PROCEEDINGS

OF THE

ROYAL IRISH ACADEMY.

VOL. V.

DUBLIN:
PRINTED BY M. H. GILL,
PRINTER TO THE ACADEMY.
MDCCCLIII.

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VOLUME V.

PROCEEDINGS

OF

THE ROYAL IRISH ACADEMY.

November 11th, 1850.

HUMPHREY LLOYD, D.D., President, in the Chair.

On the recommendation of the Council,

It was Resolved,—That a sum not exceeding £75 be granted for the purpose of defraying the expenses incurred in the erection of the meteorological and tidal instruments.

The President read the following paper on the induction of soft iron, as applied to the determination of the changes of the earth's magnetic force.

"To determine completely the laws of the changes to which the earth's magnetic force is subject, observation must furnish the values of three distinct elements. Of these, the variations in the direction and magnitude of the *horizontal component* are completely determined by the methods given by Gauss and others; but, until lately, no satisfactory means had been devised for the determination of the variations of the remaining element. The principle of the method by which, as I conceive, this desideratum is now supplied, has been already submitted by me to the notice of the Academy;* but as the mode of applying it has since undergone many important

* Proceedings of the Royal Irish Academy, vol. ii. p. 210.

alterations, I deem it right to resume the subject, and to lay the method in its complete and amended form before the Society.

"When a bar of soft iron is held in any direction not perpendicular to that of the earth's magnetic force, it becomes a temporary magnet, by the inducing action of that part of the force which acts in its direction. The *small changes* of the induced magnetism may be assumed to be proportional to those of the inducing force; and, as the former may be measured by their effects, the latter become known.

"To apply this simple principle to the determination of the variations of the *vertical component* of the earth's magnetic force,—two soft iron bars,* of the same size and form, are to be placed vertically, at equal distances on either side of a small freely-suspended horizontal magnet, and so that the plane containing them may pass through the centre of the magnet, and be perpendicular to its axis. Then, if the upper extremity of one of the bars, and the lower extremity of the other, be in (or near) the horizontal plane containing the suspended magnet, it is obvious that they will conspire to deflect it, the predominant pole being in one a north, and in the other a south pole.

"The moment of free magnetism of the suspended magnet being denoted by M, let MU and MU' be the moments of the forces exerted upon it by the two bars. The quantities U and U' are functions of the vertical component of the earth's magnetic force; and depend also upon the quantity and distribution of magnetism in the bars, and upon their position with respect to the suspended magnet. They may likewise each contain a term dependent on the *permanent* magnetism of the bars, which is seldom wholly evanescent. These forces conspire to turn the magnet, and are resisted by the horizontal component of the earth's magnetic force, whose

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* "The employment of a *second* bar originated with Dr. Lamont, of Munich, to whom (as will presently be stated) this method is indebted also for other improvements."

moment is $MX \sin u$,—X denoting the horizontal component, and u the angle of deflection of the magnet from the magnetic meridian. Hence the equation of equilibrium is

$$U + U' = X \sin u.$$

"Now let the two components of the earth's force undergo any small changes, δX and δY, and let $V \delta Y$ and $V' \delta Y$ be the changes of U and U' produced by the latter. Then, δu denoting the corresponding change of the angle u, in parts of radius,

$$(V + V') \delta Y = X \cos u \delta u + \delta X \sin u.$$

Dividing by the equation $Y = X \tan \theta$, in which θ denotes the magnetic inclination, there is

$$(V + V') \tan \theta \frac{\delta Y}{Y} = \cos u \delta u + \sin u \frac{\delta X}{X};$$

or, making, for abridgment, $(V + V') \tan \theta = \frac{1}{p}$,

$$\frac{\delta Y}{Y} = p \left(\cos u \delta u + \sin u \frac{\delta X}{X} \right).$$

The angle u, in this formula, being the deviation of the suspended magnet from the position which it would assume under the action of the earth alone, its changes, δu, are the differences between the observed changes of position, measured from a fixed line, and the corresponding changes of declination.

