω is sometimes used intransitively. My objection to either of these words in the assigned signification is, that I do not recollect having met with a similar instance, whilst I at once call to mind the the use of *φάνηθι* by the Tragedians; *e. gr.* Æschylus, *Persæ*, 667; Sophocles, *Ajax*, 697; Euripides. *Phœnissæ*, 1748.

The true explanation of the inscription is, in my judgment, suggested by the consideration of the probable date. Mr. Hawkins judiciously remarks on this subject:

> This specimen was found lodged in the Cyclopian walls of Samé in Cephalonia. The determination of its date must depend on the degree of probability which may be attached to the supposition that it was deposited there by one of the Achæan slingers from Ægium, Patræ, and Dyme, of whom there were one hundred in the army with which the Roman consul, M. Fulvius, reduced that place, after a siege of four months, B.C. 189.—(Livy, xxxviii. 20.)

The siege of Same took place, as is well known, at the end of the Ætolian war, in which Phæneas, ΦΑΙΝΕΑΣ, took a prominent part, as Prætor of the Ætolians. (See Livy, xxxii. 32; xxxiii. 3; xxxvi. 28; Polybius, xvii 1; xviii. 20; xx. 9.) In this year, B.C. 189, he, in conjunction with Damoteles, had obtained peace from M. Fulvius, from which, however, the Romans specially excluded Cephallenia. (See Livy, xxxviii. 8; Polybius, xxii. 12.) It appears, then, that if there was a letter after ΦΑΙΝΕ, it probably was Α, *i.e.* Φαινέα for Φαινέου. The inscription of his name seems to indicate that the bullet was Ætolian, cast whilst he was Prætor (see p. 95), or it may have been so stamped to signify to the besieged that Phaeneas was then on the Roman side.

ΕΥΣΚΑΝΟΥ is on a *glans* made of brass. Vischer explains it as standing for *εὖ σκήνου*, an ironical address to the person struck by it, "be lodged well," "take good quarters." The view of Curtius, that it was an address to the missile to place itself well in the head of the enemy, seems to me preferable. ΤΡΩΓΑΛΙΟΝ, *i.e.* *τρωγάλιον*, is on a bullet preserved at Argos. It means "a sweet-meat," or "fruit for dessert," and is used here in the sense– 'Here's a sugar-plum for you.' On the original the inscription stands thus:

ΤΡΩΓ
Ε
ΑΛΙΟΝ,

whence Goettling proposed the strange reading *Τρῶγε Ἄλιον*, in the sense, I presume, "Bite it in vain," like our "This is a hard nut to crack." Curtius explains the E as a numeral denoting the number of bullets thus inscribed. To me this explanation seems unsatisfactory, and I am inclined to suggest that it was intended that *τρωγ* should be taken twice, *scil.* *τρῶγε τρωγάλιον*, "eat a sugar-plum."

ESVREIS ET ME CELAS, *i.e.* *esuris et me celas*, "you are starving, and hide* it from me," refers to the famine in Perusia, during the siege, and the extraordinary care with which L. Antonius endeavoured to conceal it from the besiegers. See Appian, v. 35. On the same *glans*, which bears C·CAESARVS VICTORIA, we have also

LANTONI CALVI†
PERISTI,

i.e. *L. Antoni calve peristi*, "Lucius Antonius, you bald-pate, you are undone." There is no historical testimony as to the baldness of Lucius Antonius, but De Minicis believes that he has found evidence of it on a denarius bearing a representation of his head.

Some expressions in inscriptions of this class are, as might be expected, very coarse. Thus we have on one, belonging to the be-

* This use of *celare* with the a[ccu]sative is not uncommon. Thus in Cicero, *Phil.* ii. *Eleuim vereor, ne aut celatum me [a]b ipsis illis non honestum*, &c. The meaning of *celatum me* is not "that I was concealed," but "that I was kept in the dark," "that it was concealed from me." See *Epist. ad fam.* vii. 20.

† The second I is effaced, II standing as usual for E; or the horizontal lines of E have disappeared.

sieged, *PET CVLVM OCTAVIA, *i.e. pete culum Octaviani;* and another, thrown by the besiegers, bears †LA CALVE FVLVIA CVLVM PAN, *i.e. Luci Antoni calve, Fulvia, culum pandite.*

(7) The legionary inscriptions appear on *glandes* found in Picenum and also in Perusia, such as LEG·XX, L·XV, *Legio vicesima, Legio quinta decima,* L·V·M P FEL, *Legio quinta Macedonica pia felix.* It is especially worthy of observation, that amongst this class are noticed some bearing epithets, which were certainly not used before the time of the Emperors—*e. gr.*,

L·XII
FVL

Legio duodecima‡ *fulminata*, and

LEG·XXX
VV

Legio tricesima Ulpia victrix. Suspicions are at once excited as to the genuineness of *glandes* of this class, especially those regarding which Mommsen observes, "*non reperiri apud scriptores antiquiores, eas que nuper demum emersisse omnes et maxime insinuasse se in museum Minicianum.*" And yet there are some, regarding which there can be no reasonable doubt.

From the foregoing pages it appears that many of the inscriptions on the Greek and Latin sling-bullets may be read and explained without much difficulty. There are a few, however, particularly those consisting of merely initial letters, of which no probable interpretation can be offered. Of those, which are doubtful, the most remarkable is one that has frequently been found at Perusia. It is given by Mommsen, n. 687, as LVFVIASIA, or, rather, LVFVLASIA; but on comparing Ritschl's, Pl. ix. nn. 40, 41, 42, 43, 40*b*, and 42*b*, it seems certain that the true letters are LVFINASIA, as they are clearly written in n. 41. From a reading of the portion after LV as INEMASA, De Minicis ingeniously suggested *sine maza*, with reference to the want of provisions in Perusia. This is, however, undoubtedly incorrect. Mommsen can offer no other explanation than that LV stands for *Lucius, scil. Lucius Antonius,* and

* Mommsen, nn. 682, 684. It is extremely difficult to decipher this inscription. The reading given above is believed to have been suggested by the accomplished epigraphist, Borghesi.

† See Kellermann, *Vigil. Rom.* n. 249.

FVL for *Fulvia*, whilst ASIA indicates *Marcus Antonius*, who was at the time in Asia. The use of LV for Lucius, although a solœcism, may, he thinks, be excused "*tali plebei hominis scriptione.*" There are, I think, but few who will accept this view. And yet in this case, as in many others, it is far easier to tell what interpretation should be rejected than it is to propose one which should be adopted.

Of the various expansions, that have presented themselves to my mind, there is not one which I regard as sufficiently probable to induce me to propose it.

In addition to leaden *glandes*, there have also been found in Sicily* objects of a similar form, made of clay, *argilla*. I have never seen one, but they are described as being of the size of an egg of our domestic fowl, and having on one side a figure, indistinct, but said to resemble Hercules, a man with a sword, a man with a helmet in one hand and a shield in the other, or a man binding shoes on his feet. The inscriptions on them generally consist of the following abbreviations: ΠΡΩ ΦΥΛ, *i.e.* πρώτα φυλά; ΔΕΥ ΦΥΛ, *i.e.* δευτέρα φυλά; ΤΡΙ ΦΥΛ, *i.e.* τρίτα φυλά, followed first by ΦΑ, which seems to stand for φρατρία, then by ΠΑΕ, ΛΑΚΥΝ, and other letters, probably the commencement of the names of places, and finally by names of men, supposed to be of magistrates, as ΦΙΛΟΞΕΝΟΣ ΑΡΚΕΣΙΛΑ, *i. e.* Φιλόξενος Ἀρκεσίλα. Franz, n. 5468, remarks: "*Cui usui inservierint non constat. Ratione habita figurarum impressarum haud scio an pertineant ad milites.*" I am inclined to think that these objects are similar to those described by Cæsar, *Bell. Gall.* v. 43: *ferventes fusili* ex argilla glandes fundis *et fervefacta jacula in casas, quæ more Gallico stramentis erant tectæ, jacere cœperunt.* This use of φυλή and φρατρία calls to mind the Homeric: Ὡς φρήτρη φρήτρηφιν ἀρήγῃ, φῦλα δὲ φύλοις; and the words appear to denote divisions and sub-divisions of an army. See Thucydides, vi. 98. Hence we may conjecture that these missiles were made for the bodies named thereon, and that the names of places and of men are used in the senses already noticed in pages 95, 96.

Inscribed sling-bullets were also used for the purpose of communicating information to the besieged or the besiegers; and, in addition to them, were similar, but apparently different objects, thrown from slings, called by Appian, *Mithridat.* 31, πεσσοὶ ἐκ μολύβδου.

* See Franz, *Corp. Græc. Inscrip.* iii. nn. 5468, 5567, 5620, 5686, 5743; also the authorities cited by him:—Alessi, "'Littera sulle ghiande di piombo iscritte, trovate nell' antica città di Enna,' Palermo, 1815;" and Mommsen, Zeitschrift. f. Altreth. 1846, n. 98, p. 784.

Mr. Hawkins, *l. c.*, notices "many leaden bullets for slings, found among the ruins of Eryx," [in Sicily], "some of which are inscribed with imprecations. (See Captain Smyth's 'Sicily and its Islands,' p. 242.)" He gives as an instance "one of these inscriptions, which is translated: Your heart for Cerberus."

No sling-bullets have, so far as I am aware, been discovered in Great Britain. There are, however, peculiar leaden objects, bearing devices and inscriptions, which have been found at Felix-Stowe, in Suffolk, and at Brough-upon Stanmore, in Westmoreland. It is not clear to what age they belong, or for what purpose they were intended. See Mr. C. R. Smith's *Collectanea Antiqua*, iii. p. 197, and *Journal of Archæological Institute*, 1863, p. 181. Mr. Smith appears to regard them as "Roman seals fastened to merchandize of some kind," but observes that "their general character seems to bespeak a Phœnician origin."

I do not see sufficient grounds for either of these opinions.

P.S.—Since the foregoing article was in type, I have noticed a report, in the *Gentleman's Magazine* for June, 1863, of the proceedings at a meeting of the Society of Antiquaries of London, on May 7th.

From this report it appears that the inscription on the *glans* exhibited by the Count d'Albanie was deciphered by Mr. Franks, who was "of opinion that the βουστροφηδόν character of the inscription was due to Phœnician influence,—the bullet having been found in a lead-mine in Granada." In this opinion of the learned Director I cannot concur: the inversion of the letters in this instance, as in Mommsen's n. 646, seems to me to be merely the result of a blunder of an unskilled or careless workman, who had not inverted the letters on the mould so as to give an impression that could be read in the usual direction. There are examples, however, of another kind of inversion, whereby the letters are turned upside down, which seems to have been intentional and not due to accident or mistake. See Mommsen's nn. 682, 694.

NOTE ON THE OCCURRENCE OF ALLANITE IN CANADIAN ROCKS.

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(*Laid before the Canadian Institute, February* 20, 1864.)

The mineral *Allanite* or *Orthite* is a comparatively rare species. Up to the present time, the only announcement of its occurrence in Canada, is contained in the following brief notice by Prof. Sterry Hunt, given in the last Report of the Survey (1863.)

" CERIUM :—Some small crystals of a mineral having the aspect of Allanite were found in a feldspathic rock near Bay St. Paul, and gave by analysis a portion of oxide of cerium with lanthanum. Minute crystals of a similar mineral have been observed in a rock composed of labradorite and hypersthene, from Lake St. John."

In a collection of specimens, obtained from the Muskoka district of Upper Canada by Mr. H. White, P. L. S., and lately submitted to me for examination, I found a number of sharp-edged fragments of a black amorphous mineral, which proved to be a compact variety of allanite. These fragments had much the appearance of anthracite coal, or pitchstone. Some of them were as large as hazel nuts, and the whole weighed over two ounces. They were obtained, according to Mr. White and his son, from a vein an inch or more in width, at Hollow Lake, the head-waters of the South Muskoka. This lies far within the Laurentian area; but I am unable to ascertain whether the vein occurs in an ordinary gneiss rock, or in one of the anorthosites of the upper part of the Laurentian series.

The presence of this mineral, in such comparative abundance, in our Laurentian rocks, is a fact of some interest; and I have therefore thought it desirable to insert a short notice of the discovery in the *Canadian Journal*.

