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THE

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THE CANADIAN JOURNAL.

NEW SERIES.

No. LXI.—JANUARY, 1866.

THE OPTICAL DEFECTS OF THE EYE AND THEIR TREATMENT BY THE SCIENTIFIC USE OF SPECTACLES.

BY A. M. ROSEBRUGH, M.D.

(Read before the Canadian Institute, February 3rd, 1866.)

The following pages were written as an introduction to a course of lectures recently delivered by me on the diseases of the eye. I have not thought it necessary to alter the form, as I propose publishing them as a pamphlet, hoping that they may be useful, not only to the members of my ophthalmic class, but to Canadian medical students generally.

In their preparation, I must here acknowledge my indebtedness to the elaborate works of Mr. J. Z. Laurence and Mr. J. Soelberg Wells, of London, and especially to the very comprehensive treatise of Professor Donders, of Utrecht, published in 1864 by the New Sydenham Society.

Chapter I.—Optical Considerations.

The eye is pre-eminently an optical instrument, and the phenomena of vision all depend upon the laws of optics. Hence, a knowledge of some, at least, of the elementary principles of light is essential to a correct appreciation of the physiology of the eye. The diagnosing of optical defects of the eye,—long and short sight, &c. &c., and their treatment with the scientific use of spectacles, require some knowledge of the laws of refraction, and the properties of convex and concave lenses.

The philosophy of the ophthalmoscope can hardly be understood unless the principles of both refraction and reflection are thoroughly mastered.

You will therefore, I hope, not consider the time ill spent if, before proceeding with the investigation of diseases of the eye—you review with me some of the elementary principles of optics which lie at the foundation of all ophthalmic science.

The *nature* of light is not known. I can no more tell you what light is, than your professor of physiology can tell yon what life is. We know that the sun shines, but how it shines we cannot tell.

"Two different theories have been advanced of the more intimate nature of light." "One, the *Newtonian* (*corpuscular*) conceives that each luminous point is constantly giving off a succession of luminous corpuscles which follow each other in uninterrupted succession on an imaginary line or axis like a string of beads on a rigid thread."

The *undulatory* theory (Christian Huychens') on the other hand considers space as pervaded by a subtle gaseous fluid or ether; that luminous bodies have the power of communicating to this ether a wave motion which affects the retina the same as vibrations of the air affect the auditory nerve.

Sir John Herschel, speaking of the great ingenuity of the undulatory theory says, "if it is not true it deserves to be."

The sun is the great natural source of light; as it shines by its own light it is called *self-luminous*. The fixed stars are also self-luminous; so is a lighted lamp and bodies in a state of ignition. But most bodies by which we are surrounded, are seen only by reflected

light. The light from an object seen by moonlight is reflected twice before it reaches the eye. The moon reflects the light from the sun, and the object, the light which it receives from the moon.

Every luminous object gives off, or radiates, in every direction, an infinite number of straight lines of light. Each of these lines taken alone is called a *ray* of light. A bundle of rays is called a *beam* of light when the rays run *parellel* to each other. When the rays *diverge* from a luminous point or are made to *converge* to a focus they are called a *pencil* of rays, thus :

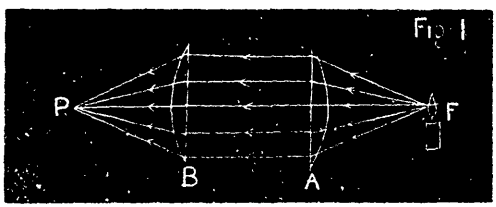


Fig. 1 represents a pencil of rays diverging from a flame F, after passing a convex lens they are rendered parallel and these parallel rays passing the second convex lens B, the rays are converged to the point (focus) P.

The parallel rays may be called a *parallel* pencil; the diverging rays a *divergent* pencil, and the convergent rays a *convergent* pencil. The point where rays of light meet is called the *focal* point or simply a *focus*.

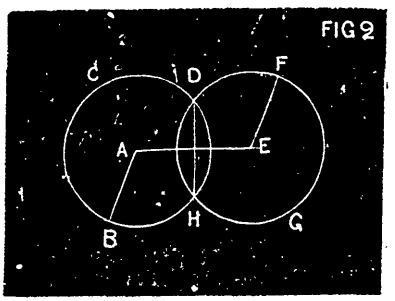
Strictly speaking, there is no such thing in nature as parallel rays; the nearest approach we have to it are the rays of light we receive from the sun and the fixed stars. Practically, for our purpose however, we may consider rays of light parallel that are received by the pupil of the eye from objects that are twenty feet distant or any distance greater than that. Pencils of light from objects less than twenty feet distant are more decidedly divergent.

A good illustration of a divergent pencil can be obtained from a lighted lamp or candle in a dark room. If a piece of card board, with a small circular opening in it, be held near the lamp, you will have, upon the opposite wall, an illuminated spot of the same shape as the opening in the card, but very much larger.

This will prove not only that the rays *diverge*, but also that the rays proceed in straight lines.*

Convex lenses :—We shall now proceed to the consideration of convex lenses, which, for our purpose, is the most important part of the subject. Lenses are made of various transparent substances as amber, alum, quartz, glass, diamond, and even of ice. Those in ordinary use are made of glass. When the two surfaces of a convex lens have the same degree of curvature, the lens is said to be equi-convex. When one of the surfaces is flat or plane, the lens is called a plano-convex lens. Glass spectacles used by old persons for reading, &c., are commonly made double convex.

In order to simplify the subject as much as possible, let us confine our attention to lenses that are equi-convex.

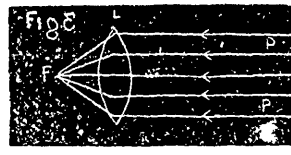


In fig. 2 let A be the centre of the circle B, C, D, of which A, B, is the radius, and let E be the centre of the circle F, G, H, of which the radius E, F, is equal to the radius A, B. The circle F, G, H, will be equal to the circle B, C, D. The part D,H, common to both circles, represent a section of an equi-convex lens. The line A,E, is called the *axis* of the lens, and the line D, H is called the *diameter*. The centre of the diameter (where it is intersected by the axis) is *the optical centre of the lens.*

Reading glasses, and burning glasses, are examples of a double convex lens. Many of you have, doubtless, seen the experiment of

(* Convergent pencils of light do not exist in nature. Parallel pencils or divergent pencils of rays can be rendered convergent by means of a convex lens. Thus in fig. 1, the rays diverging from F, are made to *converge* to P by the convex lenses, A, and B.)

setting fire to wood, paper, &c., by means of a burning or sun glass. The explanation of this is simply that the convex lens possesses the property of converging a portion of the sun's rays to a point called the focus.



In Fig. 3, P, P, represent a pencil of parallel rays converged to a focus at F by means of the double convex lens, L.

The focus for parallel rays is called the *principal* focus. It is always the same distance from the optical centre in the same lens. The length of the focus for parallel rays is, in equi-convex lenses, equal to the length of the radius of curvature.

The shorter the focus, the greater is the "power" or "strength" of the lens. A lens that can bring parallel rays to a focus at a distance of one inch from the optical centre of the lens, would be called a *one inch* lens. Another lens whose focus is two inches from the optical centre, is called a *two inch* lens, and so on. Convex lenses therefore receive their names according to the number of inches, or fraction of an inch, the principal focus is distant from the centre of the lens. The strongest lenses used for spectacles are what are called cataract glasses; they are worn by patients who have had their crystaline lenses removed. Their strength ranges from 2 to 4 inches focal length. The weakest spectacles that are ordinarily used have a focus of 36 inches. Convex lenses having a focus of 36 inches do not enlarge the letters of a book at the ordinary reading distance.

Let us now see what practical application we can make of this principle of convex lenses.

Supposing that a person accustomed to using convex spectacles, gets one of the glasses broken, and applies to you to learn the strength of the glass that would be necessary to replace the broken one, or in other words—to learn the strength of the glass that is still whole. How would you proceed? One method is to use the lens as a sun glass, and ascertain by measurement, how far from the glass, the sun's rays are brought to a focus. If you find, for instance, that the focus is 10 inches from the lens, you will have ascertained that the person has

been wearing glasses of 10 inch focus, or as they are sometimes called No. 10 convex, or simply + 10 (plus 10).

The method, however, that is usually adopted, depends upon a property of convex lenses that will be more fully explained further on.

If, for instance, you hold up a 10 inch convex lens at a distance of 10 inches from a white wall—the wall being about 20 feet from an open window, opposite—there will appear, behind the lens, upon the wall, an inverted, miniature picture of the window, and trees or buildings, &c., in front of the window. If the lens be held at a greater or less distance from the wall than the focal length of the lens, the inverted picture will be indistinct. Measuring the distance therefore that the lens must be held from the wall, to produce the sharpest picture, will give the focal length of the lens.

Suppose, now, that we bring the lens to within, say 5 feet of the window, and hold a sheet of white paper at the principal focal distance behind the lens, viz., at ten inches, we will find a change in the inverted picture, there will still appear distant buildings, trees, &c. but the sash of the window will be very indistinct. If, however, we move the sheet of paper 12 inches from the lens—that is, two inches farther from the lens, we will again see the image of the sash but scarcely any trace of the buildings, trees, &c. This experiment is an illustration of the fact that the nearer an object approaches the front of a convex lens, the farther will be its image behind the lens; thus, when an object is 5 feet or rather 60 inches from the front of a 10 inch convex lens, the inverted image is found to be 12 inches behind the lens; when 30 inches, it will be 15 in.; when 20, that is, double the length of the focus, the image will be double the length of the focus behind the lens; viz., 20 inches; when 15 inches, the image behind the lens will be removed to 30 inches. As the object approaches the principal focal distance of the lens the image recedes much more rapidly; thus, when at 12 inches, the image will be 60 inches; when at 11, the image will be 110 inches behind the lens. When however we bring the object to within 10 inches of the lens—that is, at its principal focus, there will be no image formed behind the lens, as the rays after passing the lens will be parallel.

(I would strongly urge you, gentlemen, to perform all these experiments for yourselves, as in that way only can you become familiar with these important principles. These latter experiments can be performed best in a dark room—taking for an object the flame of a lamp or candle).

From the above we can easily understand the principle, 1st, that the *less* divergent the rays of a pencil (that is, the nearer they approach parallel rays,) incident or falling upon a convex lens, the nearer will the focus of the convergent pencil be to the principal focus of the lens. 2nd. The *more* divergent the incident pencil, the less convergent (the more nearly parallel) will be the refracted pencil, and the more distant will its focus be from the principal focus of the lens.

Questions of the following nature very often arise in optics, viz., the length of the principal focus of a convex lens being given, and the distance a certain object is in front of it;—to find how far behind the lens will be the inverted image of the object. Or to express it more technically, the length of the principal focus of a convex lens being given and the length of the divergent incident pencil, to find the length of the focus of convergent refracted pencil. Thus: Suppose you had the following question: A 10 inch lens is 60 inches from an object; how far behind the lens will be the inverted image?

This could be solved immediately, by actual trial, and measurement, but this is not always practical.

The rule given in some text books on optics is as follows: multiply the length of the divergent incident pencil, that is, the distance the object is from the lens, by the focal length of the lens, and divide by the difference; thus: $60 \times 10 = 600$, $60 - 10 = 50$, 600 divided by $50 = 12$; or $\frac{60 \times 10}{60 - 10} = \frac{600}{50} = 12 =$ the distance behind the lens.

There is another property of convex lenses which I must not omit to mention; namely, what is called it magnifying power.

When a convex lens is placed between the eye and an object,—the object being at a less distance from the lens than its principle focus, the object will appear enlarged or magnified. The shorter the focus of the lens, the greater is its magnifying power. Thus, a 4 inch lens has a greater magnifying power than an 8 inch lens; a 2 inch lens greater than a 4, and a 1 inch greater than a 2 inch lens. The 1 inch lens has, in fact, double the magnifying power of a 2 inch lens; a 2, double that of 4 inch; a 4 inch, double that of an 8 inch, &c.

The "power" of a lens is therefore inversely proportional to its focal length. For this reason a different form is used in expressing the "power" or strength of a lens. A 1 inch lens is taken as unity,

and as a 2 inch lens is just half the strength, it is simply expresed $\frac{1}{2}$, and as a 3 inch lens has just one-third the strength of a 1 inch, it is written $\frac{1}{3}$; a 4 inch is $\frac{1}{4}$ &c. We will find that this nomenclature is not only very convenient, but scientifically correct.

For example, suppose we have two lenses of 4 inch focus each, and we wish to know their combined "power" when used as one lens; we simply add their reciprocals thus $\frac{1}{4}+\frac{1}{4}=\frac{2}{4}=\frac{1}{2}$. The two lenses have, therefore, the magnifying power of $\frac{1}{2}$, which is the reciprocal of 2, and are consequently, together, equal to a 2 inch lens, which can be proved by actual measurement. Again, suppose we have a 6 inch lens, and a 12 inch lens, and we wish to know their combined strength, $\frac{1}{6}+\frac{1}{12}=\frac{3}{12}=\frac{1}{4}$ which represents the power of a 4 inch lens; the 6 and the 12 inch lenses taken together being equal to one lens having a focus of 4 inches.

To save repetition, I may here state that when a *concave* lens enters into combination with a *convex* lens, it has a neutralizing effect upon the convex lens. If we have a convex 6 and a concave 6 the one would neutralize the other,—thus $\frac{1}{6}-\frac{1}{6}=0$. But if the convex lens has the higher power, the concave lens simply weakens it—that is, lengthens its focus—thus, if we have a convex 6 and a concave 9 the result will be $\frac{1}{6}-\frac{1}{9}=\frac{3}{18}-\frac{2}{18}=\frac{1}{18}$, which represents the strength of one lens having a focus of 18 inches. If, however, the concave lens has the higher "power" it will simply be weakened by the concave lens,—the combination will be equal to a concave lens having a lower "power," or a longer focus than the concave lens taken,—thus reversing the last example, suppose we have a *concave* 6 and a *convex* 9, we will then have $-\frac{1}{6}+\frac{1}{9}$ or simply $\frac{1}{9}-\frac{1}{6}=\frac{2}{18}-\frac{3}{18}=-\frac{1}{18}$, which represents the strength of a *concave* lens having a focus of 18 inches.

This fractional nomenclature (taking 1 for numerator and the focal length of the lens for denominator) will assist us also in understanding the principle of the formation of images at different distances behind a convex lens, according to the distance of objects in front of it.

Let me remind you that when an object, for instance the flame of a candle, is placed in the focus of a convex lens, the diverging rays of light from the object are rendered parallel by the lens. Thus, a lens having a focus of 20 inches will render parallel pencils of light diverging from an object 20 inches from the lens. Bearing this in mind let us again try the solution of the following question, pro-

pounded not long since, viz. :—When an object is 60 inches in front of a 10 inch convex lens, how far behind the lens will be the inverted image of the object? Or, to express it differently, when a divergent pencil of light emanates from a point 60 inches from a 10 inch convex lens, at what distance behind the lens will the pencil be converged to a focus?

Now, we know that a lens of 60 inches focus, placed in the position of the 10 inch lens, would render the rays parallel that fall upon it from the object 60 inches distant. Were it possible, therefore, to divide the 10 inch lens into two lenses, one having a focus of 60 inches to render the rays parallel, the remaining portion would bring these parallel rays to a focus at its principle focus. Deducting then $\frac{1}{60}$ from $\frac{1}{10}$ will give the strength of the remaining portion of the lens $\frac{1}{10}-\frac{1}{60}=\frac{5}{60}=\frac{1}{12}$; the two parts then $\frac{1}{60}$ and $\frac{1}{12}$ are equal to the one lens $\frac{1}{10}$. And, as the $\frac{1}{60}$ will render the rays parallel from the object 60 inches distant, and these parallel rays falling upon the other part $\frac{1}{12}$, they will be brought to a focus at the principle focus of this part, viz: at 12 inches from the lens. Let us illustrate this with another example. Suppose that an object is 30 inches in front of a convex lens of 10 inch focus, and we wish to know how far behind the lens will be the focus of a pencil of rays diverging from a point in the object. We will have $\frac{1}{15}-\frac{1}{30}=\frac{2}{30}=\frac{1}{15}$; this $\frac{1}{15}$ represents the power of a 15 inch lens, which we know will bring the parallel rays to a focus at 15 inches behind the lens.

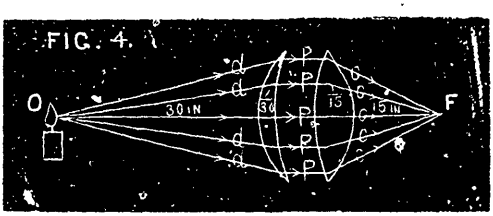


Fig. 4 illustrates this; O represents an object 30 inches from a ten inch convex lens, the lens supposed to be divided into two parts, one having a focus of 30 inches, and the other a focus of 15 inches. The 30 inch lens refracts the rays of the divergent pencil d, d, d, d, so as to render them parallel, as shown at P, P, P, P, P. These parallel rays, meeting the 15 inch lens, are again refracted and are converged to a focus at F, which is the principle focus of the lens, viz., at 15 inches.

Fig. 1, page 3, represents a 10 inch lens, at a distance of 20 inches from an object, F. The lens is supposed to be divided into two equal parts, of 20 inch focus each: *the first half renders the diverging* pencil parallel, and the second half converges the parallel pencil to a focus, at 20 inches from the lens; $\frac{1}{10}-\frac{1}{20}=\frac{1}{20}$.

(Dr. Giraud-Teulon, of Paris, has ascribed the origination of the above theory to Mr. J. Z. Laurence, of London, to whom we are very much indebted, for his praiseworthy efforts to popularize this, hitherto neglected, field of Physiological and Pathological Optics.)

Let me next direct your attention to certain optical considerations, which have a most important application, in the treatment of optical *defects of the eye.*

You may remember that in a former experiment, a 10 inch lens was held ten inches from a white wall, so as to show the miniature inverted picture of the window, &c., 20 ft. distant; and that when the lens was brought to a distance of 60 inches from the window, it was found that the image of the window was formed 12 inches behind the lens, instead of 10 inches, and that at 10 inches, the image was so indistinct as to be scarcely recognizable.

Now suppose that a 12 inch lens be immovably fixed 12 inches from the same wall, it will then be in a proper position to bring parallel rays to a focus on the wall, where it will form an inverted picture of the window, and objects at a distance beyond the window.

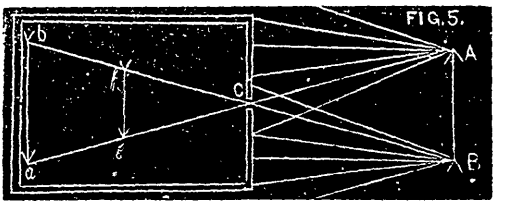
If we now bring the flame of a lamp, for instance, to a distance of 60 inches from the lens, no distinctly defined image of the flame will appear upon the wall; but if, by any means, we can render the pencil parallel that diverges from the flame, the 12 inch lens will then converge it accurately to a focus upon the wall, where we will have an inverted image of the flame.

From the knowledge that we have now obtained, we know that a 60 inch lens placed in front of the 12 inch lens will render these rays parallel. All that we have to do then is to combine a 60 inch lens with the 12 inch lens: the 60 inch lens to render the rays parallel that diverge from the flame, 60 inches distant, and the 12 inch lens to converge these rays to a focus, at the principal focal length of the lens. This is exactly what we do in supplying old people with convex spectacles. Their eyes are constructed to bring parallel rays to a focus, on the retina; but the rays from near objects are *too divergent to be focussed upon the retina without artificial aid;* this deficiency is what we supply with suitable glasses.

Before leaving the consideration of optical lenses, there is one subject to which I wish to direct your attention; namely, the formation of an inverted image behind a convex lens.

Many of you are, probably, familiar with the fact, that when light is admitted into a darkened room, through a small orifice, there appears upon the opposite wall of the room, an inverted, dim, shadowy picture of buildings, trees, &c., in front of the aperture. This can also be seen, on a smaller scale, by holding a sheet of white paper a few inches from the key-hole of a darkened hall.

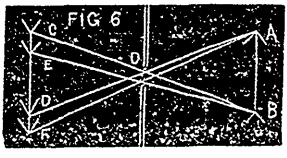
The philosophy of this is seen in Fig. 5.



Let A, B, represent the position of a flame of a lamp that is a short distance in front of an aperture of a darkened box. Pencils of divergent rays of light radiate from the apex of the flame in every direction; one of these pencils is represented in the figure to illuminate the end of the box, and one of the rays escaping through the small orifice *c;* this ray passes in a straight line to the back of the box, and strikes the point *a,* which it illuminates.

Rays of light diverge from the lower part of the flame, also; one of these rays is shown to enter the aperture *c,* and to pass to the back of the box at *b:* In a similar way it might be illustrated that pencils of light radiate from every point in the flame A, B, and that one ray from each point passes into the box and illuminates a portion of the back. In this way we get an illuminated spot at the back of the box, which is an exact counterpart of the flame in front of the box, but *inverted,* the apex of the flame pointing downwards. The reason that the picture is reversed is that, as rays of light (in the same medium) pass in straight lines, a ray from the top of the flame, after passing the aperture, must necessarily pass to the lower part of the back of the box; and a ray from the lower part of the flame must necessarily (in moving in a straight line) pass to the upper part of the back of the box. You will observe, also, that the

size of the image depends upon its distance behind the aperture; if the image is as far behind the aperture, as the object is in front, the image will be of the same size as the object, if half the distance, half the size, as seen at f, g.



If, in the above experiment, the aperture be enlarged, it will be found that the image at the back of the box will become much less distinct; the more the aperture is enlarged, the more indistinct will be the image. The reason of this indistinctness in the image is that, when the aperture is enlarged, a number of diverging rays from one point in the flame pass through the aperture, and each one repeats the image, so that the parts of the image overlap each other.

This is shown in Fig. 6. A, B, represents the flame of the lamp, and C, E, D, F, the image behind an aperture. The aperture is supposed to be just large enough to admit two divergent rays, each of these rays produces a separate image; thus, the point A is repeated twice at D and F, and the point B is repeated at C and E. The larger the aperture, the more light is admitted, but the more indistinct is the image.

If now, a convex lens be inserted in the enlarged aperture, these divergent rays that enter the aperture (from every point of the object) are converged to a focus; thus in

Fig. 7.

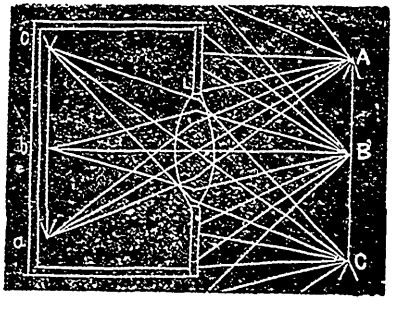


Fig. 7. A C represents an object in front of a convex lens, and *a c* the inverted image behind the lens. Rays diverging from the point A and falling upon the lens L are brought to a focus at *a;* rays from B are similarly focussed at *b*, and so on. In a similar manner, diverging rays from every point in the object A C that enter the lens are brought to a focus in the image between *a* and *c*. We will then have in the position of *a c* a distinct inverted image of the object A C. If this image is received upon a sheet of white paper we can see it only upon its front surface; but if it is received upon thin oiled paper, or upon ground glass, we can see it from behind; and if, while viewing the image from behind, the ground glass be removed, we can still see the inverted image (or at least a portion) occupying the same position as the ground glass just occupied—being suspended, as it were, in the air, and forming what is called an ærial image. In order to see this ærial image under favourable circumstances, one eye only should be used, and should be in a line with the lens and the object, and should be at least ten inches behind the position of the inverted lens.