"In order to correct for the effect of temperature upon the iron bars, we have only to substitute $(\delta u - a \delta t)$ for δu, δt being the actual change of temperature, and a the change of angle (in parts of radius) corresponding to a change of one degree. The effect of an increase of temperature upon a soft iron bar, in all my experiments, has been an *increase* of its induced magnetism,—the reverse of its effect upon the permanent magnetism of an artificial magnet. The amount of the change is, however, very small. With the bar which has been most used in the Dublin Magnetical Observatory, an increase of 1° Fahr. produces a change of angle amounting only to $+ 0'\cdot 05$; so that $a = + \cdot 000015$, and the relative change of the force of the bar $= + \cdot 000029$.

"If we assume that the induced magnetism of the iron bars is proportional to the inducing force, the coefficient p may be found by *inverting* the bars, and observing the angles of deflection in the direct and inverted positions. For, these angles being denoted by u and u', it may be readily shown that

$$p = \frac{2}{\sin u + \sin u'} .$$

It was by this method that I originally proposed to determine the constant of the preceding formula. The assumption upon which it rests is the same as that which Poisson has taken as the basis of his theory of induced magnetism. It is, however, as Dr. Lamont has shown, not strictly in accordance with fact; and it is therefore necessary to seek another mode of determining the constant. It is obvious that this quantity will be known, if we can alter the inducing force artificially, by a small but known amount, and observe the change of angle thereby produced. This is the principle of the method devised by Dr. Lamont for the purpose; it is practised in the following manner.

"A magnet is placed at a considerable distance above or below the suspended magnet, their centres being in the same vertical line; and it is so arranged as to be capable of rotation round a horizontal axis parallel to the suspended magnet in its deflected position. Let this magnet be first placed *vertically*, in which position it exerts no *direct* action upon the suspended magnet, but only on the iron bars. Then, if R and R' denote the forces exerted by the auxiliary magnet upon the two bars, $\delta U = VR$, $\delta U' = V'R'$; so that if kn denote the corresponding change of angle, expressed in scale-divisions of the instrument, we have

$$VR + V'R' = X \cos u \, kn.$$

Let the deflecting magnet be now turned (the position of its centre remaining unchanged), so that its axis is *horizontal*, and perpendicular to that of the suspended magnet. In this position it exerts no action upon the iron bars; but tends to turn the suspended magnet with a force whose moment we shall denote by S. The equation of equilibrium in this case is therefore

$$U + U' + S = X \sin (u + kn'),$$

kn' being the change of position of the suspended magnet due to the small added force. Hence

$$S = X \cos u \, kn';$$

and, dividing the equation last found by this,

$$V \frac{R}{S} + V' \frac{R'}{S} = \frac{n}{n'}.$$

"Now, the deflecting magnet being vertical, and its distance considerable as compared with its length, the force which it exerts upon the unit of free magnetism at the centre of one of the iron bars, in the direction of the joining line, and in the perpendicular direction, respectively, are

$$\frac{2M}{e^3} \cos \phi, \quad - \frac{M}{e^3} \sin \phi,$$

in which M denotes the magnetic moment of the deflecting magnet, e the length of the line connecting its centre with the centre of the iron bar, and ϕ the angle which that line makes with the vertical.* And the sum of these forces, resolved in the vertical direction, is

$$\frac{M}{e^3} (2 \cos^2 \phi - \sin^2 \phi).$$

But we may consider the quantities e and ϕ (and therefore the force exerted by the magnet) to be the same for all points of the bar, the variations of these quantities being of the same order as those neglected in the approximation; so that

* Transactions of the Royal Irish Academy, vol. xix. p. 162.

$$R = \frac{M}{e^3}(2 - 3\sin^2\phi), \quad R' = \frac{M}{e'^3}(2 - 3\sin^2\phi');$$

e' and ϕ' denoting the corresponding quantities for the second bar. Also, if a denote the distance between the centres of the deflecting and suspended magnets, we have

$$S = \frac{M}{a^3}.$$

Substituting these values, and observing that $\sin^2\phi = \sin^2\phi'$, very nearly,

$$(2 - 3\sin^2\phi)\left(V\frac{a^3}{e^3} + V'\frac{a^3}{e'^3}\right) = \frac{n}{n'}.$$