The allanite of this locality constitutes a somewhat distinct variety, characterized more especially by its want of crystallization. It appears to resemble the variety from East Bradford, Chester County, Pennsylvania, analysed by Rammelsberg, (*Mineral chemie*, 744, 746), and that from Monroe, Orange County, New York, examined by Genth (*Am.*

Journ. Science [2] xix., 20.) The specific gravity, however, is considerably lower than in these latter varieties, and in others from Pennsylvania analysed by Genth. One specimen gave me 3.255; another, apparently quite free from foreign matter, and carefully weighed, 3.288. Rammelsberg's specimen from East Bradford, Pa., gave 3.535; and that from Orange County, New York, as examined by Genth, yielded 3.782. Prof. Brush (Dana's Mineralogy, first supplement) obtained from the latter a still higher value, 3.935. The Pennsylvania specimens analysed by Genth varied in sp. gr. from 3.491 to 3.831. The lowest recorded density of allanite is 3.193, found by A. Erdmann in a blackish-green variety from Tunaberg, Sweden. These variations, although, perhaps, partly due to structural differences, arise most probably from the variable amount of water present in the different specimens.

The leading characters of the Muskoka allanite are as follows:—

Amorphous: with compact structure; shining, pitch-like lustre; and more or less conchoidal fracture. Colour, jet-black; streak, light-grey. H = 5.75; sp. gr. = 3.288.

Heated in the bulb-tube, it decrepitates, and gives off a small quantity of water.

Before the blow-pipe, it intumesces exceedingly, and fuses with great readiness into a black, opaque, and very feebly magnetic globule.

With Borax, it is rapidly attacked, and is dissolved in considerable quantity. The glass shews the reactions of cerium and iron oxides. If a little phosphor-salt be added to it, the glass may be rendered milky by flaming. This reaction, not hitherto noticed in books, holds good with other silicates of cerium.

With phosphor-salt, a "silica skeleton" is obtained, and the glass becomes opaline on cooling.

With carb. soda, the test-substance forms a yellowish slaggy mass, which, on the addition of a little nitre, exhibits the reaction of manganese.

In boiling chlorhydric acid, decomposition is readily effected—the silica separating in a gelatinous state.

The filtered liquid yields a precipitate with ammonia, from which, a certain amount of alumina is dissolved out by caustic potash. In the original solution, filtered from the ammonia precipitate, oxalic acid shews the presence of lime.

The substance, consequently, is an undoubted allanite: consisting essentially of—SiO^2, Al^2O^3, Fe^2O^3, CeO, CaO, MnO, (a trace,) and a small amount of water. An exact analysis would probably reveal, in addition, the presence of LaO and YO, with perhaps a half-per-cent. of MgO, NaO, and KO. Part of the iron may also be in the state of FeO.

University College, Toronto,
February 1, 1864.

DESCRIPTIVE CATALOGUE OF COINS, ANCIENT AND MODERN, IN THE COLLECTION OF THE CANADIAN INSTITUTE.

BY THE REV. DR. SCADDING,
LIBRARIAN TO THE INSTITUTE.

NO. I.*

GREEK COINS.

I. SILVER.

(A) OF AUTONOMOUS CITIES.

1. Chalcis in Eubœa.† Obverse—Female Head to the right, with ear-drop. (Aphrodite.) Reverse—an Eagle and Serpent. Legend XA. Drachma. Weight—2 dwt. 3 grs., Troy.‡

* In 1857, Major Rains, at the instance of the late A. H. Armour, Esq., presented to the Canadian Institute a collection of silver and copper coins, consisting principally of denarii, quinarii and assaria of the Roman Emperors, but com-

† Coins of Chalcis, the capital of the district of Chalcidice in Syria are found, but they are generally of the times subsequent to the Roman conquest, and bear the names (in Greek characters) of Roman Emperors. Chalcis in Eubœa took its name from the χάλκεα μέταλλα (copper mines) in its neighborhood.

‡ The weights of the coins are given and their denominations as thence derived, but the latter only conjecturally, the remark of Eckhel in his Chapter *de pondere ac valore monetae veteris*, being borne in mind. "Fatendum est multa esse adhuc in hac causa dubia atque incerta, multa Cimmeriis adhuc noctibus involuta, quod satis ex eruditorum litibus atque dissidiis apparet.' Vide plura, *Doctr. Num. Vet.* Vol. I. xxxiv.

2. Elea or Velia (Gr. Hyele) in Lucania. Obverse—Fine head of Pallas to r.; on the helmet a gryphon; behind the neck A.* Reverse—a lion stalking to r. In the field a dolphin and Φ. In the exergue ……ΛΗΤΩΝ. [ΥΕΛΗΤΩΝ.†] Drachma. Weight—4 dwt. 17 grs.

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prising also a few coins of the republican era, and some Greek drachmæ, chalci, dichalca, &c., with specimens of the coinage of various States of Europe of rather ancient dates.

In the preceding year (1856) H. B. Hope, Esq., presented to the Institute a number of early English coins.

The gifts of these two gentlemen, together with a few others, amounting in all to some 340 pieces, constitute the present collection, of which a complete classified and descriptive Catalogue has lately been made.

It is intended to insert in the *Journal* those portions of this List that may be supposed to possess some interest for the Canadian numismatist; and it is hoped that members and others who may have in their possession historic coins, ancient or modern, European or of this Continent, will be induced to add some of them to the (at present) very modest Cabinet of the Institute

It will be seen that this collection, although containing pieces of considerable value to the student, is entirely destitute of specimens of the large-sized coins and medals which in the Cabinets of Europe illustrate so exquisitely the history and the arts of by-gone centuries—of times, which, in some instances, have left no other records.

* The A may indicate the name of the designer or engraver of the die The lion on the reverse refers to an *ex voto* figure of that animal offered in the temple at Delphi, on the first emigration of the people of Phocis to Asia. The Φ is probably the initial of Philogenes, one of the leaders of the expedition. The dolphin indicates that Velia was a maritime community The dolphin and trident on the Great Exhibition Medal of 1851 imply the same thing in regard to England.

† This coin is described in Rasche, *Lex. Rei Num.*, vol. x. p. 801; and there the epigraph is given in full. The name of the inhabitants of the πόλις or state occurs on Greek coins usually in the possessive case. The ellipsis is νόμισμα. Ὑελήτων implies that it is a coin of the Hyeletae. The original colonists, Phocaeans from Alalia, in Corsica, named the place (B. C. 543) Hyele, altered by the later Italians to Elea, Helia and Velia. ("Oppidum Helia, quae nunc Velia." Plin. iij. 10.) Cicero dates a letter to Trebatius "xiij. kal Sext., Velia." It was situated on the sea coast a little to the south of Naples, near the mouth of the Hales, which Cicero in the above mentioned letter calls a noble stream—"Halethem, nobilem amnem." As Elea, it gave name to the Eleatic School of Philosophy. Cicero (de Nat. Deor iij. 33) asserts that Zeno the Eleatic was here cruelly put to death,—"Zenonem Eleae in tormentis necatum." Horace refers to it as a place resorted to by invalids. He asks his friend Vala (Ep. j. 15) to inform him "Quae sit hiems Veliae," &c.

3. Histiaea in Euboea. Obverse—Female head to r., with ear-drop. Reverse—Fortune seated on a prow holding a sail: on the prow a fulmen or thunderbolt.* In the exergue ΙΣΤΙ. Some letters vertically at the back of the figure, probably intended for ΑΙΩΝ, in continuation of ΙΣΤΙ. Half-drachma. Weight—1 dwt 11 grs.

4. Leucas in Acarnania, a colony of Corinth. Obverse—Pegasus with rounded wings. Reverse—the same repeated. Underneath—Λ. The Λ may denote Locri Epizephyrii.† Quarter-drachma or obol. Weight—13 grs.

5. Neapolis in Campania. Obverse—Fine head of Artemis‡ to l., with ear-drop, and filleted: behind the neck an ivy-leaf and berries. Reverse—Victory crowning a human-faced bull.§ Behind—ΙΣ.‖ In exergue ...ΠΟΛΙΤ., *i.e.* ΝΕΟΠΟΛΙΤΩΝ.¶ Didrachma. Weight —4 dwt. 9 grs

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* Fortune on the prow holding a sail, alludes to the etymology of Histiæa, viz: ἱστον, a sail. This city, according to the list given in Il. ij. sent ships to Troy. The epithet πολυστάφυλος, *rich in grapes*, is there applied to it. The place was at a later period called *Oreus*, and *Oropus*.

† "Locri Epizephyrii in Bruttiis agnati sunt Corcyraeis, et per hos Corinthiis, quorum extant et aerei numi cum typo Palladis et pegasi." Rasche, *Lex. Rei Num.* Vol. iv., p. 1814

‡ The epigraph ΑΡΤΕΜΙΣ occurs on coins of Naples described in Rasche, v. 1130.

§ This figure symbolizes either the sun, which the people of Naples are said to have worshipped under the image of a bull with a human face and called Hebon, or the Vulturnus, the principal river of Campania. The Tiber is styled (Æn. viii 77.) *Corniger* Hesperidum fluvius regnator aquarum.

‖ These letters, denoting an artist's name, are seen on many Neapolitan coins in Rasche, vol. v., 1138.

¶ A city, poetically called Parthenope, was "founded originally by the Cumæi; but afterwards being peopled by Chalcidians, and certain Pithecussacans and Athenians, it was on this account denominated Neapolis." Strabo, v. 4, 7; *i.e.* Parthenope became Palaeopolis *the old city*; and the new settlement situated a little to the west of the old one, acquired the name of Neapolis. *new city*. The epigraph is nearly always ΝΕΟ-, not ΝΕΑ-ΠΟΛΙΤΩΝ on the coins, shewing that *Neapolis* was long regarded as a common, not a proper name; as doubtless "New College," Oxford, (properly St Mary's) was. Νεοπολίτης is new burgher,—not a citizen of Newburg This would be Νεαπολίτης, as is read on a few coins in Rasche. [On two or three the epigraph is Νευπολ., suggestive of Neu-borac-um as not an improper substitute for the rather awkward Neo-Eboracum, usually given as the latinized form of "New York."]

6. Syracuse. Obverse—Head of Arethusa* to r.; a beaded fillet confines the hair. Reverse—A sepia or cuttle-fish. Epigraph ΣΥΡ. [*i.e.* ΣΥΡΑΚΟΣΙΩΝ.] Quarter-drachma or obol. Weight—12 grs.

7. Syracuse. Obverse—An Eagle: in the field, three small globules. [=3 obols?] Reverse—A Chimaera.† Half-drachma. Weight—1 dwt. 17 grs.

8. Thebes in Bœotia. Obverse—The Bœotian Shield. Reverse—The Cantharus of Heracles, surmounted by his club. Legend—ΘΕΒΗ.‡ Half-drachma. Weight—1 dwt. 15 grs.

(B) MONARCHICAL.

1. Philip II. of Macedon. Obverse—Head of Hercules, youthful and wearing a lion's scalp § Reverse—Jove seated, with eagle. Epigraph—ΦΙΛΙΠΠΟΥ, and monogram‖ denoting place of mint or artist's name. Drachma. Weight—2 dwt. 15 grs.

2. Philip II. of Macedon, or Philip III. (Arrhidaeus), the successor of Alexander. Obverse—Youthful Head to r., with royal bandlet.¶ Reverse - Horseman with causia.** Epigraph—ΦΙΛΙΠΠΟΥ Monogram. Half-drachma. Weight—1 dwt. 13 grs.

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* Syracuse, founded in the 8th century, B.C., consisted of five towns or wards, Acradina, Tycha, Epipolae, Neapolis, and Ortygia: in the latter, which was an island attached to the shore by a bridge, rose the famous fountain of Arethusa, the ἄμπνευμα σεμνὸν Ἀλφεῶ of Pindar, Nem. i. i.

† Here represented triform in respect of heads, according to the Hesiodic tradition, not the Homeric, which Lucretius (v. 902) ridicules:—

> Qui fieri potuit, triplici cum corpore ut una
> Prima Leo, postrema Draco, media ipsa Chimaera
> Ore foras acrem efflaret de corpore flammam?

The Chimaera was in reality a symbol of a volcanic district, like the Syracusan neighborhood.

‡ The E is archaic for H. This name is usually plural; in Il. xiv. 323, we have Ἀλκμήνης ἐνὶ Θήβῃ, an expression that refers to the myth alluded to in the Cantharus and club before us. [The sign H for long E, arose from ƎƎ.]

§ Plutarch says of Alexander, the son of Philip, ὅτι τῷ γένει πρὸς πατρὸς μὲν ἦν Ἡρακλείδης ἀπὸ Καράνου. *Vit. Alex.* I.

‖ The ingenious and interesting combinations of many letters in one character, called monograms, cannot be presented to the eye without the aid of the engraver.