Chapter II.—Optics of Normal Eye.

The human eye, from before backwards, is about one inch in diameter. Its transparent media are the cornea, aqueous humour, crystaline lens, and vitreous humour. This combination, with the convexity of the cornea, is equal to a convex lens having a focus of about one inch (more accurately $\frac{15}{20}$ of an inch.)

When a normal eye is directed to a distant object (*i. e.* in a state of rest), parallel rays of light are brought to a focus upon the retina, and a very minute inverted picture of the object is sharply defined upon that membrane. If the sclerotic coat be removed from the back of the eye of an ox, and the eye be placed in an aperture of a darkened room, with the cornea looking, for instance, towards the opposite side of the street, an inverted image of the buildings, &c., in front of the aperture will be seen at the back of the eye.

The impression that objects make upon the retina, is conveyed through the optic nerve to the brain, but in what manner this communicates to the mind a knowledge of the appearance of objects, is more than we can tell. We can simply say with Potterfield, that "God has willed it so."

We are aware, however, that although the eye may be free from

disease, and the connection between the retina and brain in every way perfect, if the optical mechanism of the eye be in any way defective so as to produce ill defined images upon the retina,—vision will be indistinct, and that the distinctness or indistinctness of vision will be in exact proportion to the distinctness or indistinctness of the inverted picture. Hence the necessity of understanding the optics of the eye in order to comprehend the pathology and treatment of the numerous optical defects to which it is liable.

CASE 1. Let me here take an example. A few weeks ago a physician of this city sent a patient for my advice, fearing that he was losing the sight of his left eye. Upon examination, I found that he had what we call "paralysis of accommodation" of that eye.

He could see distant objects with perfect distinctness, but near objects he was unable to define; he could not read large type unless the letters were very large, and several feet from the eye. The eye was, in fact, simply passive, like a convex lens, or a camera-obscura with the screen to receive the image immovably fixed at the principal focus of the lens, and could only bring parallel rays to a focus on the retina.

I found that by rendering the diverging rays parallel, by means of a convex lens, he could see near objects distinctly; by placing a six inch convex lens before that eye, he could read fine type at six inches, with a 10 inch lens at ten inches, with an 18 inch lens at eighteen inches, &c. &c. The 6 inch lens rendered the rays parallel that diverged from the letters six inches distant, and these parallel rays falling upon the eye were brought to a focus upon the retina. [A 6 inch lens does not increase the apparent size of letters one-half, whereas this patient could not see letters ten times the ordinary size at six inches, or any distance less than about two feet from the eye.] The 10 inch lens rendered the rays parallel from objects ten inches distant, and the 18 inch lens from objects eighteen inches distant.

The eye was unable to bring diverging rays to a focus upon the retina; in other words it had lost the power of "accommodation." (We can temporarily paralyse the accommodation of the eye by applying a strong solution of Atropine.)

A normal eye differs from the glass lenses we have been describing in the fact that it can, not only focus parallel rays upon the retina, but also rays that diverge from objects as near as from four to six or eight inches from the eye. When parallel rays fall upon a 1 inch convex

lens, they are brought to a focus one inch behind the lens, but if an object, for instance the flame of a lamp, be brought to within four inches of the lens, we know that the focus will fall farther than one inch behind the lens. If we wish to receive the inverted image of the lamp upon a screen, the screen must be held one inch and a third behind the lens.

Now when an object is brought to within, say four inches of the eye, it has no power to move the retina backwards to receive the image that would be formed behind that membrane, but, what answers the same purpose, it has the property of so far increasing its refractive power, as to be able not only to render parallel, these diverging rays, but also to focus them upon the retina. This increase in the power of the eye, is equal to the addition of a 4 inch lens in front of an eye that has its "accommodation" paralysed, as a 4 inch lens renders rays parallel that diverge from objects four inches distant.

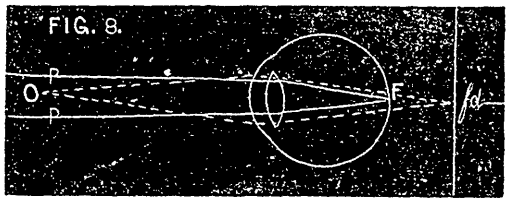


Fig. 8 represents the section of a normal eye. When it is accommodated for distant objects parallel rays P, P, are focussed upon the retina at F, while diverging rays from O, would form a focus at *fd*. When, however, the eye is accommodated for the near object O, these diverging rays are focussed upon the retina at F.

The manner in which this increase in the refractive power of the eye is effected is still a disputed point. Most physiologists however are now inclined to the theory that it is caused by an increase in the curvature,—a thickening from before backwards, of the crystaline lens.*

* The accommodation of the eye was at one time believed to be produced by the external muscles, but it is now ascertained that the accommodation can remain perfect with all the external muscles paralysed.

The iris was thought, by others, to have the power of increasing the refractive power of the eye, but it was proved by a case that occurred in Dr. Von Graefe's practice that accommodation can still be effected with entire absence of the iris.

Helmholtz and Cramer have proved by means of the opthalmometre, that when the eye is accommodated for a near object it undergoes the following changes:—

The "near" and "far" point.—The nearest point to which objects can be brought to an eye and be seen with perfect distinctness, is called the "near" point, and the farthest point of distinct vision is called the "far" point.

In a normal eye the "near" point is about seven inches from the front of the cornea, and the "far" point is at an unlimited distance. In childhood, however, the "near" point is about $3\frac{1}{2}$ inches from the eye and recedes as age advances. At the age of forty the "near" point of a normal eye is nearly eight inches from the eye.

When the "near" point recedes to a greater distance than eight inches from the eye it becomes inconvenient; such an eye is called *presbyopic* or long-sighted.

When the "far" point is not unlimited, but is at a definite distance from the eye, as for instance from six inches to four or five feet from the eye—such an eye is called *myopic* or short-sighted.

Range of Accommodation.—The distance between the "near" and "far" point in any eye, is called the "range of accommodation." If a person can read distinctly very fine type at four inches from the eye, and can also see clearly at an infinite distance the range of accommodation would be said to equal $\frac{1}{4}$ because, when such an eye is directed to objects at an infinite distance, (accommodated for parallel rays) in order to see clearly objects only four inches distant, it is necessary to increase the curvature of the crystaline lens, or in other words the "power" of the eye to an extent equal to the addition of a 4 inch convex lens; the power of which is expressed by $\frac{1}{4}$. If a person's "near" point is at eight inches from the eye, and his "far" point at an infinite distance. his range of accommodation would be said to equal $\frac{1}{8}$.

If the "near" point of a myopic eye be 3 inches, and the "far" point be 12 inches, we get the range of accommodation by the equation $\frac{1}{3}-\frac{1}{12}=\frac{1}{4}$.

Chapter III.—Myopia.

Concave Lenses.—Before proceeding to the consideration of Myopia, it will be well for us to glance at some of the properties of concave lenses; and, in order to simplify the subject, we will confine

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1st. The pupil contracts; 2nd. The pupillary edge of the iris moves forward; 3rd. The peripheral portion of the iris moves backwards; 4th. The anterior surface of the lens becomes more convex (arched); 5th. The lens does not change its position; 6th. The cornea retains the same degree of curvature.

ourselves to equi-concave lenses. An equi-concave lens is bounded by two surfaces, which are portions of the concave side of two circles which have equal radii.

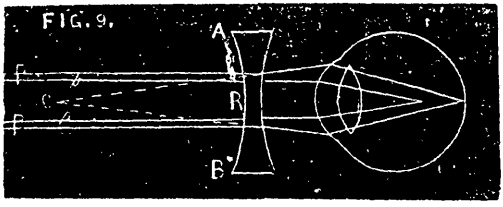

Fig. 9. A, B, one of the concave surfaces of the lens. C is the centre of curvature, and C, R the radius of curvature. When parallel rays, P, P, strike one surface of the lens, they have a divergence upon leaving the second surface of the lens, as if they proceeded from the centre of curvature, C, which, in an equi-concave lens, is also the principal focus of the lens. C, R, is the focal length of the lens. In a convex lens, the focus is measured *behind* the lens; in a concave lens, it is measured *in front* of it. If we call the focus of the convex lens positive, we must call the focus of the concave lens negative. When parallel rays of light fall upon a convex lens, they are converged to a focus. When they fall upon a concave lens, they are made to diverge. A convex lens enlarges, and a concave diminishes the apparent size of objects. The focal length of a convex lens is measured behind; and that of a concave lens, in front of the lens. They are, therefore, entirely opposite in all their properties; and, for this reason, a convex lens is called a positive lens; and a concave one, a negative lens. Or, shorter still, they are indicated by the plus (+) and minus (—), algebraic symbols; thus, + 5, and — 5; or, + $\frac{1}{5}$, and — $\frac{1}{5}$. To ascertain the focal length of a concave lens, we ascertain what convex lens it will neutralize.

1. In a myopic eye, parallel rays, as well as those that have a certain degree of divergence, are focussed *in front* of the retina; and, the inverted image of distant objects being formed in the same position, the picture upon the retina will be ill-defined, and vision for distant object consequently indistinct.

Patients with myopia complain that, although their vision for near objects is perfect, they cannot see objects at a distance with any dis-

tinctness. They can read the smallest type, when brought near the eyes, even better than persons with normal vision, but they are not able to recognize their friends at a distance of fifteen or twenty feet.

In order to enable such persons to see distinctly at a distance, it is necessary for them to wear concave spectacles of such a strength, that the parallel rays from distant objects may have such a degree of divergence, that, falling upon the myopic eye, they may form a focus upon the retina. Theoretically, we should prescribe concave glasses of such a strength that their focus will correspond with the patient's "far" point. Thus, if the "far" point be at 12 inches, we should prescribe — 12, as a twelve inch concave lens, placed before such an eye, will give parallel rays from distant objects the same degree of divergence as if they proceeded from the "far" point of the eye; namely, at 12 inches from the eye. Thus, in Fig. 9, P. P. represent parallel rays falling upon the concave lens, A. B.; they are made to diverge, as if coming from the focus, C., and falling upon the eye divergingly, they are focussed upon the retina at F. Practically, however, we would find that — 12 would be rather too strong, and that — 15, or — 16 would probably answer better. As a rule, the weakest glasses should be worn that will enable the patient to see distant objects with distinctness.

In testing the degree of myopia, we use a series of test types that are so constructed that No. I (smallest) can be distinctly seen and read by a person having normal vision, at a distance of 1 foot; No. II, at 2 feet; No. V, at 5 feet; No. XX, at 20 feet; and so on. A specimen of these types will be annexed to this paper. The types are also used in testing the acuteness of vision in Presbyopia, Hypermetropia, Amblyopia, &c.

2. In determining the degree of myopia in any case, we ascertain the greatest distance at which No. I test types can be read distinctly; if at 10 inches, the "far" point will be at 10 inches, and the myopia would be called $\frac{1}{10}$; if at 6 inches, the myopia would be called $\frac{1}{6}$. From this we can, as stated above, get a proximate knowledge of the strength of the concave lens necessary to relieve the myopia.

3. A myopic eye, when in a state of rest, is adjusted for diverging rays. To enable such an eye to see distant objects, that is, to bring parallel rays to a focus on the retina, it is necessary to give these parallel rays a preliminary degree of divergence by the interposition of the proper concave lens.

4. Myopia can be distinguished from every other defect of vision, by the fact that concave glasses improve vision for distant objects. If we have no concave glasses convenient, we can diagnose it from Amphyopia, (insensibility of the retina) by the following ready method:—A person with normal vision can read distinctly, No. I test type at 12 inches, and even a little farther. We will suppose that a patient's vision is so impaired, that he can only read No. II at 6 inches; if he is *not* also myopic, he can also read No. IV at 12 inches, or No. LX at 180 inches—that is at 15 feet. However impaired then a person's vision may be, unless he be also myopic, he can see as well proportionately, at one distance as at another. On the contrary, a person with myopia, say $\frac{1}{6}$, can see the smallest type (much smaller than No. I,) at 6 inches, but he cannot see No. II, or even No. V, at 12 inches.

This disease is often hereditary. Over exertion of the eyes upon near objects at the age of puberty, (about 14 or 15) is a very frequent cause of myopia.

Short-sighted persons often inquire if we would advise the use of spectacles. There can be no objection to wearing glasses that will enable them to see distant objects; for their eyes are thus changed to normal ones, but as most persons use their eyes much more frequently upon near than upon distant objects; the glasses should be no stronger than necessary. Some contend, however, that short-sighted persons should dispense with glasses for reading, writing, &c. Prof. Donders, however, recommends their use for this purpose, for the following reasons:—

1st. "Because strong convergence of the optic axes is necessarily paired with tension of the accommodation. The latter is an associated action, not arising from the mechanism of the convergence, but existing within the eye itself, and may consequently easily lead to an increase of the myopia. Besides this, the pressure of the muscles upon the eye ball appears to be greater when the optic axes are convergent, than when they are parallel, and this increase of pressure cannot but tend to give rise to the development of posterior staphyloma.

2d. "On account of the habit which short-sighted persons have of bending their head forwards during reading or writing. This must cause an increased flow of blood to the eye, and an increased tension within the eye itself. Owing to this development of sclerotico—choroiditis posterior, effusions of blood and detachment of the retina,

which are so apt to occur in short-sighted persons, are undoubtedly greatly promoted. For this reason, we should always tell these patients to read with their head well thrown back, and to write at a sloping desk. But it may, on the other hand, be urged that it is just in looking at near objects that myopic persons have an advantage, for they can see them remarkably distinctly. And the great danger is, that after reading for a short time with spectacles, the patient, on getting somewhat fatigued will, instead of laying the book aside, approach it nearer to the eye, in order to gain greater retinal images, and thus strain and tax his power of accommodation too much. If we, for instance, give a patient whose far point lies at 8 inches, a pair of spectacles which enable him to read at 12 inches, he will, if not very careful, after a short time almost insensibly bring the book nearer to his eyes, and thus have to make use of a greater amount of accommodation. If he does this frequently, he will soon increase his myopia. The greater the range of accommodation the less harm will spectacles do, and *vice versâ*. Spectacles may also be used for near objects in those cases of myopia in which asthenopia (depending upon insufficiency of the internal recti muscles) shows itself as soon as the patient has read or worked at near objects for a short time. Whilst these forms of myopia may be furnished with spectacles for near objects, it is very dangerous to permit their use in patients whose range of accommodation is very limited, and who, moreover, suffer perhaps from such an amount of amblyopia (generally depending upon sclerotico—choroiditis posterior) that they cannot read No. 4 or 5 Jäger even with the most accurately chosen glasses. Such patients will bring the object very close to the eye, in order to obtain large retinal images, the accommodation will be greatly strained, the intra-ocular tension be increased, and great mischief will be sure to ensue. If there is much amblyopia, spectacles should not be permitted at all for near objects."*

In cases where the myopia is extreme, there usually co-exists posterior staphyloma of the selerotic. Von Græfe says it is present in all cases of myopia where the "far" point is less than five inches; the myopia being less than $\frac{1}{5}$. Out of sixty cases of myopia examined by J. Z. Laurence, forty-four had posterior staphyloma.

The presence of this disease can be easily diagnosed with the ophthalmoscope. (See Hulke or Zander on the ophthalmoscope.)

*Mr. J. Z. Laurence, of London, recommends that deeply concave lenses be *tinted*, in order to obviate their "dazzling" effect.—(Med. Times and Gazette, Oct. 22nd, 1864.)

Posterior staphyloma is a serious complication in myopia, as the sensibility of the retina becomes more or less impaired in the position of the bulging of the selerotic, and in some cases the retina becomes detached from the choroid. It is the existence of this disease that prevents improvement in cases of myopia, as the eye becomes flattened with advancing age.

Donders considers that in myopia, the antero-posterior diameter is alone at fault; that is, it is too much elongated, and that the cornea and crystaline lens have usually a normal curvature.

The characteristics of a myopic eye, are*

1st. Parallel rays are focussed in front of the retina.

2nd. The "far" point is at a definite distance and positive.

3rd. When the eye is in a state of rest it is adapted for divergent rays.

4th. Concave glasses improve vision.

Chapter IV.—Hypermetropia.

You will remember that when a normal eye is in a state of rest, and directed to a distant object, parallel rays are brought to a focus upon the retina, and that when a myopic eye is in a state of rest, parallel rays are brought to a focus in front of the retina. When, however, a hyperemtropic eye is in a state of rest, parallel rays would (if continued) form a focus behind the retina. Hypermetropia is, therefore, the reverse of myopia. In myopia, the refractive power of the eye is excessive, and in hypermetropia it is not strong enough. When the accommodation of a myopic eye is paralysed, it has the power of focussing none but diverging rays upon the retina, but a hypermetropic eye under the same circumstances can focus only converging rays upon the retina. The "far" point of a myopic eye is at a definite distance and positive, but the "far" point of a hypermetropic eye is at a definite distance and negative. Concave glasses improve the vision for a myopic eye, and convex for a hypermotropic one.

This is an affection which has received very little attention until within the last ten years. It was indeed noticed by Dr. McKenzie of Glasgow, in 1841, but it was not until about five years ago that

* From Donders' system of classification.

Prof. Donders, of Utrecht, from his elaborate researches on this subject, first pointed out how common this affection is, and how *frequently it is the sole cause* of that peculiar weakness of sight (formerly so little understood) called asthenopia.

Donders believes that this condition of the eye depends more upon a shortening of the antero-posterior diameter of the eye, than upon a too low degree of its refractive power; that the cornea and crystaline lens have a normal degree of curvature, and that parallel rays would form a focus at the normal distance behind the lens, were the retina far enough back to receive it.

A very good illustration of a hypermetropie eye is one in which the *crystaline lens* has been removed in the operation for cataract. To enable such an eye to see distinctly, even distant objects, it is necessary to place in front of it a strong convex lens of about four inches focus, called a cataract glass. The eye having too low a refractive power to converge rays to a focus, on the retina, it is necessary to give rays falling upon the eye, a preliminary degree of convergence; the eye having sufficient power to complete their refraction to a point upon the retina. We do the same thing in relieving cases of hypermetrophia.

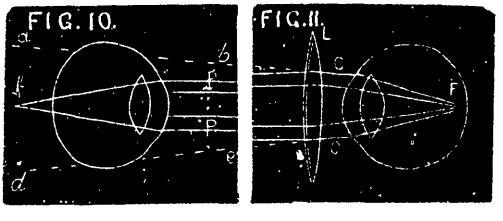

Fig. 10 represents a hypermetropie eye in a state of rest. P P are parallel rays which are focussed behind the retina at f. L, Fig. 11, is a convex lens which changes the parallel rays to convergent ones, at c, c, as if they came from the direction *a b* and *d e*, which again are refracted by the eye, and brought to a focus upon the retina at F.

When a hypermetropie eye is in a state of rest, and directed to distant objects, it is adjusted for convergent rays; images upon the retina will consequently be ill defined, and vision will be indistinct. To remedy this, it is necessary for the eye to increase its refractive power by increasing the antero-posterio diameter of the crystaline lens, so as to bring parallel rays to a focus on the retina.

When a person with hypermetropia, attempts to read or write, or accommodate his eyes to short distances, it is necessary for him to tax his accommodation to its utmost extent, in order to bring the diverging rays to a focus on the retina. This excessive effort at accommodating the eye for short distances, can not be kept up for more than a few minutes, when the ciliary muscle begins to relax,—the "near" point commences to receed, and (if he is reading) the letters become indistinct. The eye also feels fatigued, and other symptoms arise which will be referred to when speaking of Asthenopia.

Diagnosis.—When we suspect a patient has hypermetropia, we test his eyes as follows:—We place a series of test-types, No. xv., xx., xxx., &c., at a distance of about 20 feet. If he can read No. xv. or xx. at this distance, his acuteness of vision is normal. We then try his vision with weak convex glasses, say No. 50, and if he can read the same type, at the same distance, we try successively No. 40, 36, 30, 24, &c., until we reach the glasses that render the test type indistinct at that distance. Some persons may possibly be able to relax their accommodation so as to see as well at a distance, with convex 50 lenses, as without them; and not be hypermetropic; it would, however, be very strong presumptive evidence of its presence; and if, in addition, the patient complain of the symptoms of Asthenopia, we would be generally safe in pronouncing it a case of hypermetropia. The shorter the focus of the lens he can use, the stronger is the presumptive evidence of the disease.

Again, if another patient be tested with the same type, at the same distance, and we find that he can not read a smaller type than No. xl. at 20 feet without spectacles, and that he can read No. xv. or xx. with convex glasses, say + 10 or + 12, his would be called a case of hypermetropia *absolute*.

In order, however, to test accurately the degree of hypermetropia in any case, it is necessary to neutralize one element in the refractive power of the eye; namely, the power of accommodation. In most cases of hypermetropia, particularly in young subjects, the accommodation of the eye is so constantly exercised, even when directed to distant objects, that it is quite impossible for them, by any effort of their own, to completely relax that accommodation. I related in a former chapter, the case of a patient who had lost the power of accommodating his eye to different distances. As the refraction of his eye was normal, parallel rays were brought to a focus upon the retina, and vision for distant objects remained perfect.

Had his eye been hypermetropic, parallel rays would not have been sufficiently converged by the refractive power of the eye, to form a focus upon the retina; vision would, consequently, have been indistinct. By placing, however, the proper convex lens in front of such an eye, the requisite preliminary convergence would be given to the rays, to enable the eye, with its low refractive power, to focus these rays upon the retina, and thus render vision distinct.

The lens used in such a case would indicate the degree of hypermetropia. If the lens were a + 15 inch, the hypermetropia would equal $\frac{1}{15}$ if a + 10, the hypermetropia would be $\frac{1}{10}$, and so forth.

We have, however, the means of temporarily producing this condition of the eye by artificial means. By applying a four grain solution of atropine to the eye, within two hours the action of the ciliary muscle will be completely paralysed. A solution of one grain of atropine to an ounce of pure water (also a solution of the extract of belladonna) will dilate the pupil widely, and in some cases, will render the eye slightly presbyopic, but it will not paralyse the accommodation.

If we test, in this manner, the case of suspected hypermetropia mentioned above, and find that after his accommodation is paralysed, he is not able to read No. xxx. even with + 50, and that the only glass with which he can read No. xv. and No. xx. at 20 feet is + 20; his hypermetropia is therefore $\frac{1}{20}$. But as he could see as well with + 50 as without them, before his accommodation was paralysed; he had a manifest hypermetropia of $\frac{1}{50}$. The difference between his total hypermetropia and his manifest hypermetropia will give the amount of the *latent* hypermetropia, which he overcame with the exercise of his accommodation, namely, $\frac{1}{33\frac{1}{3}}$, thus $\frac{1}{20} - \frac{1}{50} = \frac{1}{33\frac{1}{3}}$.*

Asthenopia, according to Donders, depends almost invariably on hypermetropia. He describes it as follows: "The power of vision is usually acute,—and nevertheless, in reading, writing, and other close work, especially by artificial light, or in a gloomy place, the objects after a short time, become indistinct and confused, and a feeling of fatigue and tension comes on in, and especially above the eyes, necessitating a suspension of work. The person affected now often involuntarily closes his eyes, and rubs his hand over the forehead and

* Hypermetropia can easily be diagnosed with the ophthalmoscope.

eyelids. After some moments rest, he once more sees distinctly, but the same phenomena are again developed more rapidly than before."