"Now, if b denote the horizontal distance of the axis of each bar from the centre of the suspended magnet, and h the distance of their centres above and below the plane in which the latter moves, we have

$$e^2 = (a+h)^2 + b^2, \quad e'^2 = (a-h)^2 + b^2;$$

accordingly, if we expand $a^3 e^{-3}$, $a^3 e'^{-3}$, according to the ascending powers of $\frac{h}{a}$, $\frac{b}{a}$, (stopping at the second), we find

$$V\frac{a^3}{e^3} + V'\frac{a^3}{e'^3} = (V+V')\left(1 + 6\frac{h^2}{a^2} - \frac{3}{2}\frac{b^2}{a^2}\right) + 3(V'-V)\frac{h}{a};$$

in which, since V and V' are nearly equal, the term $3(V'-V)\frac{h}{a}$ may be neglected. Also $\sin^2\phi = \frac{b^2}{e^2} = \frac{b^2}{a^2}$, $q.p.$ And, substituting these values in the formula obtained above, it becomes

$$2(V+V')\left(1 + 6\frac{h^2}{a^2} - 3\frac{b^2}{a^2}\right) = \frac{n}{n'}.$$

But $p = (V+V')^{-1}\cot\theta$; wherefore, finally,

$$p = 2\cot\theta\left\{1 + 3\left(\frac{2h^2 - b^2}{a^2}\right)\right\}\frac{n'}{n}.$$

"In my original instrument there was but *one* iron bar; and it was placed in the vertical plane passing through the centre of the suspended magnet, and *perpendicular to the magnetic* *meridian.* This position, I soon perceived, was less advantageous than that described above; and it was accordingly abandoned in all the instruments subsequently constructed for other observatories. In the Dublin Observatory, however, I preferred the continuance of the less perfect arrangement to the interruption of the series of observations consequent upon its alteration; and I have been thus compelled to re-discuss the theory of the instrument, which is rendered much more complicated in this form.

"It was natural to suppose that the moment of the force exerted by the iron bar upon the suspended magnet was of the form $MU \cos u$, U and u denoting as before; so that the equation of equilibrium should be, simply,

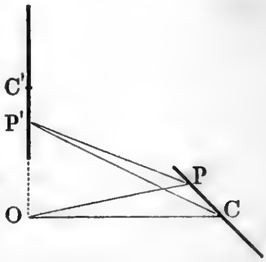
$$U = X \tan u.$$

Differentiating, and dividing by $Y = X \tan \theta$, and denoting (as before) the change of U produced by a small change of the vertical component of the earth's force by $V\delta Y$, we have

$$\frac{\delta Y}{Y} = p\left(\sec^2 u\,\delta u + \tan u\,\frac{\delta X}{X}\right),$$

in which $p = V^{-1} \cot\!\mathrm{an}\,\theta$.

"This formula, however, is only an approximate one. The expression for the moment of the force exerted by the iron bar upon the suspended magnet, in this case, is not, strictly, of the form supposed above; and it becomes necessary to seek the exact form, and to examine in what manner the formula of reduction is modified.



"Let CP be the freely suspended horizontal magnet; C'P' the vertical iron bar; and O the point in which it intersects the horizontal plane passing through CP. Also, let dm and dm' denote the elements of free magnetism at P and P', and ρ the distance PP'. Then the force exerted by dm' on dm is

$$\frac{dm\,dm'}{\rho^2};$$

and the portion of this resolved in the horizontal plane, is

$$\frac{dm\,dm'}{\rho^3} \times \text{OP}.$$

The moment of this force to turn the suspended magnet is

$$\text{CP} \times \frac{dm\,dm'}{\rho^3} \times \text{OP} \sin \text{OPC} = \text{CP} \times \frac{dm\,dm'}{\rho^3} \times \text{OC} \sin \text{OCP}.$$

Hence, putting OC $= a$, CP $= r$, and OCP $= 90° - u$, the whole moment of the force of the iron bar is

$$a \cos u \iint \frac{r\,dm\,dm'}{\rho^3}.$$

Now, $\overline{\text{PP}'^2} = \overline{\text{P}'\text{O}^2} + \overline{\text{OP}^2}$. Or, putting OC$' = h$, CC$' = e$, C$'P' = r'$,

$$\rho^2 = (h - r')^2 + a^2 + r^2 - 2ar \sin u = e^2 + r^2 + r'^2 - 2\,(hr' + ar \sin u).$$