¶ The simple fillet which, on some of the English coins, is seen on the head of the Queen is the royal *diadema*. Its passing more than once round the head may denote a plurality of crowns.

** The broad-brimmed Macedonian hat to keep off the καῦσις—the burning heat of the sun.

ON THE ABNORMAL VARIATIONS OF SOME OF THE METEOROLOGICAL ELEMENTS AT TORONTO AND THEIR RELATIONS TO THE DIRECTION OF THE WIND.

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The climate of a locality with respect to any one of its meteorological elements is characterized principally by the mean annual value of that element, and its annual and diurnal periodic variations, including implicitly a statement of its normal values for each hour of every day throughout the year.

Now the observed value of an element, it is well known, is not generally identical with the normal proper to the epoch of observation, but continues above or below it for hours, and often for days, making digressions that are variable both in amplitude and duration.

One object of the present article is to ascertain the average *extent* of the abnormal variations, (as they are here called for want of another term,) or the digressions of the observed values of certain meteorological elements above or below the normals proper to the epochs of observation, and to exhibit such relations as may be found to subsist between these abnormal variations and the season of the year, the hour of the day, and the direction of the wind.

Another object of enquiry relates to the rapidity with which any element passes from one abnormal condition to another, and the dependence of this rate of change on the season, the hour, and the direction of the wind. To carry out this enquiry completely would involve the computation of the differences between the abnormal variations at consecutive hours throughout the series, and their arrangement in tables according to the season, the hour, and the wind that prevailed during the intervals between each hour.

The less laborious process to which recourse has been had, and which, though less accurate than the one above indicated, is sufficient for the approximate results at present sought, consists in employing for discussion the differences at *like hours* on consecutive days, between the abnormal variations, in the case of the temperature, and between the observed values, in that of the other elements. The differences between the observed values of an element at like hours of consecutive days give the daily rate of change independently of the effect of regular periodic diurnal variation, though affected it may be by the hour chosen, should the element be systematically more liable to disturbance at one hour than another

As the normal temperatures for the same hour change perceptibly from day to day, in order to eliminate the effect of annual variation, the differences between the abnormal variations of temperature at like hours of consecutive days have been employed instead of the differences between the observed values, which, for the other elements, have been considered sufficient.

In seeking to establish the connection between the *change* in the condition of an element and the wind that accompanies it, the change has been referred to the *resultant* direction during the interval. When the direction has not varied greatly during the day, this method may be regarded as sufficiently accurate for the purpose designed; but if there be any very great change of direction, the resultant, though geometrically equivalent to the actual winds as they reach the anemometer, will not be necessarily equivalent in physical properties; and if the resultant wind be from a direction for which the whole number of resultants are few, errors will be introduced sufficient to conceal the true character of that particular wind in its relation to the element under consideration; and hence conclusions relative to the comparatively rare resultants, cannot be accepted for single months, unless the errors be rendered inappreciable by extending the series.

The tables in this article are derived from two series of observations —one from 1854 to 1859 inclusive, (two of the tables embrace also the year 1853,) and the other from 1860 to 1862. Those that relate to the pressure of dry air, the pressure of vapour, and the relative humidity are limited to the latter series; but the tables for the temperature and the barometer have been computed separately for both series.

The mean monthly and annual changes between the temperatures and the barometric pressures at like hours on consecutive days were computed in the first instance for the interval between 2 P.M. and 2 P.M. in the earlier series. Subsequently, when it was desired to connect the diurnal change with the daily resultant direction of the wind, since the resultants had been all calculated for the twenty-four hours, commencing at 6 A.M., it became requisite to take the differences also for that same interval. The arrangement found most convenient for collecting these differences, while it readily afforded the monthly and annual mean changes on the average of the six years, would not, without greater labour than the occasion warranted, give the annual mean changes from 6 A.M. to 6 A.M. for the separate years. On this account, for the years 1854 to 1859, the annual means of the diurnal change in the temperature and barometer have been given for the interval commencing at 2 P.M.*

The normals to which reference is made in the temperature-tables, are deduced from the table of twenty-four-hour daily means given by General Sabine in his paper† on the *Periodic and Non-periodic Variations of Temperature at Toronto,* by applying the diurnal variations given (though with a contrary sign,) in the same paper.

The approximate normals of reference for the other elements are simply the monthly means at each of the six observation hours, derived from an average of several years.

The normals thus computed are tabulated and kept as standards to which the observed values of the elements are referred; the abnormal variations with their proper signs being entered in the daily register side by side with the observed values.

TABLES I. TO VII., ON TEMPERATURE.

From table I we see that the average extent of an abnormal digression of temperature, without regard to sign, and irrespective of the hour and season, was 6°.5 on the average of nine years, and that the digression in different years never differed more than 0°.6 from this average.

In table II., which gives the abnormal variations without regard to sign for the different months, double weight is given to the earlier series in computing the means from 1854 to 1862. Double weight is also given to the earlier series wherever in subsequent tables the results of the earlier series are combined with those of the years 1860 to 1862.

The progression from month to month, though it shews that the digressions are decidedly larger in the winter than in the summer months, is not perfectly continuous. If the monthly means be collected in quarterly groups we have 6°.1 as the average digression in spring, 4°.9 in summer, 5°.8 in autumn, and 9°.1 in winter.

In table III. we have for each series separately, as well as for the two combined, the yearly and half-yearly mean abnormal variations at

* Throughout both series observations have been made on Sundays at 6 A.M. and at 2 P.M., so that no break on account of Sundays or holidays has occurred.

† Philosophical Transactions for 1853, pp. 154 to 159, and pp. 145, 146.

the six observation hours. If the annual means alone be regarded, there is nothing to warrant the belief that one hour is to any great extent more subject than another to thermic disturbance; but on referring to the hourly table for the separate *months*, from which table III. is derived, and comparing the numbers in the columns for 10^h, 12^h, 18^h, and 20^h with those for 2^h and 4^h, it was found that in the six winter months, (October to March,) the former group were, in nearly every case, number for number, greater than the latter group, and that exactly the reverse occurred in the other six months. Table III. shews that the winter half-yearly means are in every case greater, and the summer half-yearly means less, at each of the hours 10^h, 12^h. 18^h, and 20^h than at 2^h and 4^h. Hence it appears, from both series, that there is in winter a greater uncertainty respecting the temperature during the night and morning than during the hours of the day; whereas in summer the warmer hours are more subject to irregularity; or it may be briefly stated that the warm hours are most subject to disturbances of temperature in the warm months, and the cold hours in the cold months; the difference in the extent of the disturbance for each season being about 0°.8.

Table IV. gives the mean abnormal variations with their proper signs, arranged according to the direction of the wind at the instant of observation. In the results for the years 1853 to 1859 the variations are arranged in seventeen groups corresponding to the sixteen principal directions of the wind, and to light winds with a velocity not exceeding half a mile per hour, which it was the custom formerly to regard as calms. In the later series the variations are arranged in nine groups only, corresponding to the eight principal directions and to absolute calms.

From the observations of the first seven years, if each point be considered as including an angular space of 11°.15 on each side of it, it appears that the temperature is above or below the normal according as the wind blows from a point lying to the South or to the North of a line drawn from N.E.b.E. to S.W.b.W. The greatest depression, 3°.58, accompanies a wind from N.N.W., and the greatest elevation 3.61 occurs with a wind from S.S.W., giving a range of 7° 19.

That the variations that accompany the N. E. and West winds have different signs in the two series is partly owing to the proximity of these points to the line, which, in the earlier series, is found to separate the relatively warm from the relatively cold winds. Another cause of disagreement is the fact that many winds reckoned, in the later series, as belonging to the N.E. group, blew from points, which, in the earlier series, were included in the N.N.E. and E.N.E. groups. A similar remark is applicable to the West winds.

In this table the annual mean results only are given, but from an investigation made for each half-year in three years, 1860—62, the following relations were found to exist :—

With the N.E. wind and West wind the temperatures were above the normal in some half years and below it in others, without reference to the season

With the East and S.E. wind the temperature was above the normal in each winter and below the normal in each summer, and with winds from the South and S.W. the temperature was above the normal in each separate half-year.

In table V. we have the annual means of the diurnal changes in the temperature without reference to sign. For reasons before explained, the differences from which the means were derived are between 2 P.M. and 2. P.M. for the first six years, and between 6 A.M. and 6 A.M. in the years 1860, '61, and '62. The range in the numbers regarding them as comparable* from the greatest 6°.8 to the least 5°.4, differs little from that of the nine annual means of abnormal variation.

In table VI. the monthly and annual means of the diurnal changes of temperature are given for the earlier and later series separately and jointly. For both series the differences have been taken between 6 A.M. and 6 A.M. on consecutive days.

In both series, taken separately, the greatest diurnal change is in February, and the least in July. Taking the two series in combination, the greatest change is 9°.9 in February, and the least change is 3°.8 in July. The quarterly averages are 5°.3 in spring, 4°.1 in summer, 6°.5 in autumn, and 9°.3 in winter. The general annual mean being 6°.25.

It may be remarked that when the differences are taken from 2 P. M. to 2 P.M. the annual mean derived from the years 1854 to 1859 is 5°.83, and the range is systematically less in each separate year. On the average of the six years the greatest monthly mean difference

*The numbers derived from the earlier series are not strictly comparable with those from the remaining three years, inasmuch as the average value, when the differences are taken between 2 P.M. and 2 P.M. is about 0°.4 less than when the differences are between 6 A.M. and 6 A.M. This may be accounted for by the fact that 6 A.M. is an hour slightly more subject to irregularity of temperature than 2 P.M.

reckoned from 2 P.M. to 2 P.M. is 7°.4, and the least 4°.7. The quarterly averages being 5°.7 for spring, 5°.2 for summer, 5°.2 for autumn, and 7°.2 for winter.

In table VI. no distinction is made between the increasing and the decreasing changes of temperature, and it does not appear whether the changes of one sign are numerous and of small magnitude and those of the opposite sign few and abrupt, or whether the changes in either direction are on the average equal in number and magnitude. These questions have been examined in the case of the differences between 2 P.M. and 2 P.M. in the years 1854 to 1859, and the following are some of the results.

It appears that in eight months of the year there is a preponderance in the number of increasing changes of temperature, that throughout the year the temperature rises 54 times out of 100 days, and that the average value of an increasing change is 5°.4, and of a decreasing change 6°.3 nearly. The number of times out of a hundred days that the temperature rises and the average increase and decrease in the four seasons are as follows:—

	Number of increasing changes in a hundred.	Average Increase.	Average Decrease.
Spring	55	5°.2	6°.4
Summer	55	4°.7	5°.9
Autumn	54	4°.9	5°.6
Winter	51	7°.0	7° 5

Hence the descending changes of temperature are systematically more sudden at all seasons than the ascending changes.

In table VII. the annual mean changes of temperature between 6 A.M. and 6 A.M. on consecutive days, are given with their proper signs in eight groups corresponding to the resultant direction of the wind during the day in which the change took place. From the more complete tables from which table VII. is derived, it is found in the earlier series, that in every month with a resultant wind from N , N.W., and W. the temperature is lowered ; in every month with a resultant wind from S.W., S., S.E., and E. the temperature is raised, and that with a resultant wind from N.E. the temperature is raised in some months and lowered in others, the collective effect in the whole year being a rise of temperature with a N.E. wind. In the series, 1860 to 1862, the temperature is also lowered in all months with resultant winds f m N., N.W., and W. ; but with winds from other points, although there is the general correspondence in the annual means exhibited in table VII., exceptions in one month or another occur for each of the other five points.

BAROMETRIC PRESSURE.

Table VIII. gives the mean abnormal variations of barometric pressure for the different years from 1854 to 1862 derived from six daily observations. The greatest annual mean is 0.193, the least 0 170, and the general mean for the nine years 0.183.

In table IX., designed to shew the monthly averages of the extent of the barometric abnormal oscillations, the annual distribution resembles in its general character that of the abnormal oscillations of temperature. The quarterly averages are 0.191 in spring, 0.118 in summer, 0.186 in autumn, and 0.231 in winter.

The diurnal distribution of the abnormal variations of the barometer are given in table X. In both series the most tranquil hour is 10 P.M. and the most disturbed hour 8 A. M. An examination of the hourly distribution in the separate months given by the earlier series, shewed that 8 A.M. was the most disturbed hour in ten months out of the twelve, the exceptions being February and December; and that the most tranquil hour was either 10 P.M. or midnight in every month but November, when the minimum was at 4 P.M.

Table XI. gives the mean abnormal variations of the barometer that accompany different directions of the wind.