According to my own experience with these cases, the above description corresponds very closely with the description that most patients give of their symptoms. Some give more prominence to the neuralgic pains which they experience in and around the eye, and in some cases extending to the back of the head. I was consulted, about a year ago, by a lady from the town of Simcoe, C.W., who had all these symptoms in the most aggravated form. If she attempted to read even one line, it gave her so much pain in her eyes and forehead that, for several years, she had scarcely dared to even raise the lid of a book. She was unable to keep her eyes upon any one object for more than an instant at a time, without causing her pain. Others, again, do not speak of any pain or fatigue of the eye; but that, after reading a short time, the letters become indistinct, so that they are obliged to stop or look away at something distant, or close the eyes for a short time, when they can again proceed, the same symptoms recurring.

In regard to the *prognosis* in hypermitropia, Donders thinks that when it is once developed it never gives way. All the inconvenience of the accompanying Asthenopia can be relieved by wearing the proper glasses to relieve the hypermetropia; but the cause, namely (in most cases), a congenital flattening of the eye-ball from before, backwards, will probably remain through life.

As age advances, the "near" point recedes from the eye, as in a normal eye, so that in time it becomes complicated with presbyopia.

Treatment.—In order to correct this optical defect, it is necessary for the patient to wear a pair of convex spectacles of sufficient strength to enable him to see distant objects distinctly, without any effort of the accomodation. In cases where the hypermetropia is absolute, and the patients are not able to see distinctly at any distance, they can, approximately, by trial, select the glasses that will remedy the low degree of refraction of their eyes. But, in all other cases, it is necessary to paralyse the accomodation, and test with lenses of different strength, in order accurately to ascertain the degree of hypermetropia. When we ascertain this fact, we also know the number of the glasses that we must prescribe for them. The effect of the atropine usually lasts about a week, after which the patient can commence wearing glasses. Before, however, he use the spectacles that he is to wear

permanently, his accomodation must first be gradually relaxed by the use of weaker lenses. Donders' rule is to prescribe first that glass that will neutralize his manifest hypermetropia, and $\frac{1}{4}$ of his latent hypermetropia, and every two or three weeks change them for a stronger pair, as he becomes accustomed to their use, until the glasses are reached that we found to be necessary to correct his hypermetropia. Thus, if a patient has a total amount of hypermetropia equal to $\frac{1}{10}$, and a manifest hypermetropia of $\frac{1}{30}$, his latent hypermetropia ($\frac{1}{10} - \frac{1}{30} = \frac{1}{15}$), would equal $\frac{1}{15}$; one fourth of $\frac{1}{15}$ is $\frac{1}{60}$; this, added to $\frac{1}{30}$ ($\frac{1}{30} + \frac{1}{60} = \frac{3}{60} = \frac{1}{20}$), equals $\frac{1}{20}$. We would therefore prescribe, at first, 20 inch convex spectacles, which we would afterwards change successively for + 18, + 16, + 14, &c., until he has so relaxed his accomodation that he can, with ease, wear + 10. It will not be until he becomes accustomed to this last pair that all his symptoms of Asthenopia will disappear.

Strabismus.—Prof Donders was the first to direct attention to the fact, that nearly all cases of convergent strabismus arise from the presence of hypermetropia. We know that when both eyes are directed to a near object, they are very much converged,—the optic axes cross at the point to which they are directed. If one eye be covered, and the opposite eye be accommodated for its "near" point, the convered eye will be found to be very decidedly converged towards the nose,—to have, in fact, a temporary convergent squint. This arises from the constant association of the act of accommodating the eye for short distances, with the act of contracting the internal recti muscles. The hypermetropic, however, being obliged to exert the accommodation of their eyes, even when looking at distant objects, it is easy to understand that they would be inclined to contract their internal recti-muscles unduly, so as to increase this power of accommodation. This converges the eyes to a point at a nearer distance than the object looked at, and causes one of the eyes to turn inwards, while the other is fixed upon the object. When, therefore, they wish to see distinctly with one eye, they instinctively turn in the other. At first the convergent strabismus is seen occasionally only, and in this stage may be prevented by using the proper spectacles to correct the hypermetrophia. After the squint has existed sometime, it becomes confirmed and cannot be cured without an operation.

If the convergence exceeds three lines, a partial tenotomy, upon each eye, should be performed, and the effect controlled by a conjunc-

tival suture, by which means we have the power of regulating our operation, in proportion to the effect we wish to produce.

When Strabismus shows itself in childhood, it should be treated without delay, for, if not corrected, the vision of the "cross-eye" will very soon become impaired.

To get the full benefit of spectacles, in cases of hypermetropia, they should be used both on the street, and at church, as well as when reading or writing,—in fact whenever the eyes are used.

The characteristics of a hypermetropic eye then are:

1st. Parallel rays form a focus behind the retina.

2nd. The "far" point is at an definite distance and negative.

3rd. The eye, in a state of rost, is adjusted for convergent rays.

4th. Convex glasses improve vision.

5th. This affection is usually accompanied by symptoms of Asthenopia and Amblyopia, and frequently by convergent strabismus.

Chapter V.—Presbyopia.

This affection usually develops itself between the ages of 40 and 45. Most persons at this age, although previously enjoying excellent vision, complain that their sight, particularly in the evening, is beginning to fail for near objects, as small print, &c., although they can see distant objects as well as ever.

In reading they will hold the book or paper at nearly arm's length and perhaps bring the lamp almost between their eyes and the page. Reading in this manner soon fatigues them, and they are obliged frequently to rest,—or to resort to spectacles.

In childhood, when the vision is normal, the "near" point is from $3\frac{1}{2}$ to 4 inches from the eye, and the "far" point at an unlimited distance; that is, we can see objects distinctly as near as from $3\frac{1}{2}$ to 4 inches from the eye, and we can see objects clearly (the size being in proportion to the distance) from that to an indefinite distance. As age advances the "near" point recedes. At the age of 40 the "near" point is about eight inches from the eyes. When the "near" point recedes to a greater distance than 8 inches, Donders calls it a case of presbyopia; Laurence, however, thinks that it should not be called presbyopia unless the "near" point is at least 10 inches from the eye.

Presbyopia, then, is not an optical defect of the nature of myopia or hypermetropia, but is simply a lessening of the accommodative power of the eye.

It is supposed to depend upon, or to be caused by, the crystaline lens becoming hardened as age advances, so that it does not yield sufficiently to the contraction of the ciliary muscle.

In a case of pure presbyopia where, for instance, the "near" point is 12 inches from the eye, vision will remain normal for all points beyond that distance. When the "near" point is 12 inches distant, and the "far" point at an infinite distance, the accommodation is only $\frac{1}{12}$. Taking eight inches as the normal "near" point, $\frac{1}{8}$ would represent the normal accommodation. Deducting $\frac{1}{12}$ frem $\frac{1}{8}$ gives the degree of presbyopia thus: $\frac{1}{8} - \frac{1}{12} = \frac{1}{24}$. The degree of presbyopia in this case would then be $\frac{1}{24}$. This fraction $\frac{1}{24}$ also represents the strength of the glasses necessary to correct the presbyopia, namely 24 inch convex. Practically, we would probably find that a pair of 30 inch convex would answer better, as the weakest glass that can be worn with comfort, is the one that should be prescribed. Again, if a person's "near" point be at 16 inches, his presbyopia ($\frac{1}{8} - \frac{1}{16} = \frac{1}{16}$) will be $\frac{1}{16}$, and a 16 inch convex lens would enable him to read at 8 inches.

"There can be no question as to the advisability and neccssity of affording far-sighted persons the use of spectacles. They should be furnished with them as soon as they are in the slightest degree annoyed or inconvenienced by the presbyopia. Some medical men think that presbyopic patients should do without spectacles as long as possible, for fear the eye should, even at an early period, get so used to them as soon to find them indispensable. This is, however, an error, for if such persons are permitted to work without glasses, we observe that the presbyopia soon rapidly increases."*

If, however, we call all cases presbyopia, where the "near" point recedes to a greater distance than eight inches from the eye, it will follow that we may have presbyopia in cases of myopia and hypermetropia. If a person's far point be at 20 inches from the eye he would be called *near-sighted* and if his near point recedes to 10 inches from the eye, he would be also *far-sighted.*

In some persons, as age advances, the "far" point also recedes so

* J. Soelberg Wells.

as to render the person hypermetropic; this form of hypermetropia seldom exceeds $\frac{1}{24}$. When a person has both hypermetropia and prebyopia, it is necessary for him to use a stronger pair of glasses for reading, &c., than for ordinary use. If a person for instance, wears a pair of 18 inch convex spectacles to correct a hypermetropia of $\frac{1}{18}$, and as age advances his "near" point recedes to 12 inches, even with the addition of his glasses, it will be necessary for him to wear, for reading, a pair of glasses having a focus of about $10\frac{1}{2}$ inches. Thus $\frac{1}{8} - \frac{1}{12} = \frac{1}{24}$ = presbyopia, this added to the lens to correct his hypermetropia, ($\frac{1}{18} + \frac{1}{24} = \frac{1}{10\frac{1}{2}}$ nearly) equals $10\frac{1}{2}$ nearly.

In the very aged, it is necessary to prescribe glasses, that will enable them to read at 5 or 7 inches from the eye, as their vision is usually somewhat impaired.

The following table constructed by Dr. Kitchener may give a general idea of the glasses required at different periods of life when the presbyopia is unaccompanied by hypermetropia or amblyopia.

At	40	years,—	36	inch	focus.	At	70	years,—	12	inch focus.
"	45	"	30	"	"	"	75	"	10	" "
"	50	"	24	"	"	"	80	"	9	" "
"	55	"	20	"	"	"	85	"	8	" "
"	58	"	18	"	"	"	90	"	7	" "
"	60	"	16	"	"	"100		"	6	" "
"	65	"	14	"	"					

Prof. Donders thinks that when there is no hypermetropia present we should generally advise those glasses to be worn that will enable the person to read distinctly No. I (smallest) test type at a distance of 12 inches.

There is an optical defect of the eye that is occasionally met with called astigmatism (from *a* and *στίγμα*) in which horizontal and vertical lines are not brought to a focus at the same distance behind the crystaline lens. It is relieved by glasses specially ground for each case, these glasses are cylindrical. I have seen but one case of astigmatism.

A very comprehensive article on this subject appears in the Medical Times and Gazette, Nov., 1864, from the pen of J. Zachariah Laurence, M.B., of London.

The paralysis of the accommodation of the eye I have already referred to in a case on page 14.

SPECIMENS OF JÄGER'S TEST TYPES.

No. I.—Brilliant, omitted for want of type.

No. II.—Pearl.

A person with normal vision should be able to read No. II at any distance from eight inches to two feet from the eyes.

temperance was virtue. They wrought with cheerfulness on days of labour; but observed festivals as intervals of idleness and pleasure. They kept up the Christmas carol, sent true-love knots on Valentine morning, eat pancakes on Shrove-tide, shewed their wit on the first of April, and religiously cracked nuts on Michaelmus eve.

No. III.—Nonpareil.

Being apprised of our approach, the whole neighbourhood came out to meet their minister dressed in their fine cloths, and preceded by a pipe and tabor; a feast also was provided for our reception, at which we sat cheerfully down; and what the conversation wanted in wit

No. VI.—Bourgeois.

was made up in laughter. Our little habitation was situated at the foot of a sloping hill, sheltered with a beautiful underwood behind, and pratt-

No. VIII.—Small Pica.

ling river before; on one side a meadow, on the other a green. My farm consisted of about twenty acres of excellent land,

No. X.—Pica.

having given a hundred pounds for my predecessor's good will. Nothing could exceed the neatness of my

No. XII.—Great Primer.

little enclosure; the elms and hedge-rows appearing with an inexpressible

No. XVI.—2-line Great Primer.

and was covered with

Cannon. No. XX.—Snellen.

thatch, which

4-line Roman. No. XXX.—Snellen.

gave it an

8-line Roman. No. XL.—Snellen.

air of

SOME THOUGHTS ON CLASSIFICATION IN RELATION TO ORGANISED BEINGS.

BY REV. WILLIAM HINCKS, F.L.S., ETC.,

I propose in these few remarks first to touch upon the general principles of all classification and then to offer some observations on the classification of organised beings, with a view to a truly natural and instructive method.

Since classification consists in physically or mentally putting together objects or subjects of thought in groups according to observed resemblances, it seems desirable to inquire in the first place what is the real meaning of the terms *resemblance, similarity, likeness.* It is obvious enough that these terms are not applicable to single sensations or simple ideas. If a single sensation or a simple idea recur in differing circumstances of time or place it is recognised as being *the same* which had formerly occurred. What we affirm of it is not resemblance, but identity, and every other distinct sensation or idea is different from it. The states of mind being simple and indivisible,

two of them must either be the same repeated, or different. Similarity is likeness in some particulars or to a certain extent without complete identity, and therefore necessarily connotes divisibility into parts or complexity of nature. Our knowledge of what we call an external object consists in a certain set of sensations, uniformly arising from what we express by its presence, and connected together in our minds as shown by experience always to be derivable from it. The remembrance or thought of this object in the mind when it is no longer present is a complex state consisting of the separate remembrances or revivals of the various sensations received from the object, associated together from their having been received together, and that as often as the object was offered to the senses. Now suppose the mind to be conscious, simultaneously or in immediate succession, of two or more objects, each having its own qualities, or in other words, producing its own cluster of sensations, if any one distinct sensation should be alike in both or all of them, this common part in the respective clusters of sensations or correspondent ideas will associate together the separate clusters as having something common, which is precisely what we mean when we affirm resemblance or likeness of objects. It is possible that several objects notwithstanding abundant differences may agree together in several points which, of course, makes the resemblance stronger, and we can conceive of all degrees, from correspondence in one element only, up to such an agreement in all particulars as would constitute sameness, the objects differing only in time and place of being offered to the senses. We thus see how it is that single sensations or simple ideas, occurring at different times, may be the same or different; but no resemblance can be predicated of those that differ, whilst as *objects* may be made up of various parts and may cause various sensations, it is therefore possible that some part or some one or more sensations may be the same, as a part or some sensations belonging to a different object causing the two to resemble each other more or less. The mind which is conscious of the sensations, if they have much vividness or direct relation to our enjoyment or suffering, necessarily becomes conscious also of the resemblance, and associating together the objects by what is common to them, considers them together, and if occasion should arise, language applies to them a common name. Their differences are not overlooked; they are not supposed to be *the same*, but they resemble one another in certain points, which engage our attention, there being

sameness so far as these are concerned. Generalisation is no special power of the mind, but attending to, and if useful, naming what is common in several objects or complex ideas: classification is systematic generalisation, by the mind desiring to know the resemblances and differences of certain groups of objects which engage its attention. With many kinds of objects all that is needful or useful is easily attained, and if even there are resemblances in different points which allow of different combinations of the same objects, yet which method we select may be either unimportant, or may depend on the special purpose we have in view at the moment, as in a large library, where arrangement of the books according to their subjects would best assist the general student, but for some special purposes resemblance in language, in the size of the volume, or in the mode of binding might be employed, and each of these might be a good classification in reference to the purpose of him who thus combined them, all being founded upon actual resemblances; nor could any one of them be justly said to be more *natural* than the other, each proceeding on one definite character and suiting the convenience of him who uses it. When first the study of organised nature was commenced, all that was attempted was to collect together the various descriptive notices of objects observed, as they occurred in different authors, and put them in a form to be conveniently referred to, and for this purpose an alphabetical arrangement of the names employed would be first thought of, as enabling any who heard a name to look what had been said of it and by whom it had been employed; this plan, however, could not long afford satisfaction. The vastness of the subject makes it necessary to reduce the objects into large classes, by means of their most general resemblances, and then to break these up into more manageable groups, each marked by some common character, and the attempt once made, subdivision would be carried on with a view to the grand object of enabling the observer, by following out the points of resemblance from the more general to the more particular, to find for himself the name assigned to the object before him, and thus become acquainted with whatever was known of its history. Nothing of this kind can be accomplished by means of an alphabetical catalogue, in using which we must know the name in order to refer to the information, so that any system enabling us to trace an object to its place must be accounted a grand improvement—indeed it required much experience, and long continued

efforts before this could be done with any approximation to accuracy. In the mean time new wants arose: as men contemplated the variety of organised beings passing continually under their view, they could not help perceiving resemblances which had nothing to do with the technical arrangements they employed. They felt, in spite of their systems, that objects which they had placed together, were on the whole very unlike, whilst others, far removed by their classification, impressed them with a sense of near relationship. Comparison of systems founded on different characters, as seemed best to different observers, showed the defect to be a general one, and thus arose the perception of the difference between natural and artificial methods, and the advantage of the former, provided they can be practically applied. It was in relation to the Vegetable Kingdom that this subject was first discussed, and the great Linnæus, the author of the clearest, most precise, and most practically useful system founded on resemblances in some one class of characters, formed the opinion that really natural groups could only be marked out by the sagacity of the most experienced observers, being a sort of guesses at truths incapable in the nature of things of satisfactory proof, and that such groups could not be definitely characterized, so that however interesting to the enlightened lover of nature, they could afford no aid to the student in tracing the history of the objects passing under his notice. It was with these views that he laid before his pupils his own most sagacious, and notwithstanding all the difficulties in his way, frequently successful attempts at collecting plants in natural orders, as they were called, whilst he had no doubt that his artificial system, formed chiefly on the number of the most essential parts in flowers, or some equally artificial plan, must continue to be used for tracing plants to their name and what is known of their history. His principal followers entertained the same views as to the impracticability of the natural system even after Jussieu had succeeded in giving good distinguishing characters of natural families. But what it concerns us now to inquire is, what is the distinctive quality by which a natural is to be known from an artificial system, or what we precisely mean by calling an arrangement natural? Let it be observed then that in an acknowledged artificial system each group is set apart by some single character common to all its members, and wich is chosen for the convenience with which it can be tested and applied, whilst the characteristic marks of a natural group are numerous and employed with some

latitude as not being all absolutely found in all the members. All organised structures are more or less complicated, the very simplest affording various points of resemblance and difference with other structures, whilst degrees of complication themselves afford valuable assistance in grouping; but to give our studies the most interesting and instructive character, we must find out what kind of particulars are most essential in respect to living structures, what is the apparent meaning in respect to the general condition of the organism of differences observable between one and another, and with what kind of variations, or in regard to what class of circumstances the elevation or depression of the organism in the scale of being is most specially connected. If we could not obtain some clear conception of what is common to all living organisms, and enumerate the several distinct kinds of action or of progressive change by which the condition of all beings is made to be what it is perceived to be, we should have no foundation for any better classification of objects than might be formed by the arbitrary choice of any obvious particular of agreement and difference which might assist us in distinguishing and remembering the objects, but could answer no higher purpose. Hence, until life had been so studied that we could see what is common to the whole and to extensive sections of organised beings, could distinguish essential functions and different modes of performing them, and form rules for throwing classes of organisms into series ranging from the lowest to the highest, we could not possess any means for forming a natural classification which should be the expression of the real plan of nature, the actual relations of all beings to each other and to the system of the universe. If there were really no sufficient marks of an harmonious order and general plan in nature; if organised beings were found to be in a state of transition from one form and condition to another, and vital functions were performed in different ways according to changing circumstances, then indeed the pursuit of natural systems of arrangement would be vain and useless, and we might as well be content with any plan, however artificial, which would assist us to record and apply our observations on the objects around us. But we are authorised to hope for better things: there are great natural divisions indubitably established as expressing, not human contrivances for assisting study, but natural associations of objects whose real connection is clearly perceived by the mind which has been brought to the knowledge of the actual condition of things, and

as we go down to lesser groups we find that the more minutely we have studied their structure and their life history, the more readily and confidently can we associate the objects, by means of what is common to them, setting aside objects which imitate them analogically or merely externally, but have no conformity in the points which manifest real affinity. If, in addition to an acquaintance with the varieties of external form and aspect in all organised beings, we knew all the modifications of their internal structure with the exact bearing of each on the performance of the vital functions, and the wants and habits of the creature; and if we farther had traced the progress of each organism from its origin to the close of a life not interrupted by accident or violence—supposing that we had comprehension of mind to embrace and duly apply this various knowledge, our association of the objects according as their agreements and differences related to points the most important and the most numerous would produce a perfect natural system of organised beings, where the student in becoming acquainted with the classification, would, at the same time, learn the real nature and condition of the objects, and the generalisations set before us would enable us with certainty to trace each object to its place in the system, whilst, at the same time, conveying to us the best information respecting its structure, relations, and mode of existence. Physiological science combined with observation of external appearance and habits of life, forms the solid foundation for all good classification. Some good use has already been made, and may further be made of the knowledge already attained, but the road to improvement opening to us the hope of better things in future is to be sought in the cautious investigation and faithful record of facts observed in the fields, woods, and waters, or laid open by the dissector's knife or by the wonderful power of the microscope. According to their genius, their preparation and their personal circumstances and habits, it belongs to some men to collect together further materials; to others to arrange and combine these, incorporating them with those previously accumulated and making such new distributions as increasing knowledge demands; but there is no lover of nature noting what he observes, who is not a useful labourer in advancing that science whose crowning success must be a good natural system, enabling us to view all organised beings in their mutual relations, to derive from their contemplation the greatest amount of pleasure and utility, and to catch at least some

glimpses of the creative plan of the Divine Intelligence, in which order and harmony, beauty and wisdom, are perfectly developed.

It appears that likeness consists in the presence of one or more identical elements in composite objects or ideas—that degrees of likeness depend on the number of identical elements in proportion to the whole number of elements making up the composite whole, whether an external object or a complex idea—that degree of likeness will also be affected by the vividness or faintness of the impression of the identical part or parts in the objects compared, in reference to the other parts, which amounts to the importance we attach to the elements which are found to be identical as compared with those found to differ in the objects. The generalising process upon which all classification depends, consists in putting together objects or ideas, in consequence of perceiving in them all some common part or element which attracts our notice and is the means of our minds associating them; good classification must therefore consist, first, in finding out in any particular objects studied, which among the various elements comprising them, most affects their condition on the whole or their relations to us, and then looking for agreements and differences in respect of such elements; secondly, in properly noticing degrees of similarity as marked by the number of identical elements in different objects compared so as to connect together in all instances objects most like; thirdly, in the classification of numerous objects where secondary ternary and other divisions are requisite, the primary sections are founded on agreement in fewer particulars, but those considered as most important in respect to the nature of the objects, at each step in subdivision the number of agreeing points increases, whilst the separated groups are nearer to each other and are kept apart by less decisive characters until we reach the case of a number of individual objects which being only distinguishable by particulars of time and place, or by minute circumstances which experience leads us to esteem unimportant, are accounted one species and bear all of them the same name. It is one of the most difficult questions offering to the student of nature what amount of difference in objects may be consistent with specific identity. The believer in the transmutation of organic forms settles it according to convenience, judging it to be really unimportant, whilst he who relies on the reality and permanence of specific distinctions is called upon to point out the limit beyond which incidental variation cannot proceed, and finds it a

difficulty which he cannot overcome, though he thinks he sees greater difficulties in the opposite view. He conceives that certain tendencies of development in respect to some parts of structure immutably belong to the specific type, whilst others are modified by external circumstances, but he cannot point out where the limit is placed or reduce all the cases to a general law. He seems justified in pronouncing the transmutation theory unproven, and, in some points of view, unsatisfactory to the mind; but he must confess himself unable to give a plausible explanation of the known facts, according to the common notion of creation of distinct species, and is therefore unprepared to meet his adversary with a rival theory. I cannot see that it is reasonably required of the philosophical student of nature to trace the forms he examines to their origin, excepting so far as he must perceive them all to belong to a common plan, bearing the impress of supreme power, wisdom, and benevolence, and if he is determined to speculate not only on the present relations but the original production of every known type, I believe he is as yet only at the beginning of the difficulties he must encounter before he can grope his way into a clear light. But not to pursue this subject at present I pass from these preliminary considerations to offer some comments on what has been done or attempted in respect to the natural grouping of organised beings.