Accordingly, expanding $\frac{1}{\rho^3}$ according to the ascending powers of $\frac{r}{e}$, $\frac{r'}{e}$, integrating and making

$$\int r^n\,dm = M_n, \qquad \int r'^n\,dm' = M'_n,$$

and observing that, on account of the symmetrical distribution of free magnetism in the magnet and bar, M_n and M'_n vanish when n is an even number,—we have, for the moment of the force of the iron bar,

$$\frac{3ah}{e^5} MM' \cos u \left\{ 1 - \tfrac{5}{2} \frac{1}{e^2} \left[\frac{M'_3}{M'} \left(1 - \tfrac{7}{3} \frac{h^2}{e^2}\right) + \frac{M_3}{M} \left(1 - 7 \frac{a^2}{e^2} \sin^2 u\right) \right] \right.$$

$$+ \tfrac{5 \cdot 7}{2 \cdot 4} \frac{1}{e_4} \left[\frac{M'_5}{M'} \left(1 - 6 \frac{h^2}{e^2}\right) + 2 \frac{M'_3}{M'} \frac{M_3}{M} \left(1 - 9 \frac{a^2}{e^2} \sin^2 u - 3 \frac{h^2}{e^2}\right) \right.$$

$$\left. \left. + \frac{M_5}{M} \left(1 - 18 \frac{a^2}{e^2} \sin^2 u\right) \right] \text{\&c.} \right\}.$$

"This formula is unfortunately not convergent, and is, consequently, of no use in the present investigation. In fact, $\frac{M'_3}{M'}$ is of the same order of magnitude as e^2, $\frac{M'_5}{M'}$ as e^4, and so on. We are, therefore, unable to obtain the value of this moment, expressed as an explicit function of a and h, and must have recourse to a different development.

"Let the distance of any point of the iron bar from the centre of the suspended magnet, CP′, be denoted by R,

$$R^2 = a^2 + (h - r')^2, \text{ and } \rho^2 = R^2 + r^2 - 2ar \sin u.$$

Expanding $\frac{1}{\rho^3}$ according to the inverse powers of R, and integrating, observing that $M_n = 0$, when n is even,

$$\iint \frac{r\,dm\,dm'}{\rho^3} = M \int \frac{dm'}{R^3} - \tfrac{3}{2} M_3 \int \frac{dm'}{R^5} + \tfrac{3 \cdot 5}{2 \cdot 4} (M_5 + 4a^2 \sin^2 u\, M_3) \int \frac{dm}{R^7}$$

$$- \tfrac{3 \cdot 5 \cdot 7}{2 \cdot 4 \cdot 6} (M_7 + 12a^2 \sin^2 u\, M_5) \int \frac{dm'}{R^9} + \&c.;$$

or, if we make

$$M \int \frac{dm'}{R^3} - \tfrac{3}{2} M_3 \int \frac{dm'}{R^5} + \tfrac{3 \cdot 5}{2 \cdot 4} M_5 \int \frac{dm'}{R^7} - \&c. = A,$$

$$\tfrac{15}{2} \left(M_3 \int \frac{dm'}{R^7} - \tfrac{7}{2} M_5 \int \frac{dm'}{R^9} + \&c. \right) = B,$$

$$\iint \frac{r\,dm\,dm'}{\rho^3} = A + Ba^2 \sin^2 u;$$

in which, on account of the smallness of the distance of the iron bar, the term containing $\sin^2 u$ may bear a very sensible proportion to the whole. Accordingly, if we put, for abridgment,

$$Aa = MU, \qquad Ba^3 = MUQ,$$

the moment of the force exerted by the iron bar is

$$MU \cos u\, (1 + Q \sin^2 u);$$

and the equation of equilibrium therefore is

$$U (1 + Q \sin^2 u) = X \tan u.$$

"Let $V \delta Y$ denote, as before, the change of U produced by a small change of the earth's vertical force. Then, if we write the equation of equilibrium under the abbreviated form $U = Xfu$, and differentiate, and divide by $Y = X \tan\theta$,