According to the results furnished by the first seven years, the highest barometer accompanies a wind from N. N. E., and the lowest barometer one from S. W. In both series the barometer is above the normal when the wind is from N., N.E., E., S.E., and S., and below the normal when the wind is from S.W., W., and N.W.

In table XII. are given the annual means of the changes without regard to sign between the barometric pressures at like hours of consecutive days.

In table XIII these differences are classified according to the months. The correspondence in the two series is on the whole tolerably close, the maximum occurring in either January or February and the minimum in either July or August. Combining the two series, and giving double weight to the first, the greatest monthly average change in twenty-four hours is 0.281 in January, and the least 0.121 in July, the annual mean being 0.198. The quarterly means are 0.206 in spring, 0.126 in summer, 0.190 in autumn, and 0.270 in winter.

It has been found from the observations of 1854 to 1859 that on the whole the barometric pressure passes from one condition to another by gradations, of which those in which the pressure increases, are nearly equal in number and magnitude o those in which the pressure decreases, the average magnitudes of the ascending and descending changes being respectively 0.194 and 0.197.

From table XIV in which the mean changes in the barometer, with their proper signs, between 6 A.M. and 6 A.M. on consecutive days, are arranged according to the resultant direction of the wind during the day, it is seen that in both series, the barometer rises, on the average of the year, when the resultant wind is from N., N.W., and W., and that it falls with a resultant wind from other quarters. It has been also found from both series that these statements hold true in nearly every month taken separately.

A comparison in the signs in tables XI. and XIV. corresponding to the several winds, brings out the fact that the same winds that accompany a relatively *high* barometer are for the most part those that accompany a fall, and that the winds that correspond to a *low* barometer commonly accompany a rise.

PRESSURE OF DRY AIR.

Tables XV., XVI. and XVII. give for each year, each month, and each hour respectively, the mean abnormal variations of what is commonly designated as the pressure of dry air.

The following are the quarterly means of the abnormal variations of the pressure of dry air, together with those of barometric pressure, both being derived from the years 1860 to 1862 :—

	Spring.	Summer.	Autumn.	Winter.	Year.
Dry Air....	0.215	0.184	0.211	0.258	0.217
Barometer..	0.191	0.128	0.175	0.233	0.183

The maximum and minimum are as follows :—

	Dry Air.	Barometer.
Maximum.....	0.282 in December.	0.257 in December.
Minimum......	0.167 in July.	0.114 in August.

From table XVII. a very faint trace of a diurnal period, better marked in summer than in winter, is observable, the mean digressions being slightly less at 10 P.M. than at 6 A.M. and 2 P.M.

From table XVIII., wherein the abnormal variations of the pressure of dry air with their proper signs are arranged according to the direction of the wind at the hour of observation, it is seen that the signs are the same as those for the barometer, excepting that the pressure of dry air with a N. W. wind is decidedly above the normal and with a South wind slightly below it.

Tables XIX. and XX. give for each of the three years, 1860 to 1862, and for each month on the average of the three years, the mean change in the pressure of dry air during twenty-four hours.

The average changes in the four quarters, together with those for the barometer, both derived from the same three years are as follows:

	Spring.	Summer.	Autumn.	Winter.	Year.
Dry Air. . ..	0.228	0.207	0.237	0 302	0.243
Barometer ..	0.197	0.137	0.192	0.273	0.199

Hence while the diurnal change in the pressure of dry air varies with the seasons in a manner similar to that of the barometer, the change is considerably greater for the former.

From table XXI it is seen that the pressure of dry air increases in twenty-four hours with a resultant wind from N., N.W. and W., and decreases with a resultant from any other quarter. This is found to be true for each month taken separately with eight exceptions only out of the whole ninety-six.

PRESSURE OF VAPOUR

Tables XXII. and XXIII. give the abnormal variations of the pressure of vapour in each of the three years and for each month on the average of three years. The transition from month to month is not quite regular. The greatest monthly mean digression is 0.099 in August, and the least, 0.040, occurs both in January and March. The annual fluctuations in the average amount of the pressure of vapour and in the extent of its abnormal variations, are very similar in character, as may be seen from the annexed table, by which also it appears that the irregular variation averages about one-fourth of the whole pressure of vapour.

	Spring.	Summer.	Autumn.	Winter.	Year.
Pressure of Vapour	0.200	0.441	0.285	0.119	0 261
Variation............	0.055	0.090	0.071	0.043 ...	0.065

Table XXIV. shews that the maximum variation in the pressure of vapour is at 2 P. M., and the minimum at 6 A. M., which are also the hours of the greatest and least pressure included among the six hours of observation.

The mean extent of the oscillations at 2^h and 4^h are found to be greater than at 10^h, 12^h, 18^h, and 20^h in every month but January and February, and in each quarter, excepting the winter.

From table XXV. it appears that the pressure of vapour is below the normal when the wind at the time of observation is from N., N.W., and W., and above it when the wind is from any other quarter. It has also been found that with winds from N., N.W., and W. the pressure of vapour is below the normal in every month, with two exceptions out of thirty-six, and that in every month with winds from the other points the pressure is above the normal, with seventeen exceptions out of sixty.

The mean changes of the pressure of vapour in twenty-four hours, for each of the three years, and for each month in the average of the three years, are given in tables XXVI. and XXVII.

The quarterly means given are 0.044 in spring, 0.087 in summer, 0.067 in autumn, and 0.042 in winter; the general mean being 0.060, which is slightly less than the general mean abnormal variation.

From table XXVI. .ppears that a resultant wind from N., N.W., and W. is accompanied by a diminished pressure of vapour, and that with a resultant wind from any other quarter the pressure of vapour is increased. With very few exceptions this has been found to be true for each month taken singly as well as on the average of the year.

With a view of shewing more distinctly the shares taken by the pressures of dry air and of vapour in producing the varied conditions of the barometer that accompany the different winds; the abnormal variations of the barometric pressure and of the pressures of dry air and of vapour, as well as the changes between 6 A.M. and 6 A.M., corresponding to the eight principal points of the compass, have been collected in tables XXVII. and XXVIII.

RELATIVE HUMIDITY.

On the average of the three years the abnormal variation of relative humidity is 9.4, saturation being 100: the greatest monthly value is 12.3 in June, and the least 8.0 in December and January.

Of the six observation hours, 4 P. M. and 6 A. M. are the hours most subject and least subject to irregularity.

With winds from N.E., E., and S.E. the air is relatively damp, and with winds from W., N.W., and N. the air is relatively dry. The most damp wind is from the East and the most dry wind from N.W.; but the range is small, amounting only to 9.0.

The average change in humidity in twenty-four hours without regard to sign is 8.9, the greatest monthly change being 12.4 in June, and the least 7.3 in February.

The humidity increases in twenty-fours with a resultant wind from N.E., E., S.E., and S., and diminishes with a resultant from S. W., W., N.W., and N., the greatest increase of humidity being with a resultant wind from E, and the greatest diminution with one from N. W. The range between the E. and N. W. winds is, however, only 6.1.

It may be remarked with reference to the preceding paragraphs that the observations of three years are materials too scanty to justify our regarding as conclusive the results that relate to humidity.

CLOUDINESS.

If the compass be divided into four quadrants designated respectively by their middle points, the means of cloudiness found to accompany winds blowing from points included within these quadrants, together with their differences from the general mean, 59, were found from upwards of 13,000 observations in the years 1853 to 1859 to be as follows, the whole hemisphere being 100.

N. E. b. E.	S. E. b. S.	S. W. b. W.	N. W. b N.
72	54	61	51
+13	−5	+2	−8

Mean Abnormal Variations of Temperature without regard to sign, or mean differences without regard to sign between the normal temperatures of the day and hour, and the observed temperature at the same day and hour, from 1854 to 1862 inclusive.

TABLE I.

Mean Abnormal Variations of Temperature, without regard to sign, for the different years.

1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1854 to 1862.
7°.1	6°.6	6°.2	6°.8	6°.5	6°.8	6°.4	6°.1	5°.9	6°.5

TABLE II.

Mean Abnormal Variations of Temperature, without regard to sign, for the different months.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
1854 to 1859	9°.4	10°.1	7°.9	5°.5	5°.1	5°.7	5°.5	4°.5	5°.9	6°.0	5°.8	8°.8	6°.7
1860 to 1862	8.4	8.8	6.9	5.5	5.7	4.7	4.5	4.6	5.5	6.1	4.8	8.2	6.1
1854 to 1862	9.1	9.7	7.6	5.5	5.3	5.4	4.8	4.5	5.8	6.0	5.5	8.6	6.5

TABLE III.

Half-yearly and yearly mean Abnormal Variations of Temperature, without regard to sign, for the six observation hours.

Toronto Astronomical Time.		2 *h.*	4 *h.*	10 *h.*	12 *h.*	18 *h.*	20 *h.*	2 & 4 *h.*	10, 12, 18 & 20 *h.*
1854 to 1859.	Winter.	7°.6	7°.4	7°.9	8°.1	8°.6	8°.4	7°.48	8°.25
	Summer.	5.9	5.8	5.1	5.2	5.1	5.1	5.90	5.13
	Year.	6.8	6.6	6.5	6.7	6.8	6.7	6.69	6.69
1860 to 1862.	Winter.	6.7	6.6	7.3	7.4	7.8	7.4	6.68	7.48
	Summer.	5.7	5.7	4.9	5.0	4.7	4.5	5.72	4.78
	Year.	6.2	6.2	6.1	6.2	6.2	5.9	6.20	6.13
1854 to 1862.	Winter.	7.3	7.1	7.7	7.9	8.4	8.1	7.22	7.99
	Summer.	5.9	5.8	5.0	5.2	5.0	4.9	5.84	5.01
	Year.	6.6	6.5	6.4	6.5	6.7	6.5	6.53	6.50

TABLE IV.

Abnormal Variations of Temperature, with their proper signs, arranged according to the direction of the wind at the hour of observation, from six daily observations.

Direction.	N.	N.N.E.	N.E.	E.N.E.	E.	E.S.E.	S.E.	S.S.E.
1853–1859	−2°.80	−3°.18	−1°.81	+1°.37	+1°.73	+1°.18	+1°.79	+2°.28
1860–1862	−2.78	....	+0.02	....	+1.13	....	+1.35	....

Direction	S.	S.S.W.	S.W.	W.S.W.	W.	W.N.W.	N.W.	N.N.W.	Calms.
1853-1859	+2°.89	+3°.61	+3°.45	−0°.73	−2°.18	−3°.17	−3°.54	−3°.58	+1°.33
1860-1862	+1.56	......	+4.21	......	+0.14	......	−2.27	......	−0.10

TABLE V.

Annual means of the changes, without regard to sign, between the temperatures observed at like hours on consecutive days in each of the years 1854 to 1862. The changes were taken from 2 P.M. to 2 P.M. in the years 1854 to 1859, and from 6 A.M. to 6 A.M. in 1860, 1861, and 1862.

Years.	1854	1855	1856	1857	1858	1859	1860	1861	1862
Changes.	6°.8	5°.6	5°.7	5°.4	5°.5	5°.9	5°.7	5°.9	6°.5

TABLE VI.

Monthly mean differences, without regard to sign, between the temperatures of the air at 6 A.M. on consecutive days.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
1854 to 1859	10°.0	10°.0	6°.7	4°.9	4°.2	3°.9	3°.7	4°.2	6°.2	6°.8	7°.2	8°.2	6°.35
1860 to 1862	8.6	9.6	6.4	4.4	4.7	4.5	4.1	4.5	6.4	6.3	5.5	7.6	6.05
1854 to 1862	9.5	9.9	6.6	4.8	4.4	4.1	3.8	4.3	6.3	6.6	6.6	8.0	6.25

TABLE VII.

Mean differences, with their proper signs, between the temperatures observed at 6 A.M on consecutive days, arranged according to the daily resultant direction of the wind in the same interval.

	N.	N E.	E.	S.E.	S	S.W.	W.	N.W.
1854 to 1859.	−3°.30	+1°.49	+3°.49	+4°.55	+3°.86	+2°.16	−2°.87	−4°.51
1860 to 1862.	−1.88	+2.37	+4.02	+6.29	+3.90	+2.71	−3.18	−4.50

Mean Abnormal Variations of Barometric Pressure, without regard to sign, or mean differences, without regard to sign, between the normal Barometric Pressure of the day and hour and the observed Barometric Pressure of the same day and hour, from 1854 to 1862.

TABLE VIII.

Mean Abnormal Variations of Barometric Pressure for the different years.

1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1854 to 1862.
0.196	0.180	0.175	0.189	0.175	0.185	0.193	0.184	0.170	0.183

TABLE IX.