The distribution of them all into two great kingdoms, as animals and vegetables, was forced upon ignorant man even in his most savage condition, and is admitted by all who have thought upon the subject; and yet to explain the real points of universal resemblance in the members of each kingdom, and the differences which enable us most certainly to distinguish the two, is by no means easy. Widely as the most characteristic members of each kingdom differ from each other, it is easy to point to organisms which have been referred sometimes to one, sometimes to the other, by those who might be esteemed amongst the best judges, and the final settlement of these doubts can hardly yet be assumed—though individual naturalists may, in each case, have satisfied their own minds. In truth this is but one case of a universal law of organic nature, without due attention to which our attempts at natural grouping will always fail, that there are plans of structure consisting in the combination of various characters, all which characters are combined in the typical examples, whilst in different directions there is a gradual fading out of each of them, and intermixture of

other characters so as to make the precise boundaries of a group always difficult to determine, obliging us to consider not only typical plans, but intermediate conditions, where we have to judge which of two or of several types predominates. All organized beings tend to one of two plans of development, one of which has for its end the sustentation of the individual or the race, the other intercourse with external things by means of powers of sense and motion. The former only is perceptibly manifested in the vegetable kingdom, the latter is added in the animal kingdom; but besides this great addition, little perceptible in some of the lower forms of animals, the plan of nutrition itself entirely differs in the two kingdoms and it is here that we find the best marked distinctions. Vegetables are nourished by inorganic matter, water with gases or salts dissolved in it; animals by organised substances, whether fresh or tending to decomposition, but not having returned to their elements. This is the grand real distinction, but it is at least very difficult of application in some of the lower forms.

The simplicity and uniformity of the means of nutrition in the vegetable kingdom leave us no such convenient means for distinction of forms as are found in the animal. Hence we are obliged to rely for characters on the mode and results of growth, and, to a very great extent, on the reproductive system—and it follows that there can be no real analogy between plans of classification in the two kingdoms, nor any agreement otherwise than accidental in the number of divisions produced—whilst within the animal kingdom the same variations in the tendency of development which mark the primary divisions, acting again under each secondary type produce a nearly uniform conformity in the number of divisions at each step in our progress, and a consequent analogy between all groups, larger or smaller, which occupy the same position in the order of subdivision. This may also be the case in the vegetable kingdom, but as we cannot yet characterise the tendencies upon which our great groups depend, the analogies we trace are there more slowly worked out and our progress towards a complete classification is far less satisfactory. The earliest attempts at botanical classification were, doubtless, intended to follow an order discernible in nature; but they were so rude in themselves, as well as so difficult of application, that they afforded little assistance. Right ideas of the uses, relations, and variations of the organs making up a structure, necessarily precede the just perception of resemblances and differences, and these are among the hard-earned acquisitions of modern science.

Hence Linnæus judged wisely for his time in forming a simple artificial system to assist in recording and rendering accessible the knowledge of species, the utility of which is proved by the almost universal homage paid to him by his contemporaries; but although he had no definite hope of our ever being able to define large natural groups, his sagacity discerned their existence, and he had the wisdom to perceive their importance so that even the dim view of them given in his natural families was a great progressive step. Labouring with eminent advantages of talent, learning and opportunities, Jussieu advanced to the definition of natural orders. De Candolle reduced vegetable organography to a beautiful science and clearly expounded the principles on which inquiries tending to a natural classification of plants must proceed. Other eminent men have distinguished new orders, and others (amongst whom the late Dr. Lindley stands pre-eminent) have entered on the labour of combining the so-called natural orders into larger associations capable also of being well defined. All this is progress, although there are doubtless great errors to correct and important analogies not yet perceived, but it is remarkable that after the great divisions given us by Jussieu, and now universally recognized, we have advanced by working from the species upwards, finding boundaries for genera orders and intermediate divisions, and at length for alliances, but we have never clearly perceived how it is best, primarily, to divide those great primary sections which can only be compared with the sub-kingdoms or branches of the animal kingdom and ought unquestionably to be so called. We know Jussieu's *Acotyledoneæ*, *Monocotyledoneæ* and *Dicotyledoneæ* to be natural divisions, suggested by several kinds of characters, and never to be neglected without confusion, but the most plausible of other suggested classes, so far as they are good, are but divisions of these, and nothing is more remarkable in the science than the want of good classes to rank under these sub-kingdoms. The results of our labours upward in the combination of species into genera, these into orders, and these again into alliances, do not yet unite in good classes under each sub-kingdom. Such for instance as the great sections or sub-classes of the Dicotyledoneæ as given by De Candolle and by Lindley, must be acknowledged not to be natural and are indeed offered as mere aids to the student. Until this gap is properly supplied Botanical classification must remain in a very unsatisfactory condition. It seems strange that of the many great men who have employed their genius in im-

proving the science, none has yet discovered a good structural principle upon which to establish the genuine classes of what we must be allowed to call the vegetable sub-kingdoms. It is somewhat remarkable, too, that our success has been greatest with the lowest of the three, for Thallogens are certainly a class, and if we distinguish Anogens from Acrogens, by characters founded on both the nutritive and reproductive systems, which seem sufficient, guarding ourselves from the error of confounding the Ferns with Endogens on account of their imperfect vascular system, we have three natural and well defined classes of Acotyledoneæ which again subdivide into alliances and orders, in a manner, which makes the classification convey the substance of our knowledge, and afford the best aid to our minuter studies.

I must now direct your attention to the state and progress of classification in the animal kingdom. There was little that could be called progress from Aristotle to Cuvier. Linnæus' Zoological system was a very inferior one. Cuvier's improvements were founded on the study of organization in every department of the animal kingdom, and though so much has been done since he commenced his labours, correcting errors, perfecting details and extending the field of observation, his grand divisions of animals, known as sub-kingdoms or branches, are still accepted by most Zoologists with or without the addition of a fifth, which the advance of microscopical studies has in the opinion of many proved to be necessary. La Marck took as a leading division that between Vetebrate and Invetebrate animals—a real one doubtless in a certain sense, but which ignored the important fact that, any of the other divisions might, with equal propriety, have been insulated and opposed to the rest—that the difference in essential structure between Articulates and Molluscans is quite as great as that between Vertebrates and either of them. So true is this that the expression Invertebrate animals, much used since LaMarck's writings conveys a misleading and confused idea, and ought to be carefully avoided. It does not enter into my plan to criticise the schemes of particular zoologists, but rather to refer to different tendencies of thought in respect to zoological classification, and estimate their influences in leading towards a truly natural system. The great philosophical naturalist of Germany, Oken, though guided to a great degree by his extensive and accurate knowledge of structures, founded his system on a preconceived idea of what must be or ought to be, in

a sort of representation of the various functions or systems of parts of man, the highest animal, amongst the lower orders, some one function predominating, according to his view, in each division. Whilst persuaded that the idea of subdividing the vital functions of the most perfect animal, and arranging groups of animals in which each predominates and gives character to the structure is too fanciful for usefulness, and that Oken has wrongly treated as leading functions, the several branches of the nutritive, whilst it is hardly true that those branches are specially represented in the divisions to which he has assigned them; I cannot but feel that the conception of the predominance of a particular vital function in a great division of the animal kingdom, giving it its special character, is a just and noble one, and cannot fail to contribute greatly to the progress of a truly natural system.

I do not know of any principle so certainly misleading in the classification of organised beings as that of requiring that every object in a certain division should strictly conform to all its distinctions as they must be laid down in giving a general view of it. The common character represents a cluster of tendencies all clearly manifested in the most typical examples, but losing their power in remoter forms which, nevertheless, have something about them which does not permit their removal from the group. Thus is produced that shading of all natural divisions into each other and that abundance of transition forms which so conspicuously mark the order of nature. I may illustrate this remark by observing that I have noticed its being accounted a sufficient objection to Professor Owen's primary divisions of Mammals according to the development of the brain, that some which are placed in Gyrencephala do not display the gyrations which form the leading character, as for instance the small lemurs and some of the minute monkeys. Surely, however, if these animals are admitted to be most closely allied to such as do display the gyrations, and are at the same time both among the lower forms and of small size, the fading out of the character is sufficiently accounted for, and we are obliged to be content with a general characteristic, though it does not yield a rigid definition. With respect to the remainder of these great divisions, Lyencephala is supported by abundant confirmatory characters, and has hardly been called in question. As to Archencephala it would be interesting to see Professor Owen's reply to the charge of falsehood in statements which have at least the appearance of probability; but I

should not willingly give up the belief that the brain of man is in some way superior to that of monkeys, and that he ought to hold a prëemiment position in a truly natural view of the animal kingdom. It is very dangerous to rely for our principles of classification on characters drawn from one function, or one mode of viewing animal structures, if we are seeking a truly natural system. We, of course, want facts collected in relation to every part of structure, and no well-authenticated facts are lost to the enlightened naturalist; but it is always to be recollected that reliance on one set of organs will mislead us if it be not the most important not yet otherwise employed, and that we are very liable to mistake adaptive modifications of structure for great organic differences. Even embryology, high as is its degree of importance, cannot safely be trusted too far, since it has led one so profoundly acquainted with its facts, and so skilful in the application of principles as Agassiz, to cut up into distinct classes the eminently natural group of fishes. His observations may be true and valuable, and may assist in determining the subdivisions of the class; but I cannot but think that he exaggerates their proper influence when he multiplies on their account the classes under the vertebriate type.

Mr. Dana's principle of Cephalisation, as a basis of classification, may perhaps be liable to a similar objection. No doubt it embodies important truth, and real assistance may be drawn from it in determining the highest structures under each type, but I cannot help thinking that it has already shown itself liable to abuse, and that so far as it is good, it only confirms what is obtained from other sources.* Very ingenious and noteworthy attempts have been made to arrange mammals according to the mode of placentation. The facts obtained are a valuable addition to science, and might be very useful in determining in a doubtful case to which of two groups an animal ought to be referred, but I must think it a great error, in that highest class of the highest sub-kingdom, which especially represents the development of the organs of sense, and the faculties which most elevate a being, to look to the reproductive system, the lowest of the separate functions

* I cannot suppress the expression of a hope that, should this be deemed the best application of the facts, upon which it has served strongly to fix attention, respecting the concentration of important organs in the anterior portion of the body in the higher structures under each type, the expounders of the system will at least avoid certain very barbarous terminology, with which its distinguished author has burthened it.

of life, for the leading means of subdivision, nor does it at all appear to me that the grouping thus obtained is conformable with the best ideas of natural arrangement obtained in other ways. On the contrary, the great mammalian sections of Owen, founded on the structure of the brain, divide the whole into groups strikingly natural in their general aspect, and singularly constant in the correspondence of analagous divisions in all the great sections. One other observation I will venture upon at present: among the more remarkable modern systems must be accounted that of McLeay, and one thing remarkable about it is the rapidity with which—at least among English Naturalists—it was adopted for the time, with the greater rapidity with which it has been consigned to comparative oblivion. I cannot contend that as left by its author or by his great disciple Swainson, it is entitled to revived popularity, but I do think that it gave prominence to some just and important ideas, calculated to aid us in our progress, and I feel that it has met of late, when noticed at all, with some unjust treatment. Its better features are not only the calling attention to the difference between affinity and analogy, but the perception that the regular order of nature implies, prevailing uniformity in the number of the divisions under each type of structure, and the illustration of this principle in a great number of good examples, although many errors were committed from the necessary imperfection of a first attempt, the impossibility of one individual being minutely acquainted with all the branches, and from some false views as to the nature of the relations between the subdivisions of each natural group.

Let us give up the fanciful notion of each natural circle returning on itself, using the circle or the pentagon merely as a convenient way of representing the corresponding tendencies under each type in their relation to its common characters, and let us express the nature of the subdivisions, not by calling them typical, subtypical and aberrant, expressions which have no useful meaning, and which cause corresponding developments of different types to occupy different positions in their respective circles, but by giving appropriate positions to each tendency of development which shall be uniformly adhered to throughout our whole system, so as to force on our attention the analogies of nature, and we may perhaps attain to a combination of the best thoughts of the German Physiophilosophers with a most convenient exposition of the relations of the parts of creation, already affording

the best key to the grand plan of nature, and improved by every real addition to our knowledge of structure, provided that we cautiously avoid those errors which I have referred to in this paper, and into which very great men have often fallen. A good classification is a convenient summary of our knowledge, an artificial memory for retaining it, and keeping it in readiness for use ; an invaluable assistance in communicating it to others, and much more than all this it is the expression of the real plan of the great author of nature, enabling us to feel its beauty, and to understand the harmony which binds together the infinitely varied forms of organised beings.

It will, I hope, be perceived that in these few remarks, which appear to me useful after all that has been written, I do not attempt any general treatise on the subject, which would require a volume, and in which I could but repeat what has been well expressed by others. To those who seek the best general views, such works as "Typical forms and special ends in Creation," by Doctors M'Cosh and Dickie, and the admirable introduction by Agassiz to his "Contributions to the Natural History of the United States," cannot fail to afford much satisfaction. It can hardly be said at present that any particular zoological system decidedly prevails. The influence of particular eminent men has produced local effects, often I am persuaded very unfavourable to real progress, but the system which shall best combine all that is needed is yet to be determined, and a careful study of principles must prepare the way for its reception.

ON ERRATA RECEPTA, WRITTEN AND SPOKEN.

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

(Continued from Vol. X., p. 406.)

V. Wrong Etymologies and Misprints.

1. *Wrong Etymologies.*

While treating, in former papers, of vernacularisms and Anglicised foreign terms, I to some extent forestalled myself on the subject of wrong etymologies. A few miscellaneous specimens, however, re-

main, not hitherto taken up. These I shall, with the utmost brevity, discuss, and then pass on to the topic of "misprints."

It will be necessary, I suppose, for each successive generation to be reminded, once, that *camelo-pard*, a word moulded on the analogy of *leo-pard*, is not *camel-leopard*, a rendering which even Shelley admits, where he humorously refers to the *petite* bride of his tall friend, as

> "The milk-white Snowdonian antelope
> Matched with the cameleopard."
>
> *Letter to —, from Leghorn.*

Also, that *anomalous* has nothing to do with *nomos*.

Morea, the name acquired by the Peloponnesus in the middle ages, has been attributed to *morea*, Greek for the "mulberry," either from its shape, which somewhat resembles the leaf of the mulberry; or, from the early introduction of the mulberry into it (by Justinian, in 555). Others, again, say that it is a modification of *Romea*, a word indicative of the fact that this peninsula was a fragment of the empire of *Nova Roma*. With greater probability, however, it is deduced from the very ancient root *mor*, that is, *sea*—the Morea being that portion of the region occupied by the Sclavonians, which possessed the greatest extent of maritime coast.—The real meaning of *Oxford* is, "the Ford over the Ock," a small tributary of the Isis. "Oxford" has been poetically Latinized; or, rather, Græcised into 'Bosporus;' literally, "the oxen's crossing-place."—A celebrated street, in ancient Rome, was called the *Velabrum*, "the Awning." Becoming obscure, in the lapse of time, *velabrum* was interpreted to be a contraction of *velum aureum*, "golden veil." The mediæval inscription to be seen at the present day, near the locality, in the Church of "St. George in Velabro," is thus accounted for:—

> "Hic locus ad velum cognomine dicitur auri."

Septentrionals as we are, we may not deem alien anything that relates to the constellation from which we have our name. It will, no doubt, then, be interesting to us to learn that Prof. Max Muller, in his second series of Lectures (p. 365), is of opinion that etymologists laboured under a mistake when they interpreted 'Septentriones' as "the seven ploughing-oxen." Rather are we to believe that by 'triones' here (for which, in the sense of "ploughing-oxen," we have only the *ipse dixit* of Varro), is meant to be said 'striones,' an obso-

lete term for 'stars;' exhibiting, in fact, in itself, the root-element of 'star.'—As having reference to the skies, also, another item will here be in place.—A singular name, given by our English ancestors, to the Milky Way, seems to have been suggested by an etymological notion entirely wrong, and hinted at, perhaps, only in jest; as where Chaucer says, in the *House of Fame*, II.:—

> "Se, yondir, lo, the galaxie,
> The wiche men clepe the milky-way,
> For it is *white*; and some, perfay,
> Y-callen it han *Watlinge*-strete."

It is a common thing to manipulate a word until it presents to the eye the idea its sound is supposed to convey. Thus, it is likely, *uproar* is held, by many, to be expressive of the un-human, animal-like *voces naturæ*, sometimes to be heard proceeding from a tumultuous crowd. Its good Netherlandish original, *oproer*, however, is not indicative of these; but, simply, of a movement upwards—an uprising among the usually quiet multitude—what the Latins would call *insurrexio;* and the Greeks, *stasis*. (The favorite Latin term, *seditio*, is an exact synonym of *secessio: sēd* and sē denoting *apart;* and *itio*, "a going.") Again: it is, of course, popularly supposed that the *rose* of the useful garden watering-pot has its name from its circular rose-like form; and, sometimes, its perforations are, accordingly, to be seen arranged after a sort of "wind-rose" pattern. The conjecture is wide of the mark. Here is no allusion to a flower. Like the first syllable of the familiar *rosemary*, this *rose* is a descendant of *ros*, through the French, *roser*, *arroser*, 'to moisten, as with *dew*.' (*Nota bene*, in passing, that the rose-wood of the upholsterer has its name from its *smell*, when fresh cut). To remove latent misconceptions in regard to "straw-berry," it will be of use to say that the word is pure Anglo-Saxon. *Streow-berie* is the fruit whose plant *strews* or spreads itself.—"Straw," for the crushed and confused stalks of wheat, barley, &c., has its name from the use to which it was extensively put before the introduction of carpets for the floor. To this day, on paved streets, in front of houses where it is understood one of the inmates is sick, it is to be occasionally seen "strawed," just as it used to be, on the stone floors of ancient corridors and "halls."

The etymology of *sincere* remains *sub judice*. Let the unwary modern, then, not quote either his Calepin or his Donat. The former

used to give the first syllable of the word as *syn;* and, it was argued that, in a just division of the contents of a hive, the honey *with* the comb must, in exact proportion, be distributed: it was a fraud to withhold any share of the *wax*. On the other hand, Donatus taught that this *syn* was *sin;* interpreting *sincere* as *purus sine fuco et simplex, ut mel sine cerâ.*—Linguists have now changed all that. In *-cerus* is, perhaps, involved the root-element of *cre-o,* with a reference, consequently, to the *hy-le*—the stuff of which things ultimately consist.

In the phrase, "art and mystery," an unauthorized etymology, it is to be feared, is insinuated by the *y*. It was *mistery,* anciently, and this from *ministerium;* which is, also, the French *métier*. Some, with less plausibility, will have it to be *maistery,* and *mastery;* that is, *magisterium.*—*Menial* has been, also, attributed to a Latin origin —to *mœnia,* a form of *munia*: official duties and service. But, in reality, it is the adjective of *meinie,* or *meignee,* Norman-French for a nobleman's retinue. Our *many,* when used as a noun, appears to be the same word.—It would be wrong to assign to *consanguineus* the word by which our French neighbours designate the mosquito; viz., *cousin*. The eagerness of the creature to claim a share of our blood might lead to the supposition. But *cousin,* in this sense, is from *culicinus,* a diminutive of *culex,* a gnat.—The grotesque term, *bogus,* to be heard in the United States, sounds very much like one of those slang expressions which spring up, sometimes, at Universities, and then find their way into the general circulation. Before becoming aware of Mr. Bartlett's statement, in his "Dictionary of Americanisms," to the effect that the word is a corruption of the proper name, *Borghese,* borne by a man infamous for the manufacture of counterfeit bank-notes, I had formed a theory, thus: Strabo, in the Introduction to his Geography (ii. 314), refers to Posidonius's account of the repeated attempts of a certain Eudoxus to circumnavigate Africa. The narrative of what this early Vasco de Gama did and suffered, in the kingdom of Bogus, while urging his fixed idea on the monarch of that name, is considered, by Strabo, as especially incredible. Although, in all probability, founded on sober truth, like Bruce's Abyssinian marvels, at a later date, he stigmatizes the whole as "Bergæan nonsense"—as a trumped-up traveller's tale. May not a joke among the youth of the Massachusetts' Cambridge, involving the name of the above-mentioned royal personage, have given rise to the vocable in question?

2. *Misprints.*

Every one who has had anything to do with getting written matter transferred to type, knows how hard it is to secure a perfect accuracy. Errors escape the eye of the most vigilant and of the most experienced. Such printers as the Aldi and Stephani, or as the early Elzeviers and Frobenius, being themselves enlightened connoisseurs in the learning of their respective periods, superintended with intelligence and affectionate care the sheets that issued from their presses. Their editions are consequently distinguished for a great exemption from faults. As, however, the art of printing came to be more extensively practised, and employed simply as a mechanical means of obtaining a livelihood, errors of the press multiplied exceedingly. While locomotion was difficult and postal transmission slow, infrequent and expensive, authors seldom revised the proof-sheets of their own works. The corrections were made by readers incompetent for the irksome but all-important task. A notification of errata at the beginning or close of every volume was accepted as a thing of course.

At the present day every facility exists for the securing of accuracy in typography, so far as the writings of cotemporaries are concerned. But the literary works of preceding generations have not yet been quite cleared of the defects which marred them on their first appearance in type. In the most sumptuous of our modern publications, editors have not entirely succeeded in weeding out, perhaps in every instance, they have not detected, the mistakes of the early printers.

A further-removed cause, too, of uncertainty in regard to the absolute literal accuracy of our present texts of ancient authors must be borne in mind; namely, the condition of the manuscripts which served as "copy" to the first printers. In works transmitted by writing from age to age, many were the sources of error. Centuries ago, the books of Homer were well known to have undergone interpolation extensively. The agency that could, on occasion, secure from an Oracle a convenient response, could as easily induce the insertion of an apposite clause in a codex, should the same be wanted. Solon himself, we are told, gave a colour to the right of Athens to Salamis by adducing a line, foisted in for the nonce and still continuing in the Catalogue of ships in the second book of the Iliad. But even where no reasons existed for intentional falsification now and

then, the human liability to err would inevitably lead a copyist into occasional mistakes. *Homoioteleuta*, as they were called, were particularly fatal to him; that is, words of like ending catching the eye and leading to the omission of intervening matter; and then there were in all alphabets letters that were exceedingly alike, and characters used as numerical signs differenced in many minute ways, particularly likely to be misread; not to speak of intricate ligatures, obscure abbreviations, signs of contraction, sigla and symbols in general. In one or other of these points, every scribe in every place would be more or less liable to make a mistake. In a library of manuscripts gathered together from many quarters, the chances of detecting a large number of .rors and a considerable variety of readings would consequently be very considerable. One other source of inexactness, too, should be remembered—the memoranda and glosses which casual readers took the liberty to make on the margin of manuscripts. These the next copier sometimes inserted in the body of the work as though they had been omissions on the part of preceding scribes. And then again, it is said that a professional scrivener would occasionally not correct his own known blunders in order that his pages might appear without erasures. With sheep-like simplicity the next copier would then make a transcript with these faults blindly continued.