$$V \tan\theta \frac{\delta Y}{Y} = f'u\,\delta u + fu \frac{\delta X}{X}.$$

But $fu = \frac{\tan u}{1 + Q\sin^2 u}$; and $f'u = \frac{1 - Q\sin^2 u}{\cos^2 u\,(1 + Q\sin^2 u)^2}$, neglecting the term $2Q\sin^4 u$ in the numerator, as inconsiderable; wherefore putting, for abridgment,

$$p = \frac{\cot\theta}{V(1 + Q\sin^2 u)}, \quad S = \frac{1}{\cos^2 u} \cdot \frac{1 - Q\sin^2 u}{1 + Q\sin^2 u},$$

there is finally,

$$\frac{\delta Y}{Y} = p\left(S\,\delta u + \tan u \frac{\delta X}{X}\right).$$

"The coefficient p, in this formula, is obtained by the method already explained. It has been shown that when a magnet is placed vertically, above or below the suspended magnet, its inducing action on the iron bar $= \frac{M}{e^3}(2 - 3\sin^2\phi)$, e and ϕ denoting as before; and, as this force has the same effect as a small change of the earth's vertical force, the effect upon the suspended magnet is obtained by making $\delta Y = \frac{M}{e^3}(2 - 3\sin^2\phi)$, $\delta X = 0$, in the preceding equation. Wherefore, kn denoting the corresponding change of angle,

$$\frac{M}{e^3}(2 - 3\sin^2\phi) = pYS\,kn.$$

Again, when the deflecting magnet is horizontal, and perpendicular to the magnetic meridian, its effect is the same as that produced by a small change of the earth's horizontal force, whose magnitude is given by the equation

$$\delta X \sin u + \frac{M}{a^3}\cos u = 0.$$

Putting, therefore, for δX the value thus given, and making $\delta Y = 0$,

$$\frac{M}{a^3} = XS\,kn';$$

kn' denoting the corresponding value of δu. And eliminating M between this and the former equation, we find

$$p = \text{cotan}\,\theta\,(2 - 3\sin^2\phi)\,\frac{a^3}{e^3}\cdot\frac{n'}{n}.$$

"We must likewise have recourse to experiment, to determine the value of the coefficient S.* In fact we have seen that the quantity, Q, which enters into the expression of this coefficient, is the ratio of two series containing the integrals $\int r^3 dm$, $\int r^5 dm$, $\int r^7 dm$, &c., $\int \frac{dm'}{R^3}$, $\int \frac{dm'}{R^5}$, $\int \frac{dm'}{R^7}$, &c., the values of which, depending upon the distribution of free magnetism in the magnet and iron bar, cannot be known *a priori*.† We may, however, determine the value of the coefficient S by experimental means analogous to those already employed in the determination of p. We have seen, in fact, that when the deflecting magnet in that experiment was horizontal, and perpendicular to the magnetic meridian, there was

$$\frac{M}{a^3} = XS\,kn'.$$

Now, let the iron bar be removed, and, the deflecting magnet remaining in the same position, let kn'' denote the change of angle produced by its action. Then

$$\frac{M}{a^3} = Xkn'';$$

and, dividing the equation last found by this,

$$S = \frac{n''}{n'}."$$

The President exhibited to the Academy a map of Ire-

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* "It is obvious that this necessity does not arise in the adjustment of the soft iron bars described in the commencement of this Paper."

† "We may approximate to these values, and therefore to the value of Q, on the assumption that the whole forces of the magnet and bar are concentred in two points, or poles."

land, on which the stations for meteorological and tidal observations were marked, so as to show their geographical distribution. And he availed himself of the opportunity to give a brief account (derived from these observations) of a cyclonic gale, accompanied with a sudden fall of the barometer and a corresponding rise of the tide, which was felt over the whole of Ireland on the 6th of last month.

The Rev. Samuel Haughton stated, in confirmation of the President's remarks, that the returns from the tidal stations showed an elevation of water varying from ten to eighteen inches above the mean height, corresponding to the period of greatest depression of the barometer. This depression would, however, only account for part of the elevation of water, the rest must be attributed to the force of the wind.

Mr. W. Hogan read an analysis of the meteorological observations communicated by Mr. G. Yeates, and published in the Proceedings.