Mean Abnormal Variations of Barometric Pressure for the different months.

	January	February.	March	April.	May.	June	July.	August.	September.	October.	November.	December.	Year.
1854 to 1859.	0.249	0.215	0 223	0.196	0.151	0.126	0.121	0.119	0.162	0.183	0.228	0.225	0.183
1860 to 1862.	0.214	0.230	0.210	0.209	0.155	0.147	0.123	0 114	0.144	0.172	0.210	0.257	0.182
1854 to 1862.	0.237	0.220	0.219	0 200	0.153	0.133	0.122	0.117	0.156	0.179	0.222	0.236	0.183

TABLE X.

Yearly mean Abnormal Variations of Barometric Pressure for the six observation hours.

Toronto Astronomical Time.	2 *h.*	4 *h.*	10 *h.*	12 *h.*	18 *h.*	20 *h.*
1854 to 1859	0.187	0.182	0.175	0.177	0.188	0.191
1860 to 1862	0 184	0.180	0.178	0.179	0.185	0.187
1854 to 1862	0.186	0.181	0.176	0.178	0.187	0.190

TABLE XI.

Abnormal Variations of Barometric Pressure, with their proper signs, arranged according to the direction of the wind at the hour of observation, from six daily observations.

Direction.		N.	N.N.E.	N.E.	E.N.E.	E.	E.S.E.	S.E.	S.S.E.
Abnormal variations	1853 to 1859.	+.069	+.079	+.052	−.008	+.016	+.031	+.041	+.013
	1860 to 1862.	+.071	.....	+.020	.....	+.017	.....	+.037	.....

Direction.		S.	S.S.W.	S.W.	W.S.W.	W.	W.N.W	N.W.	N.N.W.	Calms
Abnormal variations	1853 to 1859.	+.016	−.057	−.115	−.079	−.061	−.043	−.017	+.019	+.030
	1860 to 1862.	+.009	.....	−.114	.....	−.076	.....	−.005	.....	+.030

TABLE XII.

Annual means of the changes, without regard to sign, between the Barometric Pressures observed at like hours on consecutive days. The changes were taken from 2 P.M. to 2 P.M. in the years 1854 to 1859, and from 6 A.M. to 6 A.M. in 1860, 1861, and 1862

Years.	1854	1855	1856	1857	1858	1859	1860	1861	1862
Changes	0.210	0.185	0.184	0.188	0.200	0.201	0.189	0.208	0.201

TABLE XIII.

Mean differences, without regard to sign, between the Barometric Pressures at 6 A.M. on consecutive days for each month.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
1854 to 1859.	0.280	0.253	0.257	0.217	0.160	0.126	0.110	0.128	0.151	0.168	0.248	0.273	0.198
1860 to 1862.	0.282	0.289	0.235	0.195	0.160	0.148	0.144	0.120	0.163	0.192	0.220	0.249	0.199
1854 to 1862.	0.281	0.265	0.250	0.210	0.160	0.133	0.121	0.125	0.155	0.176	0.239	0.265	0.198

TABLE XIV.

Mean differences, with their proper signs, between the Barometric Pressures observed at 6 A.M. on consecutive days, arranged according to the daily resultant direction of the wind in the same interval.

	N.	N.E.	E.	S.E	S.	S.W.	W.	N.W.
1854 to 1859.	+.097	—.102	—.179	—.197	— 099	—.036	+.144	+.170
1860 to 1862	+.076	—.137	—.196	—.178	—.130	—.089	+.142	+.183

TABLE XV.

Mean Abnormal Variations of the Pressure of Dry Air, without regard to sign, for each of the years 1860, 1861, and 1862.

1860.	1861.	1862.	Means. 1860 to 1862.
0 223	0.221	0.205	0 217

TABLE XVI.

Mean Abnormal Variations of the Pressure of Dry Air, without regard to sign, for the different months.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
1860 to 1862	0.240	0.251	0.229	0.229	0.186	0.193	0.167	0.191	0.201	0.215	0.218	0.282	0.217

TABLE XVII.

Mean Abnormal Variations of the Pressure of Dry Air, without regard to sign, for each of the six observation hours.

Toronto Astronomical Time.	2 *h.*	4 *h.*	10 *h.*	12 *h.*	18 *h.*	20 *h.*
Winter............	0.241	0.237	0.237	0.237	0.241	0.242
Summer	0.198	0.197	0.188	0.190	0.198	0.196
Year..............	0.220	0.217	0.213	0.213	0.219	0.219

TABLE XVIII.

Mean Abnormal Variations of the Pressure of Dry Air, with their proper signs, arranged according to the direction of the wind at the hour of observation.

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calms.
1860 to 1862.	+ 0.101	+ 0.016	+ 0.005	+ 0.026	− 0.003	− 0.150	− 0.063	+ 0.036	+ 0.035

TABLE XIX.

Mean change, without regard to sign, between the Pressures of Dry Air observed at 6 A.M. on consecutive days for each of the years 1860, 1861, and 1862.

	1860.	1861.	1862.	1860 to 1862
Mean Changes ..	0.233	0 247	0 250	0.243

TABLE XX.

Monthly mean differences, without regard to sign, between the Pressures of Dry Air at 6 A.M. on consecutive days.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October	November	December.	Year.
1860 to 1862.	0.310	0.321	0.258	0.224	0.201	0.219	0.209	0.194	0.234	0.237	0.210	0.275	0.243

TABLE XXI.

Mean differences, with their proper signs, between the Pressures of Dry Air observed at 6 A.M. on consecutive days, arranged according to the daily resultant direction of the wind in the same interval.

	N.	N.E	E.	S.E.	S.	S.W.	W.	N.W.
1860 to 1862.	+0.096	−0.152	−0.240	−0.264	−0.189	−0.109	0.180	0.227

TABLE XXII.

Mean Abnormal Variations of the Pressure of Vapour, without regard to sign, for the years 1860, 1861, and 1862.

	1860	1861	1862	Mean 1860 to 1862.
Variations.	0 067	0.064	0.064	0 065

TABLE XXIII.

Mean Abnormal Variations of the Pressure of Vapour, without regard to sign, for the different months.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November	December.	Year.
1860 to 1862.	.040	.042	.040	.053	.072	.083	.087	.099	.095	.073	.046	.047	.065

TABLE XXIV.

Mean Abnormal Variations of the Pressure of Vapour, without regard to sign, for each of the six observation hours.

Toronto Astronomical time.	2 *h.*	4 *h.*	10 *h.*	12 *h.*	18 *h.*	20 *h.*
1860 to 1862.	0.071	0.070	0.064	0.063	0.061	0.062

TABLE XXV.

Mean Abnormal Variations of the Pressure of Vapour, with their proper signs, arranged according to the direction of the wind at the hour of observation.

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calms.
1860 to 1862	—.028	+.006	+.015	+.015	+.013	+.039	—.010	—.037	—.005

TABLE XXVI.

Mean change, without regard to sign, between the Pressures of Vapour observed at 6 A.M. on consecutive days, for each of the years 1860, 1861, and 1862.

	1860	1861	1862	1860 to 1862
Mean change.	0.061	0.056	0.063	0.060

TABLE XXVII.

Monthly mean differences, without regard to sign, between the Pressures of Vapour at 6 A.M. on consecutive days.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
1860 to 1862.	.038	.043	.039	.041	.051	.091	.082	.088	.093	.065	.044	.044	.060

TABLE XXVIII.

Mean differences, with their proper signs, between the Pressures of Vapour observed at 6 A.M. on consecutive days, arranged according to the daily resultant direction of the wind in the same interval, from the years 1860 to 1862, inclusive.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
—.020	+.015	+.043	+.085	+.057	+.021	—.036	—.044

TABLE XXIX.

Annual mean Abnormal Variations of the Barometric Pressure, Pressure of Dry Air, and Pressure of Vapour, for the eight principal points of the wind's direction, derived from the three years. 1860, 1861, and 1862.

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
(1) Barometer	+.071	+.020	+.017	+.037	+.009	—.114	—.076	—.005
(2) Dry Air...............	+.101	+.016	+.005	+.026	—.003	—.150	—.063	+.036
(3) Vapour...............	—.028	+.006	+.015	+.015	+.013	+.039	—.010	—.037
(2) + (3)	+.073	+.022	+.020	+.041	+.010	—.111	—.073	—.001

TABLE XXX.

Annual means of the Diurnal Changes in the Barometric Pressure, Pressure of Dry Air, and Pressure of Vapour, that accompany the different resultant winds, from the years 1860, 1861, and 1862.

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
(1) Barometer	+.076	—.137	—.196	—.178	—.130	—.089	+.142	+.183
(2) Dry Air...............	+.096	—.152	—.240	—.264	—.189	—.109	+.180	+.227
(3) Vapour...............	—.020	+.015	+.043	+.085	+.057	+.021	—.036	—.044
(2) + (3)	+.076	—.137	—.197	—.179	—.132	—.088	+.144	+.183

TABLE XXXI.

Mean Abnormal Variations of Relative Humidity, without regard to sign, for the years 1860, 1861, and 1862.

	1860	1861	1862	Mean 1860 to 1862
Variation.	9.5	9.0	9.6	9.4

TABLE XXXII.

Mean Abnormal Variations of Relative Humidity, without regard to sign, for the different months.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
1860 to 1862.	8.0	8.7	10.0	11.1	11.8	12.3	9.5	8.2	8.3	8.4	8.1	8.0	9.4

TABLE XXXIII.

Mean Abnormal Variations of Relative Humidity, without regard to sign, for each of the six observation hours.

Toronto Astronomical time.	2 *h.*	4 *h.*	10 *h.*	12 *h.*	18 *h.*	20 *h.*
1860 to 1862.	11.3	13.9	8.6	8.2	7.4	8.8

TABLE XXXIV.

Mean Abnormal Variations of the Relative Humidity, with their proper signs, arranged according to the direction of the wind at the hour of observation.

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
1860 to 1862.	—2.8	+2.6	+3.9	+0.9	—0.7	+0.3	—3.2	—5.1	+0.4

TABLE XXXV.

Mean change, without regard to sign, between the observed values of the Relative Humidity at 6 A.M. on consecutive days, for each of the years 1860, 1861, and 1862.

	1860.	1861.	1862.	1860 to 1862.
Mean change.	9.7	8.7	8.3	8.9

TABLE XXXVI.

Monthly mean differences, without regard to sign, between the observed values of the Relative Humidity at 6 A.M. on consecutive days, for the different months.

	January	February.	March.	April.	May.	June.	July.	August.	September	October.	November.	December	Year.
1860 to 1862.	7.9	7.3	8.9	10.8	11.0	12.4	8.8	7.7	7.7	7.8	7.9	8.0	8.9

TABLE XXXVII.

Mean differences, with their proper signs, between the values of the Relative Humidity observed at 6 A.M. on consecutive days, arranged according to the daily resultant direction of the wind in the same interval, for the three years 1860, 1861, and 1862.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
−1.4	+0.8	+3.9	+3.3	+2.8	−0.4	−1.9	−2.2

THE PHYSIQUE OF DIFFERENT NATIONALITIES.

AS ASCERTAINED BY INSPECTION OF GOVERNMENT RECRUITS.

[*From a communication made to the Statistical Society of New York, by Dr. Wm. H. Thompson.*]

Some writers appear to take it for granted that the Saxon, the Celt and the German have in a measure deteriorated on American soil, especially as respects *physical* vigor. The causes which have given rise to these opinions are readily appreciable, for they lie on the surface. No one, I think, who has spent much time in Great Britain, the source of the bulk of our population, can fail to notice, on returning, a considerable contrast in the appearance of the American from his British kindred, both in features and complexion. This consists more especially in the loss of fat in the cheeks and about the eyes, with a change in the shape of the mouth owing to early alteration of the teeth, and a seeming flatness of the chest causing an appearance of stooping, from anterior prominence of the shoulders. Indeed the American features are now as readily recognised abroad as those of the German or Frenchman, and he can by these alone be very generally distinguished from his English namesake.

That the American climate, therefore, has, in the lapse of two centuries or less, considerably modified the European type, is a fact which we think few can deny. What that change indicates—whether it is simply a stage in the process of acclimatization, or a positive loss of vitality in the race, is a question the importance of which cannot be exaggerated. In the whole kingdom of life no transplanting into a new soil occurs, without an apparent decline at first; but if a new and increased vigor is to be manifested, we must find the perennial root healthy and strong, though the early leaves may wither. The question is to be decided by the condition of the stock itself, and we think that it is precisely here that the observations which have given rise to such melancholy anticipations fail most strikingly. The impressions of a tourist on the complexion and appearance of a people are accepted as scientific data, and straightway conclusions are propounded, at whose vastness even an archangel might stand aghast.