There is no doubt, however, that in the mediæval monasteries, as among the Jewish copyists of an earlier date, great precautions were taken to prevent errors in manuscripts. For one thing, the scriptorium was directed to be as far as possible, isolated, and kept in a state of quietude. In the *Liber Ordinis S. Victoris Parisiensis*, we have the regulation: "Loca etiam determinata ad ejusmodi (sc. libros scribendi) opus seorsum à Conventu, tamen intra Claustrum præparanda sunt, ubi sine perturbatione et strepitu scriptores operi suo quietius intendere possint. Ubi autem sedentes et operantes, silentium diligenter servare debent, nec extra quonam otiose vagari. Nemo ad eos intrare debet, excepto Abbate et Priore et sub-priore et armario." Continuous accuracy, age after age, was also sought to be obtained by very strict injunctions on the point of correct transcription, inserted by scribes for the benefit of their successors. In the preface to Ælfric's Homilies, there is not only an "adjuration" to the copier to transcribe correctly, but a direction to copy the "adjuration" itself into the new transcript for the admonition of

future scribes. In somewhat similar strain runs an exhortation at the beginning of the *Precatio* of St. Nerses (circa 1100): "Vos autem qui eam in libris transcribitis, hæc quoque exhortationis verba scribite; et qui eam scripserint, ipsimet scribantur in catalogo æternæ vitæ; et qui eam didicerint et recitaverint, misericordiam à Christo inveniant. Qui vero eam socium docuerint mercedem à Deo accipiant; et qui eam scripserint ne verbum quidem aut syllabam addant vel minuant, præter quam quod scripsimus, ne variantia fuerint exemplaria, sed similia cuncta, ubicunque scribantur."

In spite of every precaution, however, slips of the pen would occur. What with these, and errors from other causes already hinted at, there is no especial reason for wonder then, that when, on the invention of printing, the manuscript remains of the ancient literatures, Hebrew, Greek and Latin, came to be collated for the purpose of preparing texts for the press, a variety of readings in the manuscripts of the several authors was discovered.

From the Revival of Letters to the present time, it has been the anxious effort of careful critics to reconcile differences between conflicting codices, and to educe from them, by elimination and combination, the *ipsissima verba*, so far as it is practicable, of the original writers; and, as far as the principal and best-known authors of antiquity are concerned, great progress has been made towards purity of text. Through the united labours of the setters-forth of the *Editiones principes*, and the subsequent studies of German and French and British scholars—of Hermann and Brunck; of Casaubon and Brotier; of Porson and Bentley—the works of the leading poets, dramatists, historians, and orators, of Greece and Rome, now appear in a comparatively satisfactory condition. It cannot, indeed, be said that, in each class of these fathers of the literature of the civilized world, difficulties have been cleared up in an equal degree. But, it is evident that, in all of them, great advances have been made towards the very words of the respective authors. Homer and Herodotus; Æschylus and Thucydides; Plato and Aristophanes; with Horace and Livy, and Tacitus and Terence, can be read and enjoyed by the youth of the present generation, with a much less cumbrous apparatus of note and comment, than they could be by their immediate ancestors.

In *their* days, while yet "flourished" the so-called Porson-school, a critical edition of a Greek or Roman writer presented a somewhat formidable appearance. At the top of each page was the text, spar-

ingly displayed; just one or two lines. Then came a broad belt of very dense matter, in small Roman, Italic and Greek type, abounding with strange symbols of reference to codices, and editions, and unceremonious curtailments of distinguished names. Here was the *orchesta Martis*, the arena of conflict with editors defunct and living. The gulf below was a kind of valley of decision, filled up by two narrow columns, of a height or length varying according to circumstances; built, so to speak, of paragraphs of curt and compact Latin, the vehicle of a comment usually objurgatory and defiant.

This kind of treatment of the leading writers of antiquity has now, to some extent, exhausted itself. On very many of the points long under discussion, reasonable conclusions have been come to; and the student is at last permitted to examine his author in peace, mastering the substance of the composition before him with mind undistracted by the wranglings of critical advisers.

The text of the principal writers having been thus, in a considerable degree, settled, the turn of the lesser authorities has come. The minor poets, and historians; the geographers, physicists, and grammarians, together with the series of the so-called Byzantine writers, are, probably, at this moment, as corrupt as were Thucydides or Livy, at the time of the Revival of Letters. All their productions, however, contain matter which, when read aright, is of value to him who would, in every point, rehabilitate the past. Hitherward, then, other fields being now tolerably well beaten over, it is to the general advantage that the inquisitive spirit of man should direct itself; and, it is to be hoped and expected that it will take no rest until here, also, results satisfactory to the common understanding are arrived at.

Our literature, in that large department of it which has descended to us through manuscripts, is thus, it will be seen, even to this day, still in a transition-state. Like modern society, it is the inheritor of some subtle and complex errors; but, like modern society, also, it is awake to their existence, and bent on their extinction.—The forgeries and interpolations which, at certain periods, proved so hostile to the happiness and mental freedom of men, would never have been attempted had the printing-press been in operation at the time. Such productions as the later Sibylline books, and the Decretals, attributed to Isidore of Seville, could only have gained currency through the secret contrivances of solitary scribes. When a production is genuine, but overlaid with the incrustations of time, there is nothing like put-

ting it in the crucible of the press. It is, at once, subjected to the scrutiny of a thousand minds; and the blemish overlooked in one generation is removed in the next; until, at last, it is brought back to something like its pristine integrity.

It would not be difficult to trace, through successive editions of standard Greek and Latin authors, strange misconceptions of sense, until the destined critic appeared; who, by the change of a letter, or reconstruction of a syllable, made the truth of the passage self-evidently to flash forth. One instance, a sample of many, must suffice. Up to the time of Dindorf, the text of Pausanias (*Travels*, x. 12.) represented the Sibyl, Herophile the younger, as saying that her mother was a goddess, but that her father was an "eater of whales!"

> Εἰμὶ δ' ἐγὼ γεγανῖα μέσον θνητοῦ τε θεᾶς τε,
> Νύμφης ἀθανάτης, πατρὸς δε κητοφάγοιο.

Learned scholia, on the place, assured the reader that several profound meanings were implied. By a very simple correction, Dindorf transformed the portentous epithet, *cetcphagus*, into the very moderate and reasonable one of *sitophagus*, "eater of bread," a common poetic expression for a mortal man. In Schubart's edition (Leips., 1854.), Dindorf's emendation is incorporated in the text (πατρὸς δ' ἐκ σιτοφάγοιο).—In a similar manner, long-misunderstood inscriptions on coins sometimes receive a sudden clearing-up by the insertion of a letter, or the addition of a stroke. On the reverse of a coin of Carausius, the word ORIVNA was, for a time, a crux to numismatists. It was held, by some, to be the name of an otherwise unchronicled empress of British descent, the word including a Welsh element. By others, it was shewn to denote a certain deified heroine, the female correlative of Orion.—A matter-of-fact observer, however, by replacing an F at the beginning of the word, and a slight transverse line on the top of the supposed I, both of which had been worn away in the lapse of time, proved the disputed term to be simply FORTVNA, a name very common on the coins of emperors.

But, details of this kind not being readily intelligible; nor, perhaps, very generally interesting; I shall confine myself, now, during the remainder of the paper, to the notes which I have happened to make of verbal errors that have insinuated themselves into our literature, and common speech, mainly through a faulty typography.

The misprints of the class to be described produce, of course, a

certain sense, and so by the negligent may, in some instances, be passed over without detection. Some errors of this kind run throughout an edition, and after misleading for a few years are discovered and corrected. Others are longer-lived—so long-lived that they acquire a prescriptive right to their existence and supersede the original and actual expressions of which they are the representatives.

Before proceeding to these rather enduring typographical inaccuracies, it may be well to notice one or two of the ephemeral sort, which sometimes startle and perhaps amuse us for a moment, but which are at once set right either mentally or by some simultaneous notification. Some of these will serve to illustrate the mode in which the more enduring faults have arisen.

Not long since, it is said, a French paper astonished the world of Paris by announcing that a certain well-known savan had lately been *dévoré* (devoured) by the Emperor. An unfortunate *v* had found its way into the box for *c*'s in the compositor's case, and had here been inadvertently selected. The intention was to state that the philosopher in question had been *decoré*—had received a "decoration" at the Imperial hand. Again: London was recently amazed to learn from one of the daily journals, that a distinguished financier was about to issue a work "On the Monkeys of all Nations." Here, an extra letter had done the mischief. The *k* should have been struck out. It was a work on the "Moneys of all nations." A telegram in a Montreal paper not many weeks ago, reported from New York that the members of a wide-spread association for the accomplishment of a supposed very important political object, had been notified by circular from the central Board that, "a point had now been attained from which they could see the *gaol* plainly before them." Here injury to the sense had been occasioned by a transposition of letters. For *gaol*, *goal* ought to have been printed. In a catalogue of "choice, useful and curious" books, put forth by Mr. J. Russell Smith, the well-known publisher of Soho Square in London, I lately noticed a certain pamphlet thus entered: "*Antimonians*—A Declaration against the Antimonians and their Doctrine of Liberty, 4to. 3s. 1644." Extended as the reader's acquaintance with human notion and opinion may be, he will not, perhaps, at once call to mind the Antimonian sub-variety. Are they partisans, he may, perhaps, mentally ask of himself, of the celebrated Valentine, author of the once well-known *Currus Triumphalis Antimonii*, who experimented with such fatal

effect on the members of his own confraternity, by the too-plentiful exhibition of the metal whose name is an enduring memorial of the sad catastrophe? Not so. Two letters in different syllables have merely exchanged places. The *n* should have been where the *m* stands. They are only the old familiar Antinomians after all. The occurring of the same error twice in the same paragraph helps the impression that nothing is wrong.—It is singular to observe how in rendering the commonest names blunders will sometimes occur. A quotation from Gray's well-known "Ode on a distant prospect of Eton College" has a rather ludicrous appearance as given in Mr. Timbs' very interesting "School-days of Eminent Men," p. 218. It runs thus:

> "Say Father Thomas, for thou hast seen
> Full many a sprightly race," &c.

Some infatuation seized the compositor here to set up "Thomas" instead of "Thames." A typical mis-rendering of a proper name combined with a reduction in rank of its initial letter preverts the sense without exciting suspicion, in a couplet from the Dunciad, as given in the 1st edition of Friswell's "Familiar Words":

> "Now night descending, the proud scene was o'er,
> But liv'd in settled numbers one day more."

It should be "Settle's numbers," Pope's insinuation being (what would have been the actual fact had it not been for that very allusion) that Elkanah Settle's verses would be forgotten in a day.

The effect produced by errors of this kind is often, however, quite unsensational. The apparent sense of the words is good, and such as to give full contentment to the simple public. It seemed by no means an incredible announcement when, some months since, the papers everywhere circulated the intelligence that the Messrs. Chambers of Edinburgh, were about to issue a "History of Publishers." The subject, no doubt, struck many persons as one not devoid of interest. It turned out, however, that the forthcoming work was a "History of Peebleshire." When the readers of the *London Review*, in its January number of the present year (1866), were more than once given to understand that there had been in former times in the United States, an itinerent notability of the name of Lorenzo *Daw*, the generality of them, of course knew no better. A very mild specimen of a correction to be seen in a recent "Little's Living Age," deserves to be here set down on account of its instructiveness to

scribes: "Page 194, last line, read *green grasses* and not *green grapes*." In the preparation of copy for the press, observe what care should be taken in the execution of a double *s*. A not unfrequent erratum of "capitol" for "capital" is peculiar to the United States. The name of the national State House at Washington has confused certain writers and printers. In one of the less-distinguished United States' newspapers, I not long since noticed a reference to our own venerable town of Niagara as "the ancient *capitol* of Upper Canada."

If not narrowly watched, geographical names, ancient and modern, are liable to some singular metamorphoses in the process of printing. In my old copy of the *Geographia* of Dionysius Periegetes, the editor, "Edw. Wells, A.M., Ædis Christi Alumn," inserts at the close of his preface the general deprecation: "Orandum restat ut quæ in hoc Libro passim occurrant sphalmata (sive currente prelo serius deprehensa, sive aliunde orta) ea lector candidus facile condonarit." In a brochure of less than 130 pages, *sphalmata passim!* in the second edition too, and "è Theatro Sheldoniano." This was in 1709. According to Mr. Burton, who narrates the story in his "Book-hunter,"—in the work of a scrupulously accurate writer, an assertion appears which, could it be substantiated, would be of some interest to ourselves: it is to the effect that, on a particular occasion Theodore Beza went to sea in a *Canadian* vessel. This statement, if true, would tend to show that at the close of the 16th century the ship-building interest of Canada was already a thing *in esse*. Unfortunately, however, for the reputation of the early enterprise of our country, it was afterwards explained that an officious corrector had, without any authority, been interpolating an *a*. It was in a *Candian* vessel that the embarkation of Beza had taken place.—By a blunder of the press another name with which we have some concern, occasionally comes quite unexpectedly into view. In my copy of Carl Ritter's Comparative Geography (p. 102), I am startled when I read that "the Caucasus may be regarded as the circumvallation of the American plateau." Of course *Armenian* is intended to be said.

On the other hand, in *Locrine*, a play attributed to Shakspeare, in the lines

> "A gift more rich than are the wealthy mines
> Found in the bowels of America"—

supposed to be uttered before the Christian Era, an effort has been made to do away with the anachronism by imagining a misprint for

Armenia or Armorica. But in this instance, brought out as was *Locrine* in the reign of Elizabeth, when the wealth of America lately found, was the common talk, it is likely that the disputed word is right. In regard to a sentence in Salverte's "History of the Names of Men, Nations and Places," (vol. ii. p. 158), which sets forth that "two Welsh colonies that have been settled in America for the last five centuries, still call the island from which their forefathers sailed, Brydon"—one is at first inclined to think that *America* is here *Armorica*, having in memory the passage to be seen in some copies of Nennius about the "Britones Armorici qui ultra mare sunt," *i. e.* in Western Gaul or Brittany (p. 21). But on second thoughts, it seems probable that Salverte is referring to the emigrants under the somewhat mythic Madoc of whom Southey sings.

As a specimen of an early misprint continuing through many editions, I adduce a passage from the works of Bishop Jeremy Taylor. In all the common editions of his treatise, entitled "The Rule and Exercises of Holy Dying," in the third section of the second chapter (vol. i. p. 528), the words "relieving poor Lazarus" occur, yielding, as read in connection with the context, a fair sense. But in the edition of 1652, the expression is "relieving poor Lazars," *i.e.* poor destitute persons. It need scarcely be mentioned that "lazar" is a generalization from "Lazarus," the typical poor man in the Parable. No doubt the word written down by Jeremy Taylor was "Lazars"; but this term having become, in the lapse of a few years, to some extent unfamiliar, is changed in its passage through the printing office into "Lazarus." The apparent meaning of the passage not being thereby materially affected, the altered word has continued to be perpetuated in the modern editions. In the "Dirige" of a "Primer" of Henry VIII. of the date 1535, "Lazarus" is written "Lazer." "Thou hast raised up again Lazer from the grave when he savoured."

On the other hand we must be careful not to permit the re-introduction of readings that are faulty, simply because the *editio princeps* can be quoted as authority. The editor of Tegg's "Spectator," date 1860, cites the original Folio as ground for the lection "wild fields of ether" in Paper 420. The paragraph runs thus: "If we contemplate those wild fields of ether that reach in height as far as from Saturn to the fixed stars, and run abroad almose to an infinitude, our imagination finds its capacity filled with so immense a prospect," &c.

Instead of "wild fields of ether," the standard editions of the "Spectator" give here "wide fields of ether," an expression that certainly commends itself as far more probable than the other.

As an example of the immobility of matter when once got into type in a particular way, I add from my old copy of Milton's "Paradise Lost," of the date of 1678, four years after the poet's death, two lines in the tenth Book, printed thus:

> "Childless thou art, childless remaine,
> So death shall be deceiv'd his glut and with us two," &c.

Here "So death" belongs to and completes the metre of the preceding line. The fault began in the first, and was repeated in the second edition, during the lifetime of Milton, and is here continued in a third put forth four years after the poet's decease.

Sometimes a whole impression will exhibit a mis-reading from the too implicit adherence of the compositor to his copy. The edition of Littleton's Latin Dictionary of the year 1678, is said to contain among the meanings of *concurro*, the rather singular one of *condog*. Having ventured the question "did not 'concur' come in among the English meanings of concurro?" the amanuensis received from the lips of the lexicographer the somewhat Johnson-like response "concur?—condog!" The note facetiously taken thereof, in due time found its way into the Dictionary *sub voce*.

In the printed copies of the Public Liturgy of the English Church one or two errors of the press have been so often and for so long a time repeated that they may be almost considered as belonging to the class of established mistakes. By a typographical oversight some years ago, in what is known as the General Thanksgiving, the word "may" was left out. In editions of 1733 and 1762, which I happen to have at hand on my shelves, the language is all right—"that we may shew forth Thy praise." But in tens of thousands of copies issued in England during a century past, the omission of "may" is perpetuated. In the Liturgy as used in Scotland and in the United States, the word has never been missing.

The change in the Marriage Service of "depart," as it stands in my copy of 1616, into "do part," as we now see it in modern editions, looks at first sight, very like a misprint. But the alteration was made, it appears, intentionally, just before the so-called Act of Uniformity. It was a condescension to popular misconceptions; very

likely an adoption of a common rendering of the phrase in audible speech. The arbitrary conversion of a particle in composition into a separate auxiliary and then making the residue of the word another separate verb, all for the purpose of producing an expression that should have, in the vulgar ear, a sense, amounts almost to a quibble or pun. "Depart," in its direct sense of "separate," was no more obsolete at the time in the English language than was "troth" for "true-word," or "endow" for (so to speak) "endower." But linguistics not being an established science in the early years of the reign of Charles II., the divines of that day are to be excused for not being alive to all the niceties of their mother tongue.

This will be as fitting a place as any to notice another obsolete expression which, nevertheless, under a changed form, continues in vogue, established in the language by being printed now in its metamorphosed state. Modern writers of verse who affect the antique, think they give an archaic air to their productions by occasionally inserting the words "I wis." For the eking out of a line when two syllables more are essential, the formula is very convenient. In modern reprints of early English poetry this "I wis" is to be seen given as here, as though it were a verb "wis," preceded by a pronoun of the first person. But in the original editions of the early English poets, the expression appears in a different guise. In them it is "iwis," or "ywis," one word, an expletive with the sense of "assuredly," "in truth." Thus it is interpreted in the notes and glossaries. Here is an example from Chaucer's "House of Fame":

> "Certes, quod I, in all mine age
> Ne saw I such a house at this,
> And as I wonder'd me ywis
> Upon this house," &c.

And again, in the "Friar's Tale," v. 33.:

> "Of his office I shall him tell ywis."

It is likely that in Shakspeare's time this expression, though still in common use, was popularly misunderstood; and had begun to be written down and misprinted in the way already indicated. It is certain that in the four passages of Shakspeare where "I wis" occurs, it does no injury to the sense to interpret it as we should do in Chaucer, as a synonym for "surely;" and such it is probable Shakspeare intended it to be. In the Glossary to the Globe edition of

his works, the notice of the expression stands thus, without further explanation: "Wis, in the compound 'I wis,' certainly. R. III. 1. 3." It is, no doubt, one more form of the Anglo-Saxon *ise, gese, gise,* and *gyse,* which are all our modern *yes,* and akin to *gewiss,* the Netherlandish and German for "in truth."

In the old English "iwis," it is obvious, I think, that we have the original of the New Englander's "I guess." It is well known that the first English colonists brought with them to this continent many expressions which were in vogue in the mother country at the time of their departure from it, but which while maintained through them in some use here, have now became well-nigh obsolete there. The idiomatic use of "I guess" and "guess" without the "I," in the Biglow Papers of Professor Lowell, is quite Chaucerian when read as "I wis,"—as, for example, where Sawin says of the negro who, by suddenly running off with his wooden leg, had him at such a great disadvantage: "He showed his ivory some iwis." In fact, it is acknowledged that "guess" is akin to the Anglo-Saxon verb *wissian,* and, as may be seen by the comparison of *guard* with *ward, guerre* with *war,* &c., *gu* and *w* are often interchanged. An expression usually held to be simply a vulgarism thus suddenly ascends into the sphere of poetry.

One other phrase may be added which modern typographical use has fixed in the language in a changed form. We all probably know the first line of a certain hymn, "With one consent let all the earth." Now, in the time of Shakspeare, it is certain that the form of speech "with one consent" used in relation to music and song, was understood to be written "with one concent." In the early editions of Shakspeare, the lines 181 and 206 of Henry V. i. 2, exhibited in both instances, "with one concent." And thus the words are printed in the Variorum edition of Reed. Steevens' note on the place is this: "I learn from Dr. Burney that *concent* is connected with harmony," and that "*concentio* and *concentus* are both used by Cicero for the union of voices or instruments, in what we should now call a chorus or concert." Of course, the word is *con-cantus,* a joint singing. There is an especial appropriateness then in, at all events mentally, understanding the words "With one consent let all the earth" in the sense anciently intended by the words, however immaterial now may be the error in their received typography. It is not impossible that the well-known word "concert," a musical entertainment, is also

an established misprint. No satisfactory account of the term is given by the etymologists. May it not be an uncorrected *erratum*, if not for *consert*, at least for *concent?* Either word, considered in respect to derivation, would give the idea desired to be conveyed. One note more and we have done with cases of this sort: "Manifold" is also a word fixed now in the language in an altered state by means, mainly, of a wrong typography. In the old English it is, according to its obvious etymology, "many-folde." Thus in Nicholas Udall's translation of the Preface of Erasmus to St. John's Gospel (temp. Ed. vi.), we read of the prince "that poulleth the people, that oppresseth the poore, that by wars defaceth alle both good and bade, he that is the occasion of *manyfolde* calamities," &c. And in Shakspeare's *Lover's Lament:*

> "The heaven-hued sapphire and the opal blend
> With objects manyfold."