"The violent and fatal epidemics, affecting both animal and vegetable life, which prevailed during the preceding seven years, may have been, and probably were, in some manner connected with the state of the atmosphere; and it has occurred to me that an examination of the state of the weather during that period might be interesting and possibly instructive.

"The quantity of rain which falls at any period, in this climate, is, in general, indicative of the state in which both the barometer and thermometer stood at the time. Bright skies and serene weather are in general accompanied by a higher mark both of the barometer and thermometer, and on the contrary the mark is lower in cloudy, damp weather. It has, therefore, occurred to me that a table showing the quantity of rain which fell in each month during those seven years would, for this climate, give a general view of the state of the atmosphere at the time. The Royal Irish Academy has published

Mr. Yeates' reports of his rain-gauge for the last seven years, from 1843 to 1849 inclusive, and I have constructed my table from them.

"I began by arranging in so many parallel columns the monthly quantity of rain which fell in the seven years commencing in January, 1843, and ending in December, 1849, and having then ascertained the mean quantity for each month during those years, I assumed that it was the average quantity of rain in that month. On comparing this mean quantity with the actual fall of rain, I was surprised at finding the great irregularity which it indicated. It appeared that there was not any one month which was either wet or dry, or of average weather, during the whole of that period. The most settled weather was in August and December, and in those months the weather was either very wet or very dry; each was for four years very wet, and for three years very dry.

"I am aware that a period of seven years is too short to afford a satisfactory average, but Mr. Yeates' tables did not go farther back, and those years were marked by the epidemics I have alluded to. We had cholera, influenza, murrain, and the potato disease; on that account they deserved a separate consideration, even if the rain tables had gone further back.

"In classifying the varieties of weather, as indicated by the quantity of rain which fell, I took the mean, or any quantity within a quarter of an inch, more or less, of rain in that month, as average weather. For example, I found that about two inches of rain was the mean quantity for the month of June; I marked it as average weather in June, if the fall of rain was less than two inches and a quarter, and more than one inch and three-quarters. If more than two inches and a quarter, I marked it as decidedly wet; and if less than an inch and three-quarters, as decidedly dry. June was four times very dry and three times very wet. Adopting this scale, I found that during those seven years, the weather had a remarkable tendency to extremes; that there were but eighteen months of average weather; that thirty-two months were decidedly wet, and thirty-four decidedly dry; and also that there was no apparent order in the variations of the weather. For instance, the average fall of rain in May, was an inch and three-quarters; in May, 1843, more than four inches and a half of rain fell; in May, 1844, not much more than a quarter of an inch; and in May, 1845, very nearly the average quantity. This great and striking difference of weather in the same month, in successive years, must have had a great effect on vegetation, as well as on the state of the atmosphere.

"An inspection of the table thus prepared for seven years will prove that there were great irregularities in the state of the weather during the whole of that period. There was not a month of average weather in 1846, there was but one in 1845, and but two in 1844 and 1848.

"The year 1847 was decidedly a dry one, as there only fell twenty-one and a half inches of rain, of which nearly three inches, almost a seventh of the whole, fell in December.

"In 1846 thirty inches and a half of rain fell, and in 1848 upwards of thirty-one inches. See Table No. 1.

"The irregularity of the weather will be more striking, if we omit from the table all figures except those indicating the greatest and least monthly fall of rain in each year. See Table No. 2.

"In 1843, most rain fell in May, and least in December.

"In 1844, most rain fell in November, and least in May.

"In 1845, most rain fell in Jan., and least in September.

"In 1846, most rain fell in April, and least in December.

"In 1847, most rain fell in December, and least in July.

"In 1848, most rain fell in August, and least in May.

"In 1849, most rain fell in October, and least in June.

"Another remarkable irregularity in the weather, as indicated by the monthly fall of rain, is, that those months in which the greatest and least fall of rain took place were not, with one exception, those whose mean quantity of rain was greatest or least. February and March have the lowest mean, and yet neither was ever the dryest month in the year. August and October have the highest mean, and yet each was only once the wettest month in the year. See Table No. 3.

"It would be very interesting to extend these inquiries over the whole country. The Academy has the rain tables kept in Athlone by order of the Board of Works, and I hope to classify them in a similar manner as soon as they are published.