But a great opportunity has arisen to substitute facts and observations for theories on this whole question. A test, than which nothing more complete could be devised, has been suddenly brought to bear, not only on the working of our institutions, the extent of our resources and the character of our people, but of their development in bone and muscle as well. The issue at stake in a tremendous contest has taken hold of the feelings of the entire nation, and sent thousands from every class of the population and every condition in life to undergo the hardships of the field.

And I would now beg leave to direct your attention to one particular aspect of this great event of the age, which I have myself been more especially called upon to note. Having had the honor of an appointment by his Excellency Governor Morgan, as medical examiner for the State of all recruits for regiments in the field mustered at the depot of New York city during the past summer, it occurred to me to take advantage of the opportunity for instituting observations on a number of points of medical interest and importance. In no other connection, as we have indicated, could there be afforded better facilities for such observations, since both city and country, every calling and pursuit, every degree of culture from the professor of Hebrew to the street cleaner, and every nationality which composes our present population, were most fully represented, while all presented themselves as healthy adults at the age of their fullest physical vigor. War certainly presents some singular aspects, for what else can be conceived that would bring about a procession of some 9,000 human beings in the original costume of Eden, in the hope of their being pronounced fit to go forth to shoot and be shot. But in no other way could all those artificial circumstances, which difference men from one another to such a degree, be so completely laid aside, and every race and condition appear in the equality of nature itself.

Of special interest also is the fact of the foreign-born population being represented in almost the exact proportions which they hold in the census tables, and these thousands "of the best blood of the colonizing stock" came up by the side of English and Dutch descendants of six generations on American soil. The majority of my observations related to matters more of a professional than public interest, but at the same time I noted carefully the bodily conformation of each recruit in such a way as would enable me to classify them into several degrees of physical development. These notes were taken at my dictation by a clerk whose services I was enabled to secure, and on summing up the results of my observations, I find that I can draw comparisons between the different nationalities, which I hope will be found, from the large number examined, to be true in their main conclusions.

From the middle of July to the 1st of October, 8,700 recruits presented themselves to me to be inspected. Of this whole number, 4,538 were Americans, 1,694 were Irish, 1,453 were Germans, 345 English or Scotch, 135 French, and 545 belonged to 26 other nations. From this it will be seen that the native Americans exceeded by about a hundred the sum total of all other nationalities. The proportion of foreigners is naturally greater in recruits from New York than any other city. The first subject which naturally presented itself was the bodily stature and general physical appearance of the various recruits. In stature, the American born ranked the highest, the English next, the Irish next, the Germans next, and the French last.

We now come to the actual physical conformation of the various nationalities as deduced from my observations. I found it at first somewhat difficult to lay down clearly defined rules of classification, and I therefore adopted a very general division into four classes, which were respectively termed Prime, Good, Indifferent, and Bad. Under the head "Prime," I included first, those who had a well-proportioned osseous system, (the groundwork of the personal figure), as shown by the shape of the skull, the bones of the thorax and pelvis, and the lines of the extremities. The shape of the joints, the shape of feet and hands, and the condition of the ligaments was especially noted. Secondly came a good development of the muscular system, especially those of the lower extremities, as the most reliable indication of the vigor of spinal nutrition. Under the term "Good,' were classed those who were then apparently healthy and strong, with more especially a good muscular development, but who did not eqnal the Prime in the development of the osseous system, from lack of lateral symmetry, bow legs, large joints, flat feet, etc. Under the head of "Indifferent" might be found good forms and tolerable muscular development, but who had tendencies to constitutional diseases, as well as a good many who may have had good constitutions originally, but had become deteriorated from various causes. Under the head "Bad" were such as had never been good nor ever would be so, from an originally vicious conformation.

The results of these observations are the following:

Of American-born Recruits, 47.5 per cent, had a prime physique; the Irish 35 per cent, and the Germans 40.75 per cent.

The per centage of Good Physique, was Americans, 36; Irish, 38; Germans, 38:5.

The per centage of Indifferent was Americans, 13.5; Irish, 19.5; Germans 19. The per centage of bad—Americans 3; Irish, 7.5; Germans 3 per cent. From this it will be perceived that the Americans show the highest rate of prime physique, the Germans next, and the Irish last Of "Good," the Irish and Germans are nearly equal, and four per cent. more than the Americans. But this is owing to the excess of the latter in "Prime." These figures, therefore, confirm the estimates which we have already made which show that a great majority of the army is composed of American-born recruits. Of the Americans, 2,038 were from the country districts directly, and 2,500 were recruited from this city and Brooklyn.

Of "Indifferent," the Irish are one-half higher than the Germans, which last are 5½ per cent. higher than the Americans. Of the "Bad" the Irish are more than double the Americans and Germans, who in this respect stand alike. So far, therefore, these figures seem favorable to the American-born. But there are several considerations to be taken into account, which will, to a certain extent, modify the references to be drawn from them. In the first place the Americans were largely from classes of society, who from youth have been able to command better facilities in food, clothing, and shelter, than the classes from whom the immigrant population is derived. What an influence this must exert on physical development is sadly illustrated by the mortality returns of this city, which show that though the American population is not exceeded by the foreign, yet that seven children of foreign-born parents die in a year to one American child. Besides more than half the Americans were born and reared in country districts, and the difference which this fact causes may be shown by comparing among them the city and country recruits. Thus the proportion of "Prime" among city Americans was 42 per cent; country 58 per cent; of "Good," city, 40 per cent; country, 29 per cent; of "Indifferent," city, 14 per cent; country, 12 per cent: of "Bad," city, 4 per cent; country, 1 per cent. Another reason why the Irish are double the Americans in bad physique, seemed to be that they were often recruited for several Irish regiments, almost exclusively from the Sixth Ward. One of the most active recruiting stations being the Toombs Prison itself, and such specimens as occasionally presented themselves to our eyes and noses from those regions, could scarcely be surpassed by Macbeth's witches themselves.

Still these considerations do not affect the actual standing of the American recruits, for whatever the causes may be that have aided them, I feel safe in rating their physical development as of the highest order, and I have seen specimens of the armies of nearly all European, as well as Eastern nations. With the exception of a general loss of fat, I do not believe that there is another race that can show a larger proportion in the average population, of excellent osseous and muscular development.

We know it to be a frequent observation of tropical physicians, that the American sailor shows a greater power in resisting epidemics than his British comrade. We believe we can add to this our observation of the British soldier in the Crimea, and of the American soldier in the Peninsular campaigns, which have confirmed to our minds the old adage, that fat is not as tough as muscle.

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—DECEMBER, 1863.

Latitude—43 deg. 39.4 min. North. Longitude—5 h. 17 min. 33 sec. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of mean above Normal.	Tens. of Vapour.				Humidity of Air.				Direction of Wind.			Resultant Direction.	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.	ME'N		6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.		6 A.M.	2 P.M.	10 P.M.	Re-sul't.	ME'N		
1	29.854	29.665	29.550	29.6735	24.1	36.7	39.2	33.52	+ 2.73	.100	.155	.164	.142	.77	.71	.67	.73	S W b W	S W b W	S W	S 52 W	11.5	16.5	19.8	15.26	15.28	...	...
2	.436	.643	.912	.6892	40.7	32.7	26.2	33.15	+ 2.67	.223	.142	.110	.154	.87	.76	.77	.78	S W b W	N N W	W N W	N 61 W	15.8	19.8	5.2	9.09	11.22	...	...
3	.061	.849	.531	.7842	22.6	35.6	41.4	32.90	+ 2.82	.097	.134	.214	.152	.80	.65	.81	.78	N E	S E b E	S W b S	S	4.0	9.8	14.0	5.76	8.33	...	...
4	.478	.436	.662	.5388	40.3	51.5	36.3	42.33	+12.55	.219	.190	.193	.199	.87	.50	.90	.75	S W b S	W	N	S 81 W	7.4	28.0	4.8	7.88	9.03	...	...
5	.726	.850	30.113	.0223	33.1	25.5	19.0	24.78	— 4.58	.153	.098	.085	.110	.81	.70	.82	.79	N b W	N N W	N	N 19 W	1.5	20.8	2.0	9.75	10.07	...	Inp.
6	30.244	30.289	—	—	12.9	27.0	—	—	—	.057	.115	—	—	.73	.77	—	—	N b E	E S E	Calm.	N 71 E	4.8	1.5	0.0	1.82	2.83	...	...
7	30.215	30.128	30.024	30.1152	20.1	36.3	25.2	27.48	— 1.18	.091	.150	.122	.121	.85	.71	.90	.81	S E b E	S b E	Calm.	S 36 E	1.0	4.5	0.0	1.78	1.91	...	...
8	29.968	29.836	29.736	29.8308	28.4	39.8	35.6	34.07	+ 5.60	.134	.182	.167	.157	.86	.74	.80	.79	S E	S W b W	Calm.	S 55 W	4.0	2.0	0.0	2.24	2.62	...	...
9	.740	.807	30.109	.9332	34.2	26.6	14.7	24.27	— 3.88	.152	.098	.067	.106	.77	.68	.78	.77	W b S	N N W	N	N 17 W	8.8	19.2	14.0	13.41	14.17	Inp.	..
10	30.196	30.183	30.096	30.1535	1.0	14.3	21.2	13.78	—14.07	.036	.071	.092	.068	.76	.85	.81	.79	N E b N	N E b N	E b S	N 84 E	3.0	6.2	11.3	8.48	9.72	...	0.2
11	29.903	29.725	29.590	29.7278	20.1	28.4	33.1	28.22	+ 0.57	.091	.134	.174	.139	.85	.86	.92	.88	N E	E b S	E	S 89 E	17.8	4.8	2.8	4.39	4.69	0.040	Inp.
12	.648	.606	.520	.5808	32.7	37.8	37.8	36.18	+ 8.83	.180	.217	.226	.207	.97	.95	.99	.96	Calm.	E b N	N E b E	N 65 E	0.0	8.8	8.8	6.80	6.91	0.920	...
13	.358	.234	—	—	41.7	44.6	—	—	—	.255	.283	—	—	.96	.96	—	—	N E	N N E	N E b E	N 50 E	3.8	2.0	6.0	6.63	7.38	0.455	...
14	28.886	28.789	.137	28.9645	37.8	42.8	27.3	35.05	+ 8.09	.226	.232	.111	.187	.98	.84	.74	.88	E N E	S W b W	W	S 84 W	17.8	20.3	30.0	15.04	21.41	0.460	0.1
15	29.522	29.678	.961	29.7375	23.7	27.3	24.8	24.72	— 2.05	.098	.103	.091	.093	.77	.69	.68	.74	W	W	N W b N	N 81 W	25.5	28.0	11.8	17.41	17.96	..	0.1
16	30.106	30.145	30.107	30.1285	17.9	21.4	18.6	19.25	— 7.32	.085	.077	.083	.070	.87	.67	.82	.76	Calm.	N E b N	N E	N 51 E	0.0	0.8	11.4	8.46	8.88	...	0.5
17	29.806	29.410	29.168	29.4492	21.2	30.0	32.4	28.17	+ 1.80	.105	.171	.176	.151	.93	.99	.96	.96	E N E	E b N	E b N	N 81 E	21.0	21.7	16.0	16.21	17.51	0.130	1.5
18	.265	.270	.370	.3138	31.3	27.3	21.9	26.30	+ 0.13	.152	.126	.090	.123	.86	.84	.77	.84	S W	W S W	W b S	S 73 W	13.0	19.0	12.5	13.07	13.49	...	Inp.
19	.455	.538	.601	.5440	18.3	18.3	21.9	18.37	— 7.70	.080	.080	.099	.078	.81	.81	.84	.77	W b N	W b N	W N W	N 71 W	14.5	5.0	11.0	10.91	11.52	...	0.1
20	.713	.688	—	—	8.2	23.2	—	—	—	.035	.081	—	—	.54	.65	—	—	N W b N	W N W	W	N 73 W	1.5	23.0	0.5	5.44	5.65	...	Inp.
21	.706	.563	.505	.6220	16.9	23.3	20.1	20.15	— 5.63	.084	.116	.105	.101	.90	.93	.97	.92	Calm.	Calm	N E b E	N 45 E	0.0	0.0	8.5	4.82	5.03	...	0.3
22	.692	.708	.807	.7380	14.7	15.8	7.1	11.75	—13.93	.072	.065	.053	.064	.84	.73	.88	.85	N E b N	N E b E	N b E	N 26 E	5.5	1.5	4.5	3.88	4.11	...	Inp.
23	.846	.877	.934	.8933	7.5	19.0	17.0	14.25	—11.32	.038	.072	.079	.068	.93	.70	.80	.82	N N E	N W b N	N N W	N 23 W	2.2	9.0	10.0	7.77	7.83	...	...
24	.984	.903	30.035	30.0103	12.2	23.7	16.1	16.85	— 8.63	.065	.076	.082	.072	.86	.59	.90	.77	N	Calm.	N	N 3 E	0.0	0.0	3.7	2.85	2.88	...	...
25	30.019	30.012	—	—	19.0	29.5	—	—	—	.085	.136	—	—	.83	.83	—	—	Calm.	E b S	N E b N	N 73 E	0.0	4.5	3.5	2.78	3.13	...	...
26	30.021	29.942	29.800	29.9150	22.6	33.1	30.2	28.75	+ 3.45	.111	.130	.157	.131	.92	.69	.93	.83	Calm.	Calm.	E N E	N 40 E	0.0	0.0	0.5	0.88	0.93	...	1.0
27	29.785	.836	—	—	30.0	33.4	—	—	—	.164	.157	—	—	.94	.82	—	—	N b E	E N E	E b N	N 63 E	3.0	5.5	14.0	9.74	10.08	Inp.	0.3
28	.497	.164	.175	.2642	27.3	33.4	37.0	32.68	+ 7.53	.139	.187	.183	.171	.92	.98	.84	.92	E N E	E	S W b S	S 61 E	22.5	17.0	17.5	6.61	14.60	0.515	1.5
29	.259	.282	.460	.3435	34.2	35.6	32.7	33.98	+ 8.82	.187	.160	.165	.166	.95	.77	.88	.85	S W b S	S W	S W b W	S 59 W	13.5	20.5	5.0	14.17	14.52	Inp.	Inp.
30	.634	.806	.905	.8268	30.9	30.6	26.2	28.88	+ 3.72	.157	.144	.124	.140	.90	.85	.87	.87	S W b W	W b S	N W	N 81 W	9.0	13.0	5.0	7.39	9.49	...	...
31	.934	.573	28.987	.4267	24.8	32.4	38.1	32.13	+ 6.95	.120	.169	.195	.169	.90	.91	.85	.92	N E	E	E	S 82 E	9.8	19.5	17.8	14.24	18.10	0.440	1.5
M	29.7207	29.6766	29.6936	29.6975	24.56	30.00	27.00	27.00	— 0.09	.124	.134	.131	.129	.87	.71	.84	.83	....	....	....	....	8.10	11.36	8.77	......	9.40	2.960	7.1