It might as well have remained in this form, luminous to the eye like "many-sided." But "manifest" (connected with *manus*) had an influence; or the *i* in *multiplex.*

In a book so carefully printed as is the English version of the Bible generally, it is not to be expected that errors of typography remain undiscovered. Rewards, I believe, are offered by the Privileged printers for the detection of literal faults in the costly folio editions. In the time of the Commonwealth, impressions of the Scriptures came forth that abounded with typographical errors. In one of them, it is said, so many as six thousand mistakes have been enumerated. In 1632, the Royal printers were fined in the sum of £3000, for overlooking the omission of "not," in one of the commandments. Archbishop Ussher, on one occasion, having to purchase a Bible in a hurry, in his way to preach, at Paul's Cross, found, to his astonishment and dismay, that the text, on which he was about to hold forth, was not therein contained. Certain copies of the Bible, which happen to have, in one place, the misprint of *vinegar* for *vineyard*, fetch an extra price among book-hunters. It does not appear why an error which, typographically, is so natural, should be considered especially curious. An Edinburgh edition of the Scriptures, of the date 1637, gives a more unfortunate perversion to a passage, by reading "religious" where it ought to "rebellious."—One or two minute matters, involving verbal error, connected with the typography of the English

Bible, may be stated.—The familiar word, "helpmate," sometimes used as a synonym for "wife," had its beginning in a defective printing of the Scripture terms "help meete." It would appear that, by accident, first the space dropped out from between these two vocables, and then the double *e* of "meete," as, in the old English, it would be written, was taken to be an *a*. Again: there is a certain passage in the History of the Jewish Kings (vide 1 Sam., xxvii., 10.), which to us, in these days, sounds as if it contained a misprint, of "road" for "raid." King David, a fugitive from his native land, has made a rush over the border, with an armed band; and, after slaughtering men and women, has carried back with him "the sheep and the oxen, and the asses and the camels, and the apparel." Achish, his protector, in the place of his exile, on seeing the spoil, asks, "Whither have ye made a road to-day?" But here is no misprint. "Road" and "raid" are the same words; the former the Southern, the latter the Northern, form. Both are modifications of the Anglo-Saxon *rad*, which denotes not only the act of r'ding, but also the provisions made for its exercise; namely, a cleared highway. We have the word in Shakespeare, in lines 36—39, act 1., sc. 2., K. Henry V.:—

> "We must not only arm to invade the French,
> But lay down our proportions to defend
> Against the Scot, who will make road upon us."

In the Geneva version, in my old copy of 1603, the inquiry of Achish is, "Where haue ye bene a rouing, this day?" The word "raid," now so familiar to our Canadian ears, is not to be found in lexicons printed a few years since. It is not in my copy of Worcester, of the date 1847, nor is it in the body of Ogilvie's Imperial, of the date 1850. In the Appendix to the last-named Work, it is given as a Scottish provincialism.—Another word become, of late years, known to us, in a modern sense of its own, is "Philistine." It is not improbable that this, in its present English shape, is the offspring of a misprint. In my Geneva version, of the date 1605, to which I have, already, more than once referred, "Philistine" is everywhere printed "Philistim;" or, rather, in the plural, somewhat pleonastically, Philistims; just as we now, in our English way, say "Cherubims," when "Cherubim" is, already, plural. It is to be suspected that, on some occasion, the last member of the final *m* l been taken for an *e*, and then printed accordingly. "Philistine" was next assumed to be the possessive of the poetic *Philistia*, the very un-Hebrew

appellative made to represent "land of the Philistim;" sometimes rather boldly Latinized into *Palæstina*, also.

There is one place in the English Bible where, in very many of the modern editions, a misprint will be observed, about which there can be no question. It is in a part of the History of the Jewish Judges (ix., 53.), where an old Saxon expression occurs, which, from its having now become unfamiliar, is liable to be wrongly understood by printers. I find the passage incorrectly given in my copy of Bagster's carefully executed Polyglot, of the date 1831; and in other editions of the Bible which I have at hand. In Bagster's Quarto, generally known as the "Comprehensive," and in such of the authorized issues as are, at this moment, within my reach, the printing of the sentence is accurate.—Abimelech, a usurper, while beseiging a walled city, is struck on the head by a heavy stone, thrown down, as it happened, by a woman. The incident is thus narrated: "A certain woman cast a piece of mill-stone upon Abimelech's head, and all to-brake his scull." The misprint, when it occurs, is found in and about the expression "to-brake." The compositor, not versed in the ancient Saxon phraseology, is inclined first to expunge the hyphen and to set up the remaining vocable, as though it were "break." The passage is then made to read as though it were simply a statement of the intention of the woman, in casting down the stone, not of the effect of the blow. But the old English verb "to-break" (its parts thus connected together by a hyphen), is an intensive of "break," just as in the Anglo-Saxon *to-brœcan* is of *brœcan*. The *all* which precedes renders the word more emphatic still. So that "all to-brake his scull" is an exceedingly strong statement of the injury, not simply intended, but inflicted. This use of the Anglo-Saxon prefix *to* is to be met with in Chaucer. Thus, in the Knight's Tale, L., 1699, we read:—

> "With mighty maces the bonés they to-brest;"

that is, completely burst or crushed. In Shakspeare, also, in the Merry Wives (iv., 4. ll., 56, 57.), one of the directions about to be given to certain supposed urchins, ouphes, &c., in regard to Falstaff, is this:—

> "Then let them all encircle him about,
> And, fairy-like, to-pinch the unclean knight."

Here the usual varieties of printing will be found. Warburton, evidently not being aware of the idiom, suggested "fairy-like, too;"

and Theobald edits, without remark, simply "to pinch."—Milton, in one place (Comus, 375—380), has imitated this old expression :—

> ——— Wisdom's self
> Oft seeks to sweet retired solitude;
> Where, with her best nurse, Contemplation,
> She preens her feathers and lets grow her wings,
> That, in the various bustle of resort,
> Were all to-ruffled and sometimes impair'd."

Two misrenderings, at this place, are exhibited by the editions; some giving "too," and others "all-to."—We have retained the intensive *to* in *together*, the Anglo-Saxon *to-gædere*, which we make additionally strong by placing "all" before it, in our "altogether." Our *too* is this same particle *to*, strongly accented.—In my old black-letter Bible, of 1615, the language at the place in "Judges," above referred to, is not so antiquated as that of the more recent version. It is quaint, of course, but quite clear in its meaning: "A certaine woman cast a piece of milstone upon Abimelech's head, and broke his braine-pan." (With "braine-pan" for "head," compare the Late-Latin and Italian *testa:* in the first instance, an *earthen jar;* and, secondarily, a *head.* Hence the French *tête.*)—I have one more instance, a very clear and curious one, of a typographical error in the English Bible, that commonly circulates in the community. In this case, not only has a word been altered, and the idea conveyed by the passage changed; but, in consequence of the difference, a portion of our phraseology in intercourse, one with another, has been burdened with an inaccuracy. "To strain at a gnat" is an expression derived from a passage in St. Matthew (xxiii., 24.), and has become a part of the language of the people. The phrase is the result of an uncorrected error of the press. It should be "strain out a gnat." More than a hundred years ago, "out" was here, by some accident, misprinted "at," in an edition which appears to have been universally followed. The allusion, in the expression, is to the process of purifying wine from any extraneous substance that may, by any chance, have fallen into it. A very particular grower, to get rid of the smallest insect suspected to be in the "must," will pass and repass whole vats of it most carefully through a straining apparatus. From the precincts of the vineyard, the phrase found its way into the common language of oriental life, to denote an excessive scrupulosity in regard to small matters, especially when conjoined with a want of conscienti-

ousness in regard to great ones. A glance at the Greek original shews, of course, that "out" is the proper word. Its blundered representative, "at," has implanted, in the popular mind, the notion, wholly wrong, and rather unbecoming, that there is, in the saying, an allusion to a difficulty experienced in getting some minute and, at the same time, disagreeable thing down the throat. In my black-letter Quarto, of 1615, already referred to, the passage is free from the erratum in question. And, among the notes in the margin, I observe one on this place which, judging from the way in which misprints are occasioned, may have been the cause of the original error. That note is an interpretation of the metaphor of the proverb: "Ye stay at that which is nothing, and let pass that which is of great importance." May not a compositor, setting up from a copy containing some such annotation as this, have had his eye drawn aside to the "at," which stands close to its beginning? This instance of typographical inaccuracy has been repeatedly pointed out, but never set right. So long ago as 1754, John Wesley, in his excellent "Explanatory Notes," exclaimed "It is strange that glaring misprint 'strain at a gnat,' which quite alters the sense, should run through all the editions of our English Bible!" (Vide p. 94, Quarto ed.) It is a curious phenomenon to observe how quickly verbal errors became established, and how their continuance is vulgarly preferred to their removal, even when their character is pointed out. Here we discern the ground of the sad Machiavellian maxim,—"Vult populus decipi; ergo decipiatur."

In view of the ease with which a short-lived tradition will invest typographical mistakes with a sort of weight and authority, and of the reluctance with which many men submit to be informed of them, the world is to be congratulated that a certain bull of Pope Sixtus V., prefixed to an edition of the Vulgate (1585—1590), had little effect. It forbade all printers, on pain of excommunication, to vary one jot or tittle from the text then and there presented. The edition was speedily found literally to swarm with misprints. Could the prohibition have been enforced for a decade or two, a possibility, nay, as we see, a probability would have been established, of the perpetuation, in after-generations, under sanctions the most solemn, of a number of frivolous errors in language and common thought.

A local example of the influence of a typographical error, kept for a short space of time before the public eye, may be mentioned. It

will very likely be remembered that, not many months since, a newly invented lamp was extensively advertised under the name of the *Fumivore*. In one of our Toronto Daily Journals this term was to be seen for a series of weeks, rather conspicuously misprinted *Fumirore*. It was curious to notice how quickly among the less educated the *Fumirore Lamp* began to be talked about and inquired after.

In connexion with misunderstandings arising from errata it may, perhaps, be expected that I should say something on the subject of a wrong punctuation. But it would be endless to notice the passages in authors in which a difference in the sense is produced by a difference in the placing, or omission, of stops. Early manuscripts, like ancient inscriptions, had, as we know, no punctuation as we understand the term. Nothing short of a miracle therefore could be expected to establish among editors a unanimity on this head. It is well known that advantage was taken occasionally of this abuse of points to construct oracular responses which should be capable of a double sense, the meaning varying as you dropped the voice in one place or in another. The stock example of such a sentence is the answer to Pyrrhus when he inquired as to his chances against the Romans: "Aio te Æacida Romanos vincere posse,"—travestied in a recently-manufactured versicle "Aio Philistinos te Bospore vincere posse." And I might quote a passage from the Apology of Justin Martyr (I. 6), where the punctuation has given rise to lengthened debates on a deep question of orthodoxy; and, were I at liberty to explain at length, it would instantly be seen by every one that the discussion was not a trivial one. I pass over this instance because, to enter into particulars in regard to it, would be here out of place; and I present another which will answer my purpose just as well; an exaggerated one perhaps, and embracing details ingeniously invented if not strictly true. It is a sentence supposed to be taken from the correspondence of a country newspaper, wherein the writer describes what he saw as he sat in the gallery of the House of Commons:—"Lord P. then entered on his head a white hat upon his feet large but well-polished boots upon his brow a dark cloud in his hand his faithful walking-stick in his eye a menacing glare saying nothing he sat down." The whole communication is to be imagined as sent without any visible markings-off of its clauses. These having been supplied in the village printing office, in every instance *wrongly*, sad senses were made out of the writer's matter, as will be seen by every one who makes the experiment on the extract presented.

In the Athenæum Library at Boston, is shewn as a curiosity, a volume by an early worthy of New England, named Timothy Dexter. Its title is a "Pickel for the Knowing Ones." So troubled was this writer in regard to the matter of punctuation, that he at length decided to omit the points altogether, giving, however, at the end of his book several pages of all the varieties of stop, with an invitation to the reader "to pepper his dish as he chose." This is the peculiarity on account of which the book is exhibited.

Very much of the literary criticism on Shakspeare has been expended, not on his own genuine words, but on what are in reality typographical misrepresentations of them. The folio of 1623, the first printed collection of the dramatic works of the great poet, is full of errors, either of the press or, antecedently, of the pen. The actors Heminge and Condell were indifferent editors. Seven years after Shakspeare's death they gathered together and gave to the world the plays as they found them in the property-rooms of the theatres—some already badly printed; some still in manuscript, blotted, obscure and worn, taken down in many places from oral tradition and interlarded here and there with portions of the *ad libitum* trifling indulged in by buffo players. Intelligent possessors of a folio appearing in such a condition would naturally, from time to time, check its contents by earlier printed copies of separate plays, and by their own individual knowledge of the text as heard on the contemporary stage. There can be no doubt that very many of the manuscript corrections to be read in Mr. Collier's copy of the date 1632, were made on good authority. It can well be conceived what a field has been here found for the exercise of literary sagacity. After a lapse of two hundred and fifty years the work of emendation may be supposed to be approaching completion. A few more happy guesses, commending themselves to the general understanding and good taste of qualified men,—and, to the already innumerable recensions of Shakspeare, one more will be added, with letterpress everywhere clear of marks of doubtfulness, its subject-matter to be grasped and thoroughly enjoyed, page after page, without interruption from commentator or critic.

A near approximation to such a Shakspeare is to be found in the now widely-known Globe edition, printed in 1864 at the University press of Cambridge, and of which in October last, 50,000 copies had been sold by the Messrs. Macmillan & Co. Into its text many

emendations have at last been admitted which, notwithstanding their self-evident correctness, were previously to be seen only in appended foot-notes. Nevertheless, the obelus still appears by the side of a passage here and there where, as yet, in the opinion of the editors, no admissable improvement has been proposed, or where lacunæ occur too great to be filled up with any approach to certainty by conjecture. As a kind of contrast to the very enjoyable Globe edition, we may notice here an elaborate typographical curiosity, having relation also to the name of Shakspeare. This is Mr. Booth's reprint (1864), on paper of three several forms, of the folio of 1623. The announcement of the publisher in respect to this work, will be read with mingled feelings of pain and pleasure:—"This beautiful volume is the most perfect re-production that could be imagined or desired of the first and only authoritative edition of Shakspeare's Works. So great pains have been taken to secure accuracy that every head-piece, ornament and line has been carefully copied, and every broken or deformed letter preserved. Though the book has now been nearly two years before the public, not a single inaccuracy has been discovered." A production thus remarkable for its accurate inaccuracy appropriately finds a place in a catalogue of *errata recepta*. Another cognate, and in a scientific point of view, more interesting publication should also be noticed. Not only has the folio of 1623 been thus, with all its faults, minutely edited and carefully printed; it has also been brought out complete and in perfect fac-simile by the process of photozincography. The literary man may thus have upon his own private shelves a copy of Shakspeare in a manner identical with one of the original folios of Heminge and Condell—a copy actually struck off from the face of one of them by the all but miracle of solar typography.

All students of English are interested in the text of Shakspeare. Its perfect purity is a thing greatly longed after. Every rational contribution to this end meets with a welcome. I venture then upon a remark on three several passages which continue to be obelized as, after various treatment by the commentators, incurable. In regard to each respectively I offer a reading, which, as it has struck me, may be really the original one.

"Siquid novisti rectius istis
Candidus imperti; si non, his utere mecum."

In each case I have been more or less led to the suggestion made

by the application of a rule deduced long ago from considerations in regard to old fashioned hand-writing similar to those spoken of by Mr. J. P. Collier, in his "Account of Early English Literature," (ii. 259.) He is observing on the couplet from a now forgotten writer—Barnaby Rich:

> "To what impression I have wrought it now,
> The wise may judge, for fools feare not how."

After pointing out that in the second line, both sense and measure detect a misprint, and that "I care not how" ought manifestly to be read instead of "feare not how;" he adds, "When we recollect that in manuscript of the time (1613) the pronoun *I* was constantly carried below the line, it is easy to understand how 'I care' came to be misprinted 'feare.' This mode of detecting errors in old books has never been sufficiently attended to; and editors of Shakspeare have often preserved blunders, because they did not consider, or perhaps did not know, how words would look in writing of the period."

1. In Act iii., sc. 2. of Romeo and Juliet, the beginning of the sixth line (the *locus conclamatus*) should, I think, read:—

> "That Erinnys' eyes may wink."

It is quite in Shakspeare's way to put into the mouths of his characters mythological names well-known through the translations in vogue in his day, of Homer, Virgil, Ovid, &c. In line 2, of this scene, we have 'Phœbus;' in line 3, 'Phaethon.' The fury 'Erinnys,' familiar from Virgil's

> "In flammas et in arma feror, quo tristis Erinnys,
> Quo fremitus vocat, et sublatus ad æthera clamor—"

is here conceived of as promoting the fierce family feuds which were distracting Verona, and rendering adventures, like that of Romeo, exceedingly dangerous. In Act ii., sc. 2., line 70, Juliet says to Romeo, "If they (any of the Capulets) see thee, they will murder thee."—The name 'Erinnys,' with similar associations, is employed by Shakspeare in line 5 of 1 Hen., iv. 1. 1.

> "The thirsty Erinnys of this soil."

That is to say, it is highly probable (as Mr. Monk Mason suggested) that 'Erinnys' is the right reading here, also; and, accordingly, the word is given in the Concordance of Mrs. Cowden Clarke, with this one reference. But the idea of 'Erinnys' occurred to me as the proper lection in the place referred to in Romeo and Juliet, while considering one of the lines in the Latin invocation which, in the "Tra-

gedy of Locrine," a piece already referred to as, possibly, a juvenile essay of Shakspeare's, Albanact is supposed, somewhat unnaturally, to utter as he dies:—

"Nox cæci regina poli, furialis Erinnys."

Act ii., sc. 7.

The word that causes the trouble in the received text, as possessing in the place no tolerable meaning, is 'runaways.' I account for the appearance of such a singular expression in some such way as this: By the careless blunder or provincial pronunciation of an ill-educated reader or prompter, 'Erinnys,' or, perhaps, as it ought to be, "Erinnys's," was, on some occasion, made to sound as though it had been 'runaways.' As such, or rather, according to the old mode of spelling, as 'runawaies,' it was committed to paper, in jest or in earnest; which paper unfortunately became, at last, part of the 'copy' from which the Folio of 1623 was printed.—The suggestion of the Manuscript corrector of the Folio of 1632 is 'enemyes,' which will give a certain sense, especially if 's be attached to the preceding particle 'that:' "That's enemyes' eyes," for "That his enemyes' eyes." But 'Erinnys,' to my thinking, was the word employed here by Shakspeare. Let the passage, read with this correction, speak for itself.

2. The two hundred-and-ninety-ninth line in Scene 1. of the Fifth Act of Hamlet, is one of the 'still-vext' places of Shakspeare. I feel sure that it should be read,

"Woo't drink up Nilus? eat a crocodile?"

Indistinctness of writing, perhaps the wrong orthography of a *y* for an *i*, and an accidental transposition of syllables in the printing-office, have, together, converted the original word (as I believe) *Nilus*, into *Eysell*, *Eisil*, or *Esil* (in these several ways the modern text is given) conjectured, by the commentators, to be, variously, *esil* (that is, perhaps, *vinegar* in the sense of *poison*), or *vessels* (that is, huge caldrons), or, inasmuch as the word, from its being printed in Italics in the Folio, and beginning with a capital letter, must needs be a proper name, Yssel, Issell, Oesil, Weisel, all names so humored in the writing as to denote rivers which a Prince of Denmark might be supposed to know.—One editor, however (Hanmer), came very near the truth in suggesting *Nile*; but *Nilus* did not strike him. He was, consequently, obliged to eke out the line with an "or" in addition, and so he marred the characteristic abruptness of Hamlet's rapid queries, by

causing him to put the alternative: "Wilt drink up Nile, *or* eat a crocodile?"

The mad challenge of Hamlet is to drink up even *Nilus*, a household word for a stream extravagant in its overflowings. The name, *Nilus*, thus given at full length, occurs elsewhere in Shakspeare; as, for example, in Titus Andronicus, iii., lines 70-1:—

"My grief was at its height, before thou camest;
And now, like Nilus, it disdaineth bounds."

3. My third correction is in the eighth line of the Hundred-and-Twelfth Sonnet. I read—

"That steel'd am I 'gainst censure, right or wrong."

The editors confess that this line, as usually printed, yields but little meaning:—

"That my steel'd sense or changes right or wrong."

Like some other portions of the Sonnets and plays of Shakspeare, this line has, I think, first been taken down wrongly, from dictation, and then inaccurately printed; not only with particular letters, points, and marks of elision mistaken, but with a confusion of order in the words. By printing, as I have suggested, we recover the excellent Shakspearean term "censure," and get rid of the expression "sense;" which is not likely to have been written here, when it occurs so immediately afterwards, at the end of the tenth line of the Sonnet.*

As a final remark, I add that I think there ought to have been admitted, without further hesitation, into the Globe edition, the following corrections: "Seamews," for "seamels" (ells), in l. 176, Act ii. sc. 2, Tempest; "bollen bag-pipe," for "woollen bag-pipe," in l. 56, Act iv., sc. 1, M. of Venice; and, "Ethics" (ickes), for "checks" (eckes), in l. 32, Act i., sc. 1, T. of the Shrew.

* In regard to the apparent violation of grammar, in the eleventh line, where the nominative to "are" is "sense" in the preceding line, the reader is to observe that "adders' sense," in this place, having the meaning of "ears," is to be taken as a noun of multitude. Thus, "power," as an equivalent to "forces," is used as a plural, in K. John, v. 6. 39—41:—

"Half my power, this night,
Passing the flats, are taken by the tide—
These Lincoln Washes have devoured them."

The above proposed amendment in Sonnet cxii, has been once before suggested by me, in the little publication entitled "Shakspeare—the Seer—the Interpreter." *Vide* Note x., p. 69.

CANADIAN INSTITUTE.

SESSION—1865-66.

Notes on a few new and interesting Canadian Birds, exhibited by George McKay, Esq., Mr. Passmore taxidermist, and from the Museum of the University, by Rev. W. Hincks, 6th January, 1866.

We record very concisely the substance of the remarks made. The pintailed Grouse, Centrocercus phasianellus, though common more to the north, is rarely seen within the bounds of Canada, as commonly understood. We are much indebted to G. McKay, Esq. for the exhibition of a specimen in his possession from the neighborhood of Sault Ste. Marie.

Mr. Passmore exhibited a specimen of Anser Hutchinsii, which seems to be not uncommon, but generally mistaken for the young of the Canada Gorse. Through Mr. Passmore's kindness, Professor Hincks was enabled also to call attention to the peculiarities of a Swan, proposed by him, though with hesitation, as a new species, under the name of Cygnus Passmori. The remarkable difference in weight seemed hardly to be accounted for from age alone. There is, also, a sensible difference in the position of the eye, and in the direction of the line bounding the beak; and the bend of the trachea within the keel of the sternum is very different, so that it was thought difficult to explain it from difference of ages. Yet the question requires examination by the comparison of series of specimens, and can scarcely, as yet, be decided satisfactorily. The comparison of a full grown Trumpeter Swan with the supposed new species, and with a specimen of Cygnus Americanus, could not fail to be interesting to the members present.

FIRST ORDINARY MEETING—*2nd December*, 1865.

PROF. E. J. CHAPMAN, Ph.D., Vice-President, in the Chair.

I. *Papers were read as follows:*

1. By the Rev. Prof. W. Hincks, F.L.S, &c.:
"On chorisis as a means of explaining certain phenomena of Plants."
2. By the Rev. J. McCaul, LL.D.:
"On ancient Factions at Rome and Constantinople."
3. Prof. Croft, D.C.L.:
Exhibited Pharaohs' Serpents and explained their construction and composition.

SECOND ORDINARY MEETING.

9th December, 1865.

PROF. E. J. CHAPMAN, Ph D., Vice-President, in the Chair.

I. *The following Gentlemen were elected Members:*

Life member, JOHN DICKSON, Esq, Toronto.
Ordinary members, J. C. HAMILTON, M.A., Barrister, Toronto.
" G. M. MACDONNELL, B.A., " "

II. The nomination for office-bearers for the ensuing year took place.

THE ANNUAL GENERAL MEETING.

1*th December*, 1865.