"If it should appear that the climate of Ireland is liable to such great vicissitudes, it might be of importance to call the attention of agriculturalists to the fact, lest, by the occurrence of one or two favourable seasons, they might be induced to cultivate crops which are dependent on dry warm weather at any period of their progress to maturity. The following remark occurs in Captain Larcom's Report to His Excellency the Lord Lieutenant, which is prefixed to his Returns of the Agricultural Produce of Ireland in the year 1849, p. vi.:—'The success of any crop must necessarily depend in a great degree on the natural fitness of the soil and on the character of the climate; and in a country like this, the wheat crop must, from the latter cause, be always a hazardous one.'

"Captain Larcom states, in the same Report, that the average acreable produce of wheat in Ireland, in the year 1847, was $6\frac{6}{10}$ barrels; in 1848, was $4\frac{5}{10}$; and in 1849, was $5\frac{3}{10}$ barrels. It is remarkable that the fall of rain in those years in Dublin varied very nearly inversely in the same proportion; in 1847, the fall of rain was twenty-one and a half inches; in 1848, it was thirty-one inches; and in 1849, it was twenty-seven three-quarter inches. Oats and barley seem to have been but little affected."

Table I.

Showing the monthly Quantity of Rain which fell in Dublin, in seven Years (1843 to 1849, inclusive), as recorded by Mr. Yeates, *and published in the Proceedings of the Royal Irish Academy.*

Month.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	Monthly Mean.
January, . . .	2·589	1·031	3·495	2·843	2·598	2·005	3·248	2·544
February, . .	1·635	2·303	·762	·967	1·577	2·744	·750	1·534
March, . . .	1·643	2·042	1·412	2·660	·982	2·389	1·052	1·739
April, ...	2·645	·545	·909	5·082	2·862	2·992	2·491	2·503
May, ...	4·644	·316	1·680	1·652	1·876	·711	1.923	1·814
June, ...	2·277	1·539	3·131	1·474	1·345	3·660	·560	2·005
July, ...	1·773	2·148	3·170	2·883	·800	2·169	2·237	2·168
August, . . .	1·541	3·475	2·523	4·105	1·240	4·443	3·234	2·936
September, . .	·637	1·845	·705	2·624	1·267	2·520	3·432	1·861
October, . . .	3·302	2·530	2·677	3·937	1·762	3·305	3·707	3·060
November, . .	2·425	2·742	2·810	1·648	2·315	1·477	1·689	2·300
December, . .	·138	2·192	1·539	·713	2·968	2·667	3·309	1·938
Rain in the year, . .	25·249	23·711	26·628	30·488	21·652	31·085	29·732	26·407
Mean Temperature, . .	50·6	50·1	48·3	52·1	50	49·5	49	

In this table the average quantities are printed in large figures; and those above an average have the usual figures underlined.

Average weather in seven years, . 18 months.
More rain than the average, do. . . 32 ,,
Less than average, do. . . 34 ,,

Actual average of all the months, in seven years, 2·200.

Table II

Showing the Month in each Year, from January, 1843, to December, 1849, in which the greatest and least Quantity of Rain fell in Dublin.

Month.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	Monthly Mean.
January, . . .			W. 3·495					2·544
February, . .								1·534
March, . . .								1·739
April, ...				W. 5·082				2·503
May, ...	W. 4·644	D. ·316				D. ·711		1·814
June, ...							D. ·560	2·005
July, ...					D. ·800			2·168
August, . . .						W. 4·443		2·936
September, . .			D. ·705					1·860
October, . . .							W. 3·907	3·060
November, . .		W. 3·742						2·300
December, . .	D. ·138			D. ·713	W. 2·968			1·938
Mean Temperature, . .	50·6	50·1	48·3	52·1	50	49·5	49	

The letter W. has been placed over the number indicating the greatest monthly fall of rain in the year, and the letter D. over the number indicating the least monthly fall of rain in the year; W. indicating the wettest, and D. the dryest month in the year.

Table III.