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR DECEMBER, 1863,

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, 4 and 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer........................30.313 at 10 a.m. on 6th } Monthly range =
Lowest Barometer........................28.769 at 1 p. m. on 14th } 1.544 inches.

Self-registering Thermom.
- Maximum Temperature .... 53°4 on p.m. of 4th } Monthly range=
- Minimum Temperature .... −1°5 on a.m. of 10th } 54°9
- Mean maximum Temperature .... 34°00 } Mean daily range=
- Mean minimum Temperature .... 20°70 } 13°30
- Greatest daily range ......28°5 from a.m. to p.m. of 10th.
- Least daily range.......... 2°0 from a.m. to p.m. of 22nd.

Warmest day .... 4th... Mean temperature.......... 42°33 } Difference = 30°58.
Coldest day .... 22nd... Mean temperature......... 11°75 }
Maximum { Solar.............................. 69°2 on p.m. of 4th } Monthly range =
Radiation. { Terrestrial........................ −7°5 on a.m. of 10th } 76°7
Aurora observed on 0 night, viz.,—
Possible to see Aurora on 10 nights; impossible on 21 nights.
Snowing on 17 days, depth 7.1 inches; duration of fall, 55.8 hours.
Raining on 10 days, depth 2.960 inches; duration of fall 75.2 hours.
Mean of cloudiness = 0.72; below average 0.03.
Most cloudy hour observed, 8 a.m; mean = 0.76; least cloudy hour observed, 4 p.m.; mean, = 0.69.

Sums of the components of the Atmospheric Current, expressed in miles.

North.	South.	East.	West.
2093.11	1193.09	2341.30	3130.37

Resultant direction N. 41° W.; Resultant velocity 1.61 miles per hour.
Mean velocity ....0.40 miles per hour.
Maximum velocity .... 32.8 miles, from 8 to 9 p.m. on 14th.
Most windy day ......14th..............Mean velocity, 21.41 miles per hour. } Difference=
Least windy day ...26th..............Mean velocity, 0.93 ditto. } 20.48 miles.
Most windy hour .... 1 to 2 p.m...............Mean velocity, 11.17 ditto. } Difference=
Least windy hour ...7 p.m. to 8 p.m..........Mean velocity 8.02 ditto. } 3.15 miles.

1st. Mild, Wind in violent squalls.—4th. Mild day, Wind high and squally.—5th. Morning mild, temperature descending rapidly, night keen.—9th. Morning mild, night clear and keen, great change of temperature. 11th. Slight Snow and Rain most of the day; Foggy at midnight.—12th. Foggy till 9 a.m.; Constant heavy Rain from 0.30, p.m.—13th. Slight Rain till noon; Foggy at 2 p.m.—14th. Stormy day; Steady Rain till 5 p.m.; Snowing slightly from 8 p.m.—15th. Stormy day; Wind high with occasional flurries of Snow.—17th. Stormy day; Rain, Hail or Snow most of the day.—20th. Perfect Lunar Halo at 8 p.m.—28th. Stormy, mixture of Rain, Hail or Snow nearly all day.—29th. Slight Rain 6 to 7 a.m.; particles of Snow from 8 a.m.; Windy.—31st. Mild day, Wind high, Snowing from noon to 4 p.m. and Raining from 6 p.m. to 4 a.m. of 1st Jan, 1864.

COMPARATIVE TABLE FOR DECEMBER.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.		
	Mean.	Excess above aver'ge (26.1)	Max. observed	Min. observed.	Range.	No. of days.	Inches	No. of days.	Inches	Resultant. Direction.	Resultant. V'y.	Mean Force or Velocity.
1840	24.3	− 1.8	41.0	− 4.4	45.4	3	Inap.	18	...	...	...	....
1841	28.7	+ 2.6	45.5	+ 2.4	43.1	7	6.600	5	...	...	...	1.33lbs.
1842	24.7	− 1.4	40.3	+ 3.8	36.5	3	0.880	17	...	...	...	0.60
1843	30.0	+ 3.9	41.1	+ 2.7	38.4	6	1.010	8	8.1	...	...	0.53
1844	28.2	+ 2.1	48.9	− 0.8	49.7	6	Imp.	6	4.2	...	...	0.40
1845	21.1	− 5.0	37.6	− 2.7	40.3	2	Imp.	12	4 7	...	...	0.70
1846	27.5	+ 1.4	49.2	+ 3.7	45.5	5	1 215	9	6.0	...	...	0.57
1847	30.1	+ 4.0	59.0	+ 6.6	43.4	7	1.185	8	6.8	...	...	0.35
1848	29.1	+ 3.0	49.1	+ 0.6	48.5	7	2.750	7	16.5	S 83° W	1.12	5.44mls.
1849	26.5	+ 0.4	41.3	− 5.2	46.5	5	1.840	12	9.6	N 82° W	2.56	6.23
1850	21.7	− 4.4	48.3	− 9.7	58.0	2	0.190	18	21.5	N 44° W	2.93	7.40
1851	21.5	− 4.6	43.8	−10.5	54.3	6	1.075	15	10.7	N 82° W	4.00	7.37
1852	31.9	+ 5.8	51.0	+13.9	37.1	7	3.995	10	20.1	S 69° W	1.03	6.54
1853	25.3	− 0.8	42.2	− 5.2	47.4	4	0.625	13	22.3	N 35° W	2.39	4.98
1854	21.9	− 4.2	41.8	− 5.9	47.7	5	0.590	12	17.2	N 44° W	4.30	8 56
1855	26.8	+ 0.7	45.9	− 2.1	48.0	6	1.845	10	29.5	S 88° W	5.29	11.38
1856	22.9	− 3.2	41.2	− 9.1	50.3	6	1.790	20	16.3	S 87° W	4.62	11.56
1857	31.9	+ 5.8	45.6	+ 5.7	39.9	7	3.205	14	9.0	N 89° W	2.51	6.84
1858	27.4	+ 1.3	43.6	+ 5.0	38.6	11	1.657	18	10.4	N 18° W	1.66	9.36
1859	17.9	− 8.2	54.8	− 3.3	58.1	3	1.035	23	37.4	N 53° W	4.29	10.77
1860	24.0	− 2.1	38.5	− 7.0	45.5	3	1.362	21	23 5	N 62° W	4.66	10.14
1861	31.1	+ 5.0	55.1	+ 5 7	49.4	6	0:560	8	6.8	N 72° W	3.50	7.96
1862	28.8	+ 2.7	50.0	− 2.3	52.3	5	1.945	8	10.4	N 73° W	3.17	7.58
1863	27.0	+ 0.9	51.5	+ 1.0	50.5	10	2.960	17	7.1	N 41° W	1.61	9.40
Results to 1861.	26.11	...	45.26	−0.72	45.98	5.3	1.545	12.9	14.66	N 69° W	2.97	8.18
Exc. for 1863.	+ 0.89	...	+ 6.24	+ 1.72	+ 4.52	+ 4.7	+ 1.415	+ 4.1	− 7.56	....	......	+ 1.22

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—JANUARY, 1864.