PROF. E. J. CHAPMAN, Ph.D., Vice-President, in the Chair.

I. Mr. JAMES FRASER was elected a member.

II. The following Gentlemen were declared office-bearers and council without ballot, as only the requisite number had been proposed:

President,	Vice-Chancellor, The Hon. O. Mowat.
1st Vice-President,	Prof. G. T. Kingston, M.A.
2nd "	M. Barrett, Esq., M.A., M.D.
3rd "	J. N. Agnew, Esq., M.D.
Treasurer,	Samuel Spreull, Esq.
Recording Secretary	W. Mortimer Clark, Esq.
Corresponding Secretary,	U. Ogden, Esq., M.D.
Librarian,	Rev. H. Scadding, D.D.
Curator,	W. B. McMurrich, Esq., M.A.
Council,	Professor E. J. Chapman, Ph. D.
"	" Daniel Wilson, LL.D.
"	" J. B. Cherriman, M.A.
"	" H. Croft, D.C.L.
"	" Rev. W. Hincks, F L.S., &c. ex-officio as Editor of Journal.
"	C. B. Hall, Esq., M.D.
"	A. M. Rosebrugh, Esq., M.D.

III. The Annual Report of the Council was read by the Secretary, and on the motion of Dr. Daniel Wilson, seconded by the Reverend Edmund Baldwin, was adopted.

IV. A Paper was read by Prof. Cherriman, "On Recent Experiments in aerial Navigation."

Dr. Rosebrugh exhibited a series of mecographical photographs and enlarged photographs of micographic objects, executed by Mr. Hollingworth and presented by him to the Institute. He explained the nature of the process and the construction of the camera. At the conclusion he exhibited some enlarged photographs of microscopic objects projected by the magic lantern.

THIRD ORDINARY MEETING.

6th January, 1866.

J. N. Agnew, Esq., M.D., Vice-President, in the Chair.

I. *The following Gentlemen were elected Members:*

Rev. J. A. Williams, Toronto.
George Whitney, Esq, Toronto.
George Murray, Esq., Barrister, Toronto.
William Tempest, Esq, M.D., Toronto.

II. *The following Papers were read:*

1. By Prof. E. J. Chapman, Ph. D.:
"Remarks on some Minerals from Lake Superior."

2. By Rev. Prof. W. Hincks, F.L.S., &c.:
"Remarks on some Canadian Birds, with exhibition of specimens."

FOURTH ORDINARY MEETING.

13th January, 1866.

Prof. G. T. KINGSTON, M.A., Vice-President, in the Chair.

I. JOHNSON PILLIT, Esq, of the Village of Grimsby, C. W., was elected a Member.

Prof. Wilson read a Paper entitled: "Notes of a visit to Mal Bay on the St. Lawrence, and exhibited some illustrative sketches and made some observations geological and historical thereon."

FIFTH ORDINARY MEETING.

27th January, 1866.

I. A Paper was read by Dr. U. Ogden—"On the Propogation and prevention of Cholera."

SIXTH ORDINARY MEETING.

3rd February, 1866.

Prof. G. T. KINGSTON, M.A., Vice-President, in the Chair.

I. Dr. J. O'DEA and Dr. W. H. CUMMINGS were elected members.

II. *The following Donations for the Library received since last meeting were announced by the Secretary:*

Journal of the House of Assembly of Nova Scotia, 1865. 1 Vol.

Statutes of Canada, 1865. 2nd Session, 29 Vic., 1865. 1 Vol.

III. A paper was read by Dr. Rosebrugh—"On some of the optical defects of the eye, and their Treatment with the Scientific use of Spectacles."

Two medals of Churches were exhibited by Mr. G. H. Wilson, viz.: one of the Church of St. Paul, Rome, and St Peter and St. Paul, Philadelphia.

SEVENTH ORDINARY MEETING.

10th February, 1866.

Dr. AGNEW, Vice-President, in the Chair.

I. A Paper was read by the Rev. Prof. Hincks, entitled: "Some thoughts on classification in relation to organized beings."

EIGHTH ORDINARY MEETING.

17th February, 1866.

Prof. G. T. KINGSTON, M.A., Vice-President, in the Chair.

I. A Paper was read by Rev. Dr. Scadding, on "Reed misprints, or Traditional errors in Typography."

NINTH ORDINARY MEETING.

24th February, 1866.

M. BARRETT, Esq., M.D., Vice-President, in the Chair.

I. A Paper was read by Dr. Daniel Wilson, entitled: "An Alphabetical History.

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO CANADA WEST,—OCTOBER, 1865.

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.			Resul'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	M'N'S		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 AM.	2 P.M.	10 P.M.	Resul't.	M'N		
					°	°	°	°	°												°							
1	29.482	29.356	—	—	50.8	54.7	—	—	—	.324	.337	—	—	87	78	—	—	W b S	W b N	Calm.	N 80 W	3·0	6.5	0.0	6.97	7.60	0.035	...
2	.459	.487	29.555	29.5070	37.8	52.6	38.1	44.03	— 5.90	.208	.240	.195	.219	91	60	85	77	W N W	NW b N	Calm.	N 37 W	3·5	8.6	0.0	5.20	5.55	inap.	...
3	.555	.504	.533	.5305	42.8	50.4	41.4	45.42	— 4.12	.232	.218	.195	.218	84	59	75	72	N W b N	N N W	N N W	N 21 W	3·0	12 0	6.8	7.22	7.45	inap.	...
4	.539	.502	.593	.5557	37.0	47.2	45.0	43.97	— 5.07	.193	.239	.230	.235	87	74	77	81	N N W	N W	N W b N	N 35 W	3·2	24.5	13.0	12.27	12.38	...	...
5	.662	.700	.803	.7313	43.5	51.5	42.1	46.05	— 2.57	.223	.224	.223	.216	78	58	83	70	N W b N	N N W	N W	N 33 W	8.2	13.2	6.0	8.21	8.40	...	...
6	.864	.839	.783	.8293	33.5	57.3	48.2	49.03	+ 0.87	.199	.313	.277	.263	85	66	82	76	N W	S b W	S W b W	S 44 W	4·2	6.0	3.0	3.23	4.14	...	...
7	.681	.602	.576	.6145	56.9	65.2	60.1	60.60	+12.75	.403	.536	.489	.466	88	86	94	88	S W b W	W b S	S W b W	S 70 W	6·2	5.0	1.0	4.08	5.65	1.275	...
8	.604	.636	—	—	50.8	53.3	—	—	—	.335	.353	—	—	90	87	—	—	N E	E b N	Calm.	N 57 E	6.2	1.2	0.0	1.66	1.73	0.045	...
9	.614	.503	.494	.5573	43.9	66.3	60.9	58.73	+11.65	.233	.482	.491	.446	92	74	92	88	Calm.	S W b S	S W	S 71 W	0.0	12.5	7.0	6.18	8.24	...	...
10	.603	.692	.671	.6267	60.9	66.3	60.9	62.43	+15.77	.503	.444	.441	.439	94	68	82	77	W b N	E	N b E	N 34 E	3·2	8.0	3.4	3.61	5.32	...	...
11	.724	.692	.438	.5872	47.5	57.6	58.7	53.95	+ 7.70	.264	.320	.455	.320	80	67	92	75	N N E	S E b E	W b S	N 1 E	7.0	6.8	7.2	3.86	7.55	0.045	...
12	.707	.748	.816	.7625	42.5	47.5	40.3	43.43	— 2.53	.218	.170	.185	.189	89	59	73	67	N	N W b N	N N W	N 8 W	6.0	10.2	4.2	6.97	7.08	...	...
13	.817	.720	.641	.7238	34.5	47.2	39.2	40.65	— 4.92	.174	.210	.216	.194	87	64	90	77	N b E	E S E	S E	N 78 E	8 0	3·5	3.4	3.22	4.10	...	...
14	.448	.313	.275	.3387	36.3	52.6	45.0	45.60	+ 0.33	.185	.289	.249	.247	86	73	83	80	N E b N	E S E	N b E	N 20 E	5.6	2.0	0.6	3.71	4.57	...	...
15	.275	.337	—	—	44.6	48.2	—	—	—	.191	.190	—	—	65	55	—	—	N	N b W	N N W	N 18 W	11.0	18.2	9.2	12.17	12.47	inap.	...
16	.641	.651	.738	.6835	31.6	48.6	36.7	39.63	— 4.99	.148	.211	.197	.178	83	61	90	74	N W b N	W b N	N W	N 45 W	1.5	14.6	2 0	7.03	7.16	...	...
17	.731	.657	.565	.6448	29.5	50.8	49.7	44.80	+ 0.57	.120	.233	.247	.208	79	63	69	69	Calm.	S E	E S E	S 41 E	0.0	4.5	0.2	4.88	6.08	0.025	...
18	.400	.335	.258	.3233	51.8	55.5	53.6	53.82	+ 9.78	.300	.331	.393	.363	78	86	96	87	E S E	S S E	S E b E	S 63 E	8.2	4.5	3.5	5.20	6.46	0.460	...
19	.006	28 787	28 841	28.8695	53.6	53.6	47.9	51.57	+ 7.78	.395	.298	.240	.306	96	72	71	79	N E	W N W	W	N 69 W	8·0	22·4	16·4	16.36	17.55	0.160	...
20	.026	29.120	29.293	29.1673	41.4	47.2	38.1	42.17	— 1.40	.205	.139	.187	.181	78	42	81	68	W N W	W N W	W b S	N 73 W	18·5	33·4	5·8	16.12	16.56	0.160	...
21	.445	.573	.759	.6085	35.3	46.4	34.2	38.73	— 4.52	.164	.167	.168	.164	80	52	85	71	W	W b N	Calm.	N 72 W	11.2	23·2	0.0	10.18	10.26	...	...
22	.820	.691	—	—	34.2	51.5	—	—	—	.177	.314	—	—	89	82	—	—	Calm.	W b S	W b N	S 83 W	0·0	11·4	12·2	4·65	5.10	0.105	...
23	.762	.855	.955	.8675	37.0	44.3	33.4	38.67	— 4.08	.201	.139	.134	.165	91	47	70	70	Calm.	N W b N	Calm.	N 6 W	0·0	3·4	0·0	4.18	4.27	...	...
24	.981	.938	.958	.9753	30.2	41.4	34.9	36.40	— 6.10	.112	.126	.159	.133	67	48	78	64	N b E	N W b N	N b W	N 4 E	6·2	1·0	6·4	2.91	3.10	...	...
25	.921	.855	.831	.8643	32.7	43.9	41.7	39.70	— 2.58	.157	.218	.191	.180	85	75	71	73	N N E	N E	N E	N 45 E	4·5	4·2	3·2	4.89	5.07	...	...
26	.824	.836	.920	.8603	42.1	35.6	28.4	34.35	— 7.63	.232	.193	.142	.189	86	93	90	91	N E b N	N N E	N E	N 46 E	11·5	8·4	11·8	10.71	10.74	0.125	2.
27	.839	.736	.542	.6905	25·2	28.7	29.1	27.87	—13.92	.122	.130	.148	.135	90	82	92	88	N E	N E b E	N E b E	N 48 E	13·5	8·8	9·0	9.41	9.49	0.102	1.0
28	.275	.236	.502	.3577	33·4	34.2	32.0	33.03	— 8.45	.171	.177	.173	.170	89	89	96	90	N	N	N W b N	N 35 W	6·6	2·2	16·2	5.31	5.63	inap.	1.5
29	.696	.740	—	—	22·3	38.5	—	—	—	.101	.173	—	—	85	74	—	—	N W b W	W b S	W b S	S 77 W	0 8	11·0	4·3	3 84	3.87	...	...
30	30.015	.982	.900	.9610	34·9	44.3	44.3	41.27	+ 0.32	.161	.205	.230	.201	79	69	79	77	W	S E	S E	S 36 E	0·5	6·4	6·2	4.57	5.84	0.100	...
31	29.848	.793	.929	.8582	43.5	47.2	35.3	42.18	+ 1.43	.259	.229	.163	.209	92	71	79	77	S	W S W	W N W	S 73 W	5.2	6·6	0·2	3.82	5.20	0.018	...
M	29.6313	29.5991	29.6227	29.6187	40.17	49.36	43.05	44.54	— 0.50	.224	.251	.247	.240	85	67	83	77	.....	.....	.....	.....	5.63	9.81	5.52	.....	7.26	2.705	4.5

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR OCTOBER, 1865.

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 . . . . . 30.045 at 8 a.m. on 30th.
Lowest Barometer . . . . . 28.779 at 2.30 p.m. on 19th. } Monthly range= 1.266 inches.

Self-registering Ther.
Maximum temperature . . . 71°.4 on 10th.
Minimum temperature . . . 21°.6 on 29th. } Monthly range= 49°8
Mean maximum temperature . . 52°29
Mean minimum temperature . . 38°07 } Mean daily range=14°22
Greatest daily range . . . . . 24°8 from a.m. to p.m. of 17th.
Least daily range . . . . . 3°0 from a.m. to p.m. of 19th.

Warmest day . . . . 10th ..Mean Temperature . . . 62°43
Coldest day . . . . . 27th ..Mean Temperature . . . 27°87 } Difference=34°.56

Maximum { Solar . . . . . 115°4 on 10th
Radiation { Terrestrial . . . . . 13°5 on 29th } Monthly range= 101°.9

Aurora observed on 9 nights, viz.:—on 5th, 9th, 10th, 11th, 15th, 19th, 20th, 23d and 31st.
Possible to see Aurora on 19 nights; impossible on 12 nights.
Snowing on 3 days; depth 4.5 inches; duration of fall 27.5 hours.
Raining on 17 days; depth 2.705 inches; duration of fall, 63.8 hours.
Mean of cloudiness=0.53; Most cloudy hour observed, 2 p.m; mean=0.70; least cloudy hour observed, 10 p.m.; mean=0.46.

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

North.	South.	East.	West.
2772.32	635.10	997.78	2553.64

Resultant direction, N. 36° W.; Resultant Velocity, 3.55 miles per hour.
Mean velocity 7.26 miles per hour.
Maximum velocity 33.4 miles, from 1.30 to 2.30 p.m. on 20th.
Most windy day 19th—Mean velocity 17.55 miles per hour.
Least windy day 8th—Mean velocity 1.73 miles per hour. } Difference 15.82.

Most windy hour, 1 p.m.—Mean velocity, 10.27 miles per hour.
Least windy hour, 10 p.m.—Mean velocity, 5.35 miles per hour. } Difference 4.92 miles.

2nd. Thin ice a. m. Corona round moon at midnight.
7th. Severe thunder storm at night. 8th, Fog at night.
17th. Solar halo 1 p. m.
26th. First snow of season.

October was cool, wet and windy. The amount of snow, although far less than in 1844, is the second greatest recorded.

COMPARATIVE TABLE FOR OCTOBER.

YEAR.	TEMPERATURE. Mean.	Excess above Average	Maximum observed.	Minimum observed.	Range.	RAIN. No. of days.	Inches.	SNOW. No. of days.	Inches.	WIND. Resultant. Direction.	Velocity.	Mean Force or Velocity
	°		°	°	°							
1840	44.4	— 1.2	68.5	23.9	44.6	13	1.860	3	...	...	...	...
1841	41.6	— 4.0	58.3	20 3	38.0	6	1.360	2	...	...	...	0.41 lbs.
1842	45.1	— 0.5	68.5	30.0	38 5	8	5.175	0	...	...	...	0.35 "
1843	41.8	— 3.8	65.7	24.5	41.2	12	3 790	4	2.5	...	...	0.54 "
1844	43.3	— 2.3	69.6	17 8	51.8	7	imper	4	12.0	...	...	0 43 "
1845	46.4	+ 0.8	62.7	20.0	42.7	11	1.760	1	inp.	...	...	0.26 "
1846	44.6	— 1.0	69.7	20.7	49.0	14	4.180	2	inp.	...	...	0.41 "
1847	44.0	— 1.6	65.0	20.3	44.7	13	4.390	2	inp.	...	...	0.19 "
1848	46.3	+ 0.7	62.2	26.4	35.8	11	1.550	0	...	N 54 W	1.24	4.60 ms
1849	45.3	— 0 3	59.2	25.5	33.7	13	5.965	1	inp.	N 12 W	1.27	7.76 "
1850	45 4	— 0.2	66.6	24.8	41.8	10	2.085	0	...	N 66 W	1.10	5.50 "
1851	47.4	+ 1.8	66.1	25.0	41.1	10	1.680	2	0.3	S 72 W	1.06	4.39 "
1852	48 0	+ 2.4	70.7	29.8	40.9	12	5.280	0	...	N 5 E	1.19	4.47 "
1853	44.4	— 1 2	64.7	25.5	39.2	10	0.875	2	inp.	s 88 W	1.74	4.77 "
1854	49.5	+ 3.9	74.2	29.8	44.4	15	1.495	3	inp	N 45 W	1.52	4.57 "
1855	45.4	— 0.2	64.3	28.0	36.3	14	2.485	5	0.8	N 82 W	4.91	9.88 "
1856	45.3	— 0.3	70.1	23.3	46.8	10	0.875	2	0.1	N 76 W	2.15	6.07 "
1857	45.4	— 0.2	63.5	27.7	35.8	10	1.040	2	0.2	N 19 W	2.93	6.24 "
1858	48.8	+ 3.2	76.3	34.2	42 1	17	1.797	1	inp.	N 34 W	0.36	5.96 "
1859	43 0	— 2.6	68.4	22.3	46.1	11	0.940	4	inp.	N 68 W	5.04	8.12 "
1860	47.3	+ 1.7	63.7	28.4	35.3	15	1.618	1	inp.	N 9 W	2.00	6.33 "
1861	48.7	+ 3.1	64.5	30.2	34.3	15	1.993	1	inp.	N 61 W	1.06	5.96 "
1862	48.7	+ 3.1	76.0	27.0	49.0	19	2.634	2	0.5	N 78 W	2.89	6.53 "
1863	45.9	+ 0.3	63.4	30.9	32.5	16	2.522	0	...	S 71 W	0.48	6.16 "
1864	45.2	— 0.4	64.8	28.4	36.4	22	3.321	1	inp.	N 60 W	3.17	6.66 "
1865	44.5	— 1.1	66.6	22.3	44.3	17	2.705	3	4.5	N 36 W	3.55	7.26 "
Results to 1864.	45.65	...	66.67	25.79	40.88	12.6	2.530	1.8	0.78	N 60 W	1.74	6 14
Exc. for 1865.	—1.15	...	—0.07	—3.49	+3.42	+ 4.4	+ 0.175	+ 1.2	+ 3.72	...	...	+1.12

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST.—NOVEMBER, 1865.

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 PM	MN'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	10PM	Resul't.	ME'N		
					°	°	°	°	°												°							
1	29.942	29.866	29.610	29.7822	38.5	46.4	47.0	44.18	+ 3.72	.190	.240	.237	.226	81	76	73	77	Calm.	E	E S E	S 56 E	0.0	7.5	11.6	5.36	6.12	0.050	...
2	.488	.566	.715	.6060	48.2	49.0	39.6	44.97	+ 4.70	.317	.205	.202	.236	94	59	83	78	S W	W	W S W	S 71 W	6.5	17.0	5 5	7.33	7.57	...	...
3	.750	.667	.592	.6667	32.4	46.4	38.8	39.88	— 0.12	.169	.221	.186	.194	91	70	79	79	W	S b W	Calm.	S 14 W	3.0	6.2	0.0	3.21	4.21	...	...
4	.458	.331	.228	.3378	42.1	46.1	37.8	40.97	+ 1.20	.249	.206	.199	.220	93	66	87	86	S	S S W	N W	N 65 W	0.5	1.0	19.8	6.18	7.71	0.335	...
5	.330	.530	—	—	33.4	33.3	—	—	—	.149	.158	—	—	78	83	—	—	N W	N W	W	N 66 W	19.5	23.5	5.5	13.52	15.85	...	0.2
6	.491	.233	.564	.4345	34.5	39.6	36.0	37.05	— 2.12	.174	.150	.162	.159	86	61	76	72	S W	S W b W	W b N	S 87 W	21.7	18.2	32.0	15.48	18.62	0.070	0.2
7	.832	30.080	30.088	30.0313	25.2	28.7	26.6	27.50	—11.50	.115	.109	.126	.120	85	69	87	80	N W b W	N b W	Calm.	N 16 W	6.6	4.6	0.0	2.72	5.14	...	...
8	30.012	29.790	29.638	29.7997	33.4	39.6	41 7	38.73	+ 0.05	.171	.176	.200	.179	89	72	76	76	S E	E S E	Calm.	S 24 E	6.2	6.6	0.0	3.83	6.12	...	...
9	29.759	.922	30.090	.9148	38 1	41.9	32.0	36.55	— 1.85	.187	.184	.143	.165	81	71	79	75	W b S	N W b N	N	N 43 W	1.2	18.0	9.0	8.50	10.27	...	...
10	30.229	30.268	30.334	30.2872	28.4	30.6	27.7	28.72	— 9.37	.126	.114	.121	.121	81	67	80	77	N	N b E	N E b N	N 26 E	9.0	6.0	3.0	5 02	6.15	...	...
11	30.293	30.239	30.146	30.2217	27.7	31.6	29.1	29.10	— 8.68	.128	.126	.133	.126	84	70	82	78	N E	N E b E	Calm.	N 54 E	5.5	4.0	0.0	2.24	2.25	...	...
12	30.066	29.923	—	—	26.2	47.2	—	—	—	.124	.258	—	—	87	79	—	—	Calm.	S W b W	S W b W	S 57 W	0.0	8.2	2.7	6.01	6.33	...	...
13	29.710	.579	29.558	29.6142	36.3	55.8	44.6	45.70	+ 8.52	.176	.258	.217	.213	82	58	74	71	S W b W	W b S	W b S	S 62 W	6.0	14.2	9.4	8.18	8.52	...	...
14	.536	.483	.456	.4988	44.3	54.7	45.3	47.68	+10.78	.225	.273	.245	.241	77	64	81	73	W S W	S W b S	S W	S 42 W	7.0	10.6	2?2	5.50	5.56	...	...
15	.506	.435	.619	.5453	43.2	55.5	43.5	46.68	+10.18	.244	.326	.240	.257	87	73	85	80	S W b W	W S W	S W b W	S 53 W	4.4	7.5	3.5	4.61	4.73	...	...
16	.593	.539	.429	.5125	41.4	53.6	47.2	46.85	+10.65	.232	.288	.268	.261	89	70	82	81	S W b W	S b E	S E b S	S 6 W	2.0	5.8	0.6	3.39	4.10	...	...
17	.313	.433	.683	.5078	52.2	54.7	42.8	48.83	+13.03	.337	.200	.168	.233	86	46	61	67	S W b S	W	N W	N 88 W	11.2	30.4	12.5	12.95	15.15	...	...
18	.759	.775	.756	.7675	37.8	42.1	36.3	38.07	+ 2.58	.165	.143	.168	.163	72	53	78	71	N N W	N b W	N	N 11 W	4.0	6.0	2.2	3.97	4.06	...	...
19	.702	.836	—	—	32.7	43.5	—	—	—	.143	.186	—	—	76	66	—	—	N W b N	E	S S W	S 34 W	1.6	4 2	4.7	1.34	4.54	...	...
20	.849	.722	.660	.7347	37.1	40.3	41.4	39.77	+ 5.00	.158	.150	.214	.177	71	59	81	71	S E b S	E b S	E S E	S 73 E	8.3	14.8	8.5	8.72	9.27	...	...
21	.576	.466	.372	.4597	42.1	36.2	34.5	38 30	+ 3.92	.223	.216	.183	.206	83	90	91	89	E N E	N E	N W b N	N 30 E	6.4	12.5	5.8	6.89	9.25	0.290	0.1
22	.208	.129	.182	.1763	33.4	34.0	34.7	34.23	+ 0.15	.180	.180	.172	.177	94	92	85	89	N N W	N W	N W b W	N 41 W	6.8	15.8	17.0	14.57	14.75	...	0.5
23	.346	.475	.651	.5118	35.3	39.9	37.8	37.25	+ 3.58	.173	.181	.183	.177	84	73	80	80	N N W	N b W	N N W	N 22 W	14.2	15.0	9 2	11.40	11.56	...	...
24	.751	.786	.766	.7677	34.5	37.8	33.8	36.87	+ 3.60	.163	.173	.186	.171	82	76	78	78	N N W	N W b N	W b N	N 62 W	5.8	6.8	3.6	1.88	2.73	...	...
25	.083	.637	.714	.6833	37.1	42.5	40.3	40.02	+ 7.05	.182	.218	.185	.197	83	80	73	79	Calm.	W N W	N W b W	N 67 W	0.0	7.0	6.0	2.63	3.18	...	...
26	.747	.691	—	—	37.8	43.9	—	—	—	.190	.163	—	—	84	56	—	—	N W b W	W b N	N W	N 62 W	7.4	4.0	4.3	3.58	3.70	...	...
27	.561	.590	.784	.6590	32.7	37.4	27.7	31.93	— 0.25	.143	.154	.113	.137	76	69	74	76	W b S	N W	N W	N 52 W	3.2	33.0	2.5	11.66	12 52	...	Inp.
28	.843	.840	.778	.8192	24.4	29.8	25.9	26.93	— 4.93	.106	.133	.107	.119	81	80	76	80	N	Calm.	N E b N	N 51 E	4.5	0.0	4.2	4.28	5.08	...	...
29	.638	.542	.486	.5483	33.1	36.0	33.1	35.82	+ 4.32	.144	.147	.169	.155	76	69	74	74	E	S E b E	S	S 31 E	14.5	3.0	9.6	7.69	8.83	...	Inp.
30	.352	.053	28.962	.1058	39.2	43.5	38.8	40.47	+ 9.38	.190	.223	.204	.193	79	78	87	77	S b E	S E b S	S W	S 23 W	13.5	8.0	11.5	11.79	14.05	0.230	0.1
..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	.....	.....	.....	...	...	...	...	...	...	...
M	29.6743	29.6345	29.6485	29.6548	36.64	42. 5	37.46	38.58	+ 2.43	.187	.192	.182	.186	83	70	79	77	.....	.....	.....	.....	6.68	10.65	6.88	.....	7.90	0.975	1.1

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.....30·354 at 9 p.m. on 10th } Monthly range =
Lowest Barometer.....28·949 at 4 p.m. on 30th } 1·405 inches.

Self-registering Thermom.
Maximum Temperature.....63°2 on 17th } Monthly range =
Minimum Temperature.....23°6 on 7th } 39°06
Mean maximum Temperature.....44°85 } Mean daily range =
Mean minimum Temperature.....32°91 } 11°94
Greatest daily range.....24°2 from a.m. to p.m. of 13th.
Least daily range.....4°0 from a.m. to p.m. of 22nd.

Warmest day.....17th...Mean temperature.....48°83 } Difference = 21°88
Coldest day.....28th...Mean temperature.....26°95 }
Maximum Solar Radiation.....98°0 on 17th } Monthly range =
Minimum Terrestrial Radiation.....9°0 on 22nd } 89°0

Aurora observed on 1 night, viz:—15th.
Possible to see Aurora on 11 nights; Impossible on 19 nights.
Snowing on 7 days; depth 1.1 inches; duration of fall 21.4 hours.
Raining on 5 days, depth 0.975 inches; duration of fall 31 7 hours.
Mean of cloudiness = 0.79.
Most cloudy hour observed, 2 p.m.; mean = 0.82; least cloudy hour observed, 8 a.m.; mean, = 0.74.

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

North.	South.	East.	West.
1985.43	1577.71	870.35	2979.06

Resultant direction N. 79° W.; Resultant velocity 2.98 miles per hour.
Mean velocity.....7.90 miles per hour.
Maximum velocity.....33.5 miles, from noon to 1 p.m. of 17th.
Most windy day.....6th.....Mean velocity, 18.62 miles per hour. } Difference = 16.37 miles.
Least windy day.....11th.....Mean velocity, 2.25 ditto
Most windy hour.....noon.....Mean velocity, 10.98 ditto } Difference = 4.80 miles.
Least windy hour.....3 a.m.....Mean velocity, 6.18 ditto
1st. Solar halo, 3 p.m. Lunar halo, 6 p.m.
4th. Ground fog, a.m.
Well marked *Indian Summer*, 13 to 17th inclusive,
15th. Solar halo, 11 a.m.
25th. Dense fog, a.m.
28th. Lunar halo.

November, 1865, was warm and very dry—the quantity of rain being the least recorded during the series. The wind, both as to direction and mean velocity, closely approximated to the average of the previous 17 years.

COMPARATIVE TABLE FOR NOVEMBER.

Year.	Temperature. Mean.	Excess above aver'ge	Max. observed.	Min. observed.	Range.	Rain. No. of days.	Rain. Inches	Snow. No. of days.	Snow. Inches	Wind. Resultant. Direction.	Resultant. V'y.	Mean Force or Velocity.
	°		°	°	°							
1840	35.9	— 0.8	54.4	20.5	33.9	5	1.220	8	...	...	...	.....
1841	35.0	— 1.7	63.2	7.6	55.6	8	2.450	5	...	...	...	0 91 lbs.
1842	33.3	— 3.4	50.6	7.6	43.0	9	5 310	10	...	...	...	1.22
1843	33.5	— 3.2	51.2	14.4	36.8	10	4.765	7	1.2	...	...	0.59
1844	34.9	— 1.8	49.8	12.0	37.8	8	Imp	4	8.0	...	...	0.48
1845	36.8	+ 0.1	58.8	7.6	51.2	7	1.103	4	5.0	...	...	0.53
1846	41.3	+ 4.6	55.5	18.2	37.3	12	5.805	2	0.4	...	...	0.64
1847	38.6	+ 1.9	58.2	7.8	50.4	14	3.155	3	Imap	...	...	0.36
1848	34.5	— 2.2	49.3	16.5	32.8	9	2.020	3	1.4	N 81° W	1.81	4.81mls.
1849	42.6	+ 5.9	56.7	28.4	28.3	10	2.815	2	1.0	N 39° W	1.55	4.78
1850	38.8	+ 2.1	62.3	18.1	44.2	7	2.955	1	Imap	N 42° W	1.43	5.27
1851	32.9	— 3.8	50.1	16.5	33.6	5	3.885	6	6.7	N 50° W	1.25	4.70
1852	36.0	— 0.7	50.4	18.7	31.7	7	1.770	3	2.0	N 59° W	1.53	6.50
1853	38.7	+ 2.0	54.1	14.4	39.7	15	2.425	6	2.7	N 9° W	0.55	5.52
1854	36.8	+ 0.1	54.9	15.1	39.8	13	1.115	4	1.3	W	3.44	7.54
1855	33.6	+ 1.9	54.1	18.7	35.4	8	4.590	6	3.0	N 66° W	3.18	10.81
1856	37.4	+ 0.7	56.4	22.8	33.6	10	1 375	9	9.5	S 85° W	2.95	8.75
1857	33.5	— 3.2	57.8	— 2.3	60.1	14	3 233	9	6.9	S 61° W	5.45	9.25
1858	34.2	— 2.5	52.0	20.5	31.5	12	3.875	13	4.0	N 25° W	3.14	8.87
1859	38.9	+ 2.2	61 0	24.1	36.9	12	5.193	9	0.6	N 81° W	3.39	9.65
1860	37.9	+ 1.2	62.7	14.0	48.7	12	2.560	8	1.9	S 89° W	4.95	11.02
1861	37.1	+ 0.4	51.5	25.1	26.4	14	4.294	8	3.2	N 46° W	1.94	7.44
1862	35.6	— 1.1	58:0	17.2	40.8	11	2.205	11	5.3	N 46° W	3.00	6.60
1863	39.1	+ 2.4	57.6	19.4	38.2	13	3.650	6	0.1	N 88° W	3.50	7.86
1864	36.9	+ 0.2	56.5	21.9	34.6	11	3.765	8	4.5	S 72° W	3.82	7.64
1865	38.6	+ 1.9	55.8	24.4	31.4	5	0.975	7	1.1	N 79° W	2.98	7.90
Results to 1864.	36.75	...	55.48	16.19	39.29	10.2	3.148	5.2	3.12	N 78° W	2.43	7.47
Excess for 1865.	+ 1.85	...	+ 0.32	+8 21	— 7.89	— 5.2	— 2.173	+ 0.8	— 2.02	.....	..	+ 0.43

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—DECEMBER, 1865.

Latitude—43 deg. 39 min. North. Longitude—5 h. 17 min. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp of the Air.				Excess of mean above Average.	Tens. of Vapour.				Humidity of Air.				Direction of Wind.			Resul'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	10PM	M'E'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-sult'.	M'E'N		
					°	°	°	°	°																			
1	29.041	29.184	29.379	29.2297	33.1	34.5	33.4	33.43	+ 2.67	.168	.148	.170	.160	89	74	89	84	sw b w	w b s	sw b w	S 65 W	11.2	13.6	6.2	10.19	10.68	...	inap.
2	.384	.214	.344	.3192	36.3	40.3	38.5	37.65	+ 7.17	.168	.150	.173	.166	78	59	74	73	s s E	E	Calm.	N 83 E	7.4	6.2	0.0	3.32	4.98	...	...
3	.617	.669	—	—	32.7	38.8	—	—	—	.156	.201	—	—	85	86	—	—	Calm.	N E b E	E N E	N 65 E	0.0	8.4	12.4	6.30	6.66	0.505	...
4	.459	.626	.832	.6658	41.7	46.8	38.1	41.72	+11.03	.264	.225	.187	.222	100	70	81	83	Calm.	W N W	N W b W	N 59 W	0.0	27.0	15.5	11.47	12.23	0.055	...
5	30.031	.034	.045	.0870	26.2	34.2	28.4	29.25	— 0.12	.096	.094	.119	.101	67	47	76	63	N	W	W	S 84 W	8.6	13.0	2.0	3.34	3.81	...	...
6	29.874	.692	.494	.6735	23.3	37.4	32.4	31.58	+ 2.52	.102	.135	.160	.136	82	66	87	76	Calm.	s w b s	Calm.	S 61 W	0.0	5.4	0.0	1 72	2.08	...	...
7	.206	.477	.781	.5382	33.8	50.9	23.0	28.70	+ 0.03	.141	.096	.086	.108	75	55	69	67	NW b N	N W	W b N	N 55 W	0 2	31.2	11.5	14.83	15.66	...	...
8	.367	.926	.961	.9230	24.4	32.0	27.0	27.78	— 0.68	.116	.106	.121	.114	84	58	82	76	W S W	W	Calm.	S 89 W	8.2	13.2	0.0	4.09	4.21	...	0.2
9	.372	.562	.465	.6167	26.2	35.2	34.5	32.05	+ 3.90	.131	.136	.192	.160	92	66	96	88	N b E	S E b E	W S W	S 11 E	2.4	11.0	5.6	4.10	9.12	...	1.0
10	.503	.440	—	—	32 4	35.1	—	—	—	.161	.158	—	—	87	77	—	—	sw b w	s s w	S S W	S 35 W	6.0	3.8	5.8	4.82	5 14	...	...
11	.535	.555	.520	.5393	37.1	42 0	39.2	39 15	+11.50	.200	.204	.199	.199	90	73	83	83	S W	S S W	E	S 82 E	1.2	4.6	7.6	4.77	6.28	0.045	...
12	.428	.301	.578	.4566	42.5	50.4	34.5	41.55	+14.20	.241	.299	.148	.232	89	81	75	85	E	S b W	W S W	S 47 W	12.0	6.6	23.0	8.94	13.27	inap.	...
13	.886	.916	.941	.9218	23.3	27.3	20.5	23.70	— 3.45	.096	.076	.081	.087	76	51	73	69	sw b w	W b S	W b N	S 73 W	11.8	8.5	1.5	7.56	7.81	...	inap.
14	.864	.885	.885	.8803	19.0	13.2	15.1	15.22	—11.7.	.085	.047	.062	.063	82	60	71	71	W S W	W b S	W b S	S 74 W	11.2	19 3	17.6	16.13	16.30	...	inap.
15	.885	.861	.907	.8867	12 5	19.4	7.1	12.82	—13.95	.067	.049	.053	.058	88	45	88	76	W	W b S	Calm.	S 84 W	13.2	14.0	0.0	6.61	6.67	...	...
16	.883	.703	.706	.7893	8.2	20.8	19.4	16.32	—10.25	.046	.077	.093	.074	73	69	90	78	Calm.	S b E	S S E	S 38 E	0.0	10.0	1.5	3.40	3 88	...	0.2
17	.727	.770	—	—	16.5	27.0	—	—	—	.076	.107	—	—	84	75	—	—	E	S E b S	Calm.	S 54 E	3.0	2.8	0.0	0.80	1 20	..	inap.
18	.882	.766	.493	.6942	27.3	33.4	34.2	31.72	+ 5.57	.118	.149	.180	.153	79	78	91	85	Calm.	S E b E	S E b E	S 58 E	0.0	7.6	2.6	3.17	3.67	0.100	0.2
19	.243	.213	.460	.3232	36.3	39.6	31.2	35.03	+ 8.97	.210	.160	.136	.163	98	61	77	78	S E b E	W b S	W	S 89 W	1.5	19.0	23.5	15.57	16.75	...	inap.
20	.724	.674	.109	.4598	21.2	19.5	16.1	19.15	— 6.73	.092	.066	.074	.080	81	63	83	78	W	N E b N	N E	N 27 E	4.5	9.2	19.4	9 98	13.06	...	3.5
21	.227	.561	.729	.5297	10.4	20.1	18.3	15.78	—10.09	.055	.059	.068	.062	78	55	68	69	W N W	W N W	S W b W	S 88 W	16.2	18.6	13.5	12.17	13.42	...	...
22	.685	.720	30.035	.8490	12.0	15.8	5.7	12.35	—13.35	.063	.054	.047	.059	80	59	82	77	S W b W	W b S	Calm.	S 64 W	15.6	4.4	0.0	5.41	5.4	...	...
23	30.125	30.085	29.800	.9369	11.1	16.7	24.4	17.13	— 8.43	.065	.067	.117	.082	92	73	89	83	S W b W	W S W	S E	S 25 W	5.0	4.6	3.8	2.45	3.08	...	...
24	29.413	29.238	—	—	36.3	37 0	—	—	—	.193	.150	—	—	90	67	—	—	S S W	S W	S W b S	S 40 W	5.0	0.5	0.8	2.32	2.33	...	...
25	.240	.398	—	—	21.5	36.0	—	—	—	.177	.180	—	—	89	75	—	—	S W b W	Calm.	W S W	S 47 W	3.2	0.0	0.3	1.38	1.38	...	...
26	.505	.392	.350	.3973	33.8	37.8	36.3	36.45	+11.15	.175	.217	.210	.205	90	95	98	95	Calm.	Calm.	Calm.	N 38 E	0.0	0.0	0.0	0.41	0.66	0.810	...
27	.210	.631	.840	.5900	36.3	37.1	28.4	34.05	+ 8.77	.210	.166	.134	.172	98	75	86	87	...	...	...	...	...	...	...	...	...	0.212	...
28	.802	.642	.742	.7297	30.6	32.0	32.0	31.88	+ 6.75	.144	.166	.166	.157	85	91	91	87	NE b E	N N E	S W b W	N 68 W	2.0	0.5	6.0	3.34	4.66	...	0.1
29	.956	30.062	30.032	30.0347	28.0	24.1	21.2	24.43	— 0.68	.139	.093	.085	.104	90	72	75	78	N W b W	N b E	N E	N 23 W	2.0	6.6	4.0	1.82	7.73	...	inap.
30	.942	29.802	29.887	29.8817	27.0	23.3	23.0	23.75	— 1.42	.129	.110	.098	.109	88	87	79	85	E	N E	N E b E	N 50 E	9.0	11.0	4.5	7.51	7.66	...	...
31	.886	.716	—	—	21.5	36.0	—	—	—	.102	.129	—	—	88	61	—	—	NE b E	s	S W b S	S 18 W	4.0	10.0	11.7	9.01	10.18	...	...
M	29.6642	29.6612	29.6930	29.6761	26.50	30.58	26.48	27.71	+ 0.62	.133	.126	.126	.129	85	67	82	76	.....	.....	.....	.....	5.43	9.69	6.68	...	7.33	1.727	5.2

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR DECEMBER, 1865.

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 . . . . . 30.151 at 8 a.m. on 23rd.
Lowest Barometer . . . . . 28.926 at midnight on 20th. } Monthly range= 1.225 inches.

Self-registering Ther.
- Maximum Temperature . . . . . 54°.2 on 4th.
- Minimum Temperature . . . . . 5°.7 on 23rd. } Monthly range= 48°.5
- Mean Maximum Temperature . . 34°73
- Mean Minimum Temperature . . 23°33 } Mean daily range=11°41
- Greatest daily range . . . . . 30°6 from p.m. of 22nd to p.m. of 23rd.
- Least daily range . . . . . 3°2 from a.m. to p.m. of 20th.

Warmest day . . . . 4th...Mean Temperature . . . 41°72
Coldest day . . . . . 22nd...Mean Temperature . . . 12°35 } Difference=29°.37

Maximum Solar Radiation . . . . . 91°0 on 7th.
Terrestrial . . . . . —6°0 on 16th. } Monthly range= 100°.0

Possible to see Aurora on 13 nights; impossible on 18 nights.
Snowing on 11 days; depth 5.2 inches; duration of fall 39.6 hours.
Raining on 7 days; depth 1.727 inches; duration of fall 33.1 hours.
Mean of cloudiness=0.73; most cloudy hour observed, 4 p.m.; mean=0.82; least cloudy hour observed, 10 p.m.; mean=0.63.

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

North.	South.	East.	West.
1050.71	1397.97	1062.47	3241.48

Resultant Direction, S. 81° W.; Resultant Velocity, 3.07 miles per hour.
Mean Velocity, 7.33 miles per hour.
Maximum Velocity, 34.0 miles, from noon to 1 p.m. on 7th.

Most windy day, 19th—Mean velocity 16.75 miles per hour. } Difference, 16.15 miles
Least windy day, 26th—Mean velocity 0.60 miles per hour.

Most windy hour, 1 p.m.—Mean velocity 10.50 miles per hour. } Difference, 5.04 miles
Least windy hour, 6 a.m.—Mean velocity 5.46 miles per hour.

4th. very dense fog, 11th. Solar halo. 13th. Solar halo and parhelia.
23rd. Lunar halo. 26th. Fog at night. 28th. Lunar corona at 8 p.m.
29th. Lunar corona at 6 p.m. No Aurora observed during the month.
17th. Bay frozen over; broke up with the change of wind on the following day.

December, 1865, was comparatively warm and calm. As regards moisture, although the quantity of rain was above the average, the snow was so much less as to make the month a very dry one.

COMPARATIVE TABLE FOR DECEMBER.

YEAR.	TEMPERATURE. Mean.	Excess above Average.	Maximum observed.	Minimum observed.	Range.	RAIN. No. of days	Inches.	SNOW. No. of days.	Inches.	WIND. Resultant. Direction.	Velocity.	Mean Force or Velocity.
	°		°	°	°							
1840	24.3	— 1.9	41.0	—4.4	45.4	3	Inapp	18	...	...	...	...
1841	28.7	+ 2.5	45.5	2.4	43.1	7	6.600	5	...	...	...	1.33 lls
1842	24.7	— 1.5	40.3	3.8	36 5	3	0.880	17	...	...	...	0.61 "
1843	30.0	+ 3.8	41.1	2.7	38.4	6	1.010	8	8.1	...	...	0.53 "
1844	28.2	+ 2.0	48.9	—0.8	49.7	6	imper	6	4.2	...	...	0.40 "
1845	21.1	— 5.1	37.6	—2.7	40.3	2	Inapp	12	4.7	...	...	0.70 "
1846	27.5	+ 1 3	49.2	3.7	45.5	5	1.215	9	6.0	...	...	0.57 "
1847	30.1	+ 3.9	50.0	6.6	43.4	7	1.185	8	6.8	...	...	0.35 "
1848	29.1	+ 2.9	49.1	0.6	48.5	7	2.750	7	16.5	S 83 W	1.12	5.44 ms
1849	26.5	+ 0.3	41.3	—5.2	46.5	5	0.840	12	9.6	N 82 W	2.56	6.23 "
1850	21.7	— 4.5	48.3	—0.7	58.0	2	0.190	18	29.5	N 44 W	2.93	7.46 "
1851	21.5	— 4.7	43.8	—10.5	54.3	6	1.078	15	10.7	N 82 W	4.00	7.37 "
1852	31.9	+ 5.7	51.0	13.9	37.1	7	3.995	10	20.1	S 69 W	1.03	6.54 "
1853	25.3	— 0.9	42.2	—5.2	47.4	4	0.625	13	22.3	N 35 W	2.39	4.93 "
1854	21.9	— 4.3	41.8	—5.9	47.7	5	0.590	12	17.2	N 44 W	4.30	8.56 "
1855	26.8	+ 0.6	45.0	—2.1	48.0	6	1.845	10	29.5	S 88 W	5.23	11.38 "
1856	22.9	— 3.3	41.2	—9.1	50.3	6	1.760	20	16.3	S 87 W	4.62	11.56 "
1857	31.9	+ 5.7	45.6	5.7	39.9	7	3.205	14	9.0	N 89 W	2.50	6.84 "
1858	27 4	+ 1.2	43.6	5.0	38.6	11	1.657	18	10.4	N 78 W	1.66	9.36 "
1859	17.9	— 8.3	54.8	—3.3	58.1	3	1.035	23	37.4	N 53 W	4.29	10.77 "
1860	24.0	— 2.2	38.5	—7.0	45.5	3	1.362	21	13 5	N 62 W	4.66	10.14 "
1861	31.1	+ 4.9	55.1	5.7	49.4	6	0.560	8	6.8	N 72 W	3.56	7.96 "
1862	28.8	+ 2.6	50.0	—2.3	52.3	5	1.945	8	10.4	N 73 W	3.17	7.58 "
1863	27.0	+ 0.8	51.5	1.0	50.5	10	2.960	17	7.1	N 41 W	1.61	9.40 "
1864	24.7	— 1.5	46.8	—2.3	49.1	9	2.045	18	27.1	S 82 W	4.91	9.98 "
1865	27.7	+ 1.5	50.4	5.7	44.7	7	1.727	11	5.2	S 81 W	3.07	7.33 "
Results to 1864.	26.20	...	45.76	—0.78	46.54	5.6	1.641	13.1	14.69	N 71 W	2.97	8.32
Exc. for 1865.	+1.51	...	+4.64	+6.48	—1.84	+ 1.4	+ 0.086	— 2.1	— 9.49	...	...	—0.99