Latitude—43 deg. 39.4 min. North. Longitude—5 h. 17 m. 33 s. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of mean above Normal.	Tens. of Vapour.				Humidity of Air.				Direction of Wind.			Result't. Direction.	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.	ME'N		6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.		6 A.M.	2 P.M.	10 P.M.	Result't.	ME'N		
					°	°	°	°	°												°							
1	28.917	29.238	29.552	29.2795	33.1	8.2	−5.5	9.77	−15.45	.167	.052	.024	.071	.88	.82	.70	.78	s w b s	w s w	w s w	s 66 w	24.5	30.2	27.4	28.19	28.37	...	0.2
2	29.648	.740	.808	.7372	−6.6	−0.5	−0.5	−2.40	−27.60	.025	.035	.033	.032	.81	.84	.84	.83	w s w	w s w	w s w	s 67 w	27.5	30.5	22.2	24.22	24.29	...	..
3	.803	.720	—	—	2.8	12.5	—	—	—	.042	.062	—	—	.83	.80	—	—	w s w	w s w	w s w	s 65 w	17.0	17.5	15.0	15.54	15.57	...	...
4	.835	.827	.756	.8083	10.7	14.7	11.1	12.52	−12.62	.064	.067	.060	.065	.92	.78	.83	.86	w s w	w b s	n b w	n 40 w	4.5	1.5	5.2	3.11	4.71	...	2.0
5	.456	.541	.697	.5738	12.2	15.8	16.5	15.37	− 9.77	.071	.078	.076	.075	.94	.88	.83	.87	n	w n w	s w b w	s 88 w	11.5	1.0	13.5	7.59	10.72	...	3.0
6	.781	.839	30.065	.9158	13.2	15.1	11.1	12.47	−12.68	.071	.062	.060	.062	.91	.71	.83	.81	sw b w	w s w	n w b n	s 81 w	13.0	17.2	8.5	7.12	9.99	...	...
7	30.102	30.004	29.863	.9772	2.8	15.4	11.8	9.40	−15.73	.048	.070	.063	.057	.83	.81	.86	.82	n b w	w b s	w	s 89 w	1.8	5.0	10.6	3.84	4.33	...	Inp.
8	29.720	29.611	.803	.6158	8.6	12.9	11.4	11.08	−14.05	.053	.063	.062	.060	.82	.80	.85	.84	Calm.	w	s w	s 69 w	0.0	16.0	7.8	10.25	10.81	...	Inp.
9	.589	.549	.491	.5190	7.5	8.2	14.3	9.95	−15.18	.054	.052	.071	.060	.88	.82	.85	.86	w s w	s w b w	w s w	s 59 w	15.0	20.5	17.6	17.38	17.48	...	...
10	.532	.568	—	—	13.6	17.6	—	—	—	.047	.076	—	—	.83	.79	—	—	s w	s w	s w b w	s 50 w	18.8	10.6	11.0	13.88	13.90	...	...
11	.507	.414	.458	.4535	15.0	19.0	17.9	16.95	− 8.10	.075	.072	.072	.073	.87	.70	.74	.78	s w	w s w	w s w	s 59 w	12.8	16.8	7.5	11.87	12.00	...	...
12	.383	.192	.185	.2460	20.8	20.8	30.9	27.42	+ 2.33	.090	.133	.127	.116	.81	.80	.73	.77	s w	s w b s	s w b w	s 47 w	17.2	20.5	8.4	12.93	13.06	...	...
13	.245	.231	.497	.3098	23.1	34.0	27.0	29.83	+ 4.75	.133	.151	.121	.133	.82	.75	.82	.80	s w	s w b w	w s w	s 59 w	12.0	10.5	3.4	7.82	8.21	...	...
14	.513	.462	.454	.4723	21.5	33.8	34.5	29.58	+ 4.48	.093	.152	.181	.141	.82	.78	.91	.81	s w b w	e b s	e	s 83 e	0.5	8.0	3.0	3.68	4.07	...	2.0
15	.302	.312	.648	.4399	33.4	30.9	23.0	28.37	+ 3.27	.171	.141	.092	.128	.89	.81	.73	.79	e b s	w b n	w	s 89 w	3.5	17.5	16.0	10.01	11.67	..	3.0
16	.788	.776	.766	.7708	10.0	27.7	24.4	25.02	+ 0.02	.085	.106	.103	.105	.82	.69	.78	.77	w s w	s w	s w	s 45 w	0.2	15.0	3.4	6.66	6.69	...	...
17	.714	.618	—	—	23.4	36.7	—	—	—	.134	.171	—	—	.86	.78	—	—	Calm.	s s w	s w b s	s 31 w	0.0	8.5	6.5	5.57	5.64	...	0.5
18	.760	.669	.551	.6152	33.4	33.1	28.0	31.22	+ 6.25	.163	.145	.139	.149	.85	.76	.90	.85	Calm.	n b e	n b e	n 8 e	0.0	10.5	16.0	10.15	10.33	...	4.0
19	.334	28.910	.181	.1563	29.1	27.3	21.5	25.37	+ 0.18	.141	.133	.102	.121	.87	.89	.88	.88	n b e	w b n	n w	n 48 w	13.5	27.5	29.5	21.54	24.78	...	10.0
20	.501	29.713	.888	.7308	17.9	25.5	17.6	19.37	− 5.49	.085	.104	.076	.086	.87	.75	.78	.81	n w b n	w n w	n b e	n 36 w	20.0	6.0	3.0	4.13	4.66	...	...
21	30.010	.938	.919	.9678	8.2	23.7	25.1	18.95	− 5.83	.052	.105	.116	.092	.82	.82	.86	.83	n b e	Calm.	s w	s 46 w	4.5	0.0	11.5	6.14	6.91	...	0.5
22	29.740	.678	.768	.7257	20.5	32.4	21.9	27.85	+ 3.08	.150	.153	.099	.135	.92	.83	.84	.87	s w	s w	s w b w	s 55 w	18.0	17.0	5.0	9.14	9.25	...	0.1
23	.736	.397	.339	.4793	20.8	36.3	30.6	33.45	+ 8.78	.103	.193	.202	.168	.92	.90	.83	.86	Calm.	s s w	w b s	s 51 w	0.0	9.5	5.5	7.21	7.68	Inp.	...
24	.282	.127	—	—	35.6	41.4	—	—	—	.187	.196	—	—	.89	.75	—	—	w s w	s s w	s w b w	s 44 w	5.0	3.5	4.0	5.21	5.37	...	...
25	.256	.353	.084	.2355	30.6	38.5	36.3	34.90	+10.32	.152	.173	.193	.170	.89	.74	.90	.84	Calm.	s w b s	s	s 50 w	0.0	7.2	6.2	2.91	5.08	...	...
26	.185	.401	.430	.3728	38.1	36.0	34.9	36.02	+11.53	.179	.137	.176	.162	.77	.65	.86	.76	w s w	n b w	s b w	n 65 w	4.8	6.0	2.5	3.37	5.37	Inp.	...
27	.395	.466	.603	.5067	32.7	41.7	34.2	36.33	+12.03	.173	.184	.160	.168	.92	.69	.81	.78	s w b w	Calm.	s w	s 73 w	1.5	0.0	2.5	1.28	1.49	...	...
28	.638	.572	.721	.6502	28.4	42.5	41.0	36.82	+12.52	.134	.199	.200	.174	.86	.73	.78	.79	n w	Calm.	n b w	n 11 w	2.5	0.0	9.6	3.51	4.23	..	...
29	.882	.910	.936	.9303	36.3	29.8	24.8	29.85	+ 5.65	.168	.096	.120	.125	.78	.58	.90	.75	n n e	e b n	e n e	n 59 e	7.0	10.2	11.4	9.65	9.77	0.020	...
30	.819	.662	.703	.7288	23.0	29.1	28.0	27.13	+ 3.03	.106	.148	.139	.133	.86	.92	.90	.89	e n e	e n e	n e	n 60 e	9.4	15.0	7.0	8.46	8.78	0.225	1.0
31	.838	.877	—	—	27.3	30.9	—	—	—	.139	.157	—	—	.94	.90	—	—	Calm.	e b n	e	n 81 e	0.0	4.0	17.5	11.35	11.54	0.920	Inp.
M	29.5785	29.5601	29.6108	29.5887	21.09	25.45	22.34	22.79	− 2.01	.108	.116	.110	.110	.86	.78	.83	.82	....	....	....	....	10.26	11.72	8.58	......	10.22	1.165	26.3

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR JANUARY, 1864.

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 . . . . 30.102 at 6 a.m. on 7th. } Monthly range=
Lowest Barometer . . . . 28.910 at 2 p.m. on 19th. } 1.192 inches.

Self-register-ing Ther.:
- Maximum temperature . . . . 44°2 on p.m. of 24th } Monthly range=
- Minimum temperature . . . . —9°0 on a.m. of 2nd } 53°2
- Mean maximum temperature . . 29°58 } Mean daily range=12°07
- Mean minimum temperature . . 17°51 }
- Greatest daily range . . . . . . 26°9 from a. m. to p. m. of 21st.
- Least daily range . . . . 2°8 from a. m. to p. m. of 18th.

Warmest day . . . 23th...Mean Temperature . . . 36°82 } Difference=39°22.
Coldest day . . . . 2nd...Mean Temperature . . . —2°40 }

Maximum Radiation { Solar (Vacuum) . . . . 106°0 on p. m of 26th } Monthly range=
{ Terrestrial . . . . —13°5 on a. m. of 2nd } 119°.5

Aurora observed on 0 nights. Possible to see Aurora on 11 nights; impossible on 20 nights.

Snowing on 14 days; depth 26 3 inches; duration of fall, 65.5 hours.
Raining on 5 days; depth, 1 165 inches; duration of fall, 16.4 hours.
Mean of cloudiness=0.67; below average, 0.05. Most cloudy hour observed, 8 a.m; mean=0.77; least cloudy hour observed, 4 p.m.; mean=0.60.

Sums of the components of the Atmospheric Current, expressed in Miles.

North.	South.	East.	West.
1351.28	2678.33	827.94	5094.59

Resultant direction, S. 73° W.; Resultant Velocity, 6.00 miles per hour.
Mean velocity 10.22 miles per hour.
Maximum velocity 33.4 miles, from 1 to 2 p.m. on 2nd, and from 6 to 7 p m. on 19th.
Most windy day 1st—Mean velocity 28.37 miles per hour. } Difference 26.88.
Least windy day 27th—Mean velocity 1.49 miles per hour. }
Most windy hour, noon to 1 p.m.—Mean velocity, 12.36 miles per hour. } Difference
Least windy hour, 4 to 5 a.m.—Mean velocity, 7.95 miles per hour. } 4.41 miles.

1st, 2nd, and 3rd.—Continued storm of wind from 4 a.m. of 1st to 1 a.m. of 4th; temperature piercing and keen.—13th. Perfect solar halo at 1 and 2 p.m.—14th. Solar halo 3 to 4 p.m.—16th. Perfect lunar halo 8 to 9.30 p.m.—18th. Heavy snow storm from 3 p.m. of 18th, continuing to 8 p.m. of 19th; wind high and squally, and snow drifting furiously.—20th. Solar halo at 9 a.m.; lunar corona 9 and 10 p.m.—22nd. Lunar halo at 10 p.m.—24th. Lunar corona at 9 p.m.—25th. Solar halo during the forenoon.—30th. Stormy; rain and snow intermixed 7 a.m. to midnight.—31st. Heavy storm of rain from midnight to 6 a.m. of 1st February.

The temperature of the first eleven days of this month was uniformly cold, being, up to the 11th inclusive, 14°58 below the normal; the latter part of the month was comparatively warm.

COMPARATIVE TABLE FOR JANUARY.

YEAR.	TEMPERATURE. Mean	Excess above Average, (45°5).	Maximum observed.	Minimum observed.	Range.	RAIN. No. of days.	Inches.	SNOW. No. of days.	Inches.	WIND. Resultant. Direction.	Velocity.	Mean Force or Velocity
1840	17.0	— 6.6	40.6	—13.8	51.4	4	1.395	11	...	...	...	...
1841	25.6	+ 2.0	41.7	— 4.1	45 8	2	2.150	14	...	...	...	0.36 lbs
1842	27.9	+ 4.3	45.8	1.3	44.5	4	2.170	9	...	...	...	0.78 "
1843	28.7	+ 5.1	54.4	1.5	52.9	6	4.293	12	14.2	...	...	0.69 "
1844	20.2	— 3.4	44.6	— 7.7	52.3	7	3.005	11	24.9	...	...	0.70 "
1845	26.5	+ 2.9	43.0	— 3.4	46.4	5	Imp	9	22.7	...	...	0.70 "
1846	26.7	+ 3.1	41.2	0.3	40.9	5	2.333	10	6.0	...	...	0.55 "
1847	23.3	— 0.3	42.6	— 2.2	44.8	7	2.135	5	7.5	...	...	1.09 "
1848	28.7	+ 5.1	51.5	—12.0	63.5	7	2.245	8	7.1	N 82 W	2.03	5.82 ms
1849	18.5	— 5.1	40.1	—15.2	55.3	4	1.170	10	9.2	N 63 W	3.06	6.71 "
1850	29.7	+ 6.1	46.3	10.6	35.7	5	1.255	8	5.2	N 37 W	0.69	5.80 "
1851	25.5	+ 1.9	43.2	—12.8	56.0	4	1.270	10	7.8	S 77 W	3.26	7.69 "
1852	18.4	— 5.2	37.3	— 7.0	44.3	0	0.000	19	30.9	N 68 W	3.14	7.67 "
1853	23.0	— 0.6	40.9	— 6.6	47.5	1	0.290	6	7.5	N 27 W	2.52	6.34 "
1854	23.6	0.0	45.2	— 4.3	49.5	7	1.275	11	7.5	N 77 W	2.44	6.91 "
1855	25.9	+ 2.3	48.2	— 4.7	52.9	5	0.525	13	23.3	N 73 W	1.91	7.26 "
1856	16.0	— 7.6	33.1	—12.1	45.2	0	0.000	14	13.6	N 75 W	5.24	10.69 "
1857	12.8	—10.8	34.6	—20.1	54.7	3	Inap	16	21.8	N 70 W	4.96	10.31 "
1858	30 0	+ 6.4	45.8	7.5	38.3	6	1.152	11	4.0	N 71 W	2.33	7.40 "
1859	26.4	+ 2.8	41.5	—26.5	68.0	6	1.449	19	16.4	S 81 W	3.17	8.76 "
1860	23.4	— 0.2	45.4	— 5.1	50.5	6	0.740	16	8.7	N 89 W	6.09	9.37 "
1861	19.9	— 3.7	34.5	— 7.0	41.5	4	0.685	23	20.6	N 86 W	2.92	9.30 "
1862	21.7	— 1.9	42.8	— 1.9	44.7	5	0.115	19	27.4	N 26 W	2.69	8.83 "
1863	28.1	+ 4.5	44.6	—11.2	55.8	10	1.122	17	20.6	N 61 W	1.13	7.23 "
1864	22.8	— 0.8	42.5	— 6.0	49.1	5	1.165	14	26.3	S 73 W	6.00	10.22 "
Results to 1864.	23.61	...	42.86	—6.52	49.38	4.8	1.331	12.6	15.15	N 77 W	2.92	8.02
Exc. for 1864.	—0.82	...	— 0.36	—0.08	— 0.28	+ 0.2	— 0.166	+ 1.4	+ 11.15	...	...	+ 2.22