Showing the Month in each Year, from January, 1843, *to December,* 1849, *in which the greatest and least Quantity of Rain fell in Dublin; the Month whose mean Quantity of Rain is greatest being placed first, and the others in rank of their mean Quantity of Rain.*

Month.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	Monthly Mean.
October, . . .							3·907	3·060
August, . . .						4·143		2·936
January, . . .			3·495					2·544
April, ...				5·082				2·503
November, . .		3·742						2·390
July, ...					·800			2·116
June, ...							·560	2·005
December, . .	·138			·713	2·968			1·938
September, . .			·705					1·860
May, ...	4·644	·316				·711		1·814
March, . . .								1·739
February, . .								1·534

The numbers indicating the greatest monthly fall of rain in each year are underlined.

The monthly mean varies from three inches to an inch and a half.

Professor Allman read a paper on the reproductive system and development of the gemmæ in *Paludicella articulata*.

" All the fresh-water polyzoa produce true ova, which are formed in a definite organ or ovary. From the existence of a true ovary and ova we are at once led to expect the co-existence of a male organ. That a testis is present in all the species of fresh-water polyzoa there can, I think, now be little doubt. In most of the genera I have met with an organ which I have little hesitation in viewing as a testis, though, with the exception of *Paludicella*, the demonstration of such an organ is somewhat obscure. In this genus, however, I have had the most satisfactory demonstration of both testicle and ovary, the one loaded with spermatozoa, the other with ova.

"The ovary and testis in *Paludicella articulata* are both found in the same cell. The former is an irregularly shaped body adherent to the inner surface of the internal tunic, towards the upper part of the cell. About the end of June, when I discovered this organ, it was loaded with ova of various sizes, some so small as to require for their detection a high power of the microscope, while others were almost visible to the naked eye, and seemed ready to burst the restraining membrane of the ovary, and escape into the cavity of the cell. Attached by one extremity to the external surface of the stomach, near the commencement of the intestine, and by the other apparently in connexion with the ovary, is a cylindrical flexible cord which obeys all the motions of the stomach. Of the nature of this appendage, which thus brings the ovary into connexion with the stomach, I have been unable to arrive at any satisfactory conclusion; it can scarcely be an oviduct communicating with the cavity of the stomach, and thus affording through the latter organ a way of egress to the ova; for even though it be tubular, a condition not by any means apparent, it is evidently too narrow to receive the mature ova, even supposing it to undergo as much dilatation as would seem possible with such an organ.

"The *testicle* is an irregularly lobed mass, attached, like the ovary, to the inner surface of the lining membrane of the cell; it occupies a position near the bottom of the cell, and is thus separated by a wide interval from the ovary. Like the latter organ, it is connected with the stomach by a cylindrical cord precisely similar to that already described as belonging to the ovary. This cord, which is connected with the testicle by one extremity, is attached by the other to the fundus of the stomach, and its office is just as obscure as that of the corresponding cord connected with the ovary. The testicle was observed at the same time as the ovary, and was then loaded with spermatozoa, which projected from its surface in the form of a dense villosity, each minute filament of which exhibited a perpetually undulating motion. Many of the spermatozoa had escaped from the testicle and were carried about by the currents of the perigastric fluid, and thus brought in contact with the ovary, round which several were observed clustering. The spermatozoa in *Paludicella* are simple vibrioid bodies without any terminal enlargement, and exhibit a constant sinuous or undulatory motion.

"The ova, on arriving at a certain stage of development, and while still in the ovary, present distinctly the germinal vesicle and germinal speck; these, however, soon disappear. When the ovum escapes from the ovary it is a lenticular body, surrounded by an annulus, in which a somewhat obscurely cellular structure is apparent. A coloured and very eccentric spot may be observed at this stage in the contents of the ovum. I have not been fortunate enough to observe the ova of *Paludicella* more than once, and have thus had no opportunities of making further observations on these bodies.

"I have never witnessed in *Paludicella* the occurrence of free locomotive embryos, such as may be seen in other polyzoa, though it is by no means improbable that further research may detect them; I have, however, succeeded in following the development of the gemmæ from a very early stage to its completion. The gemma, in the earliest condition in which I have been able to observe it, appears as a minute tubercle projecting from the external walls of the cell, and filled with a granular parenchyma. We next find it hollowed out into a cavity which communicates with the interior of the parent cell. The tubercle, with its cavity, increases in size, and the gemma is now found to consist of an external envelope continuous with the external tunic of the parent cell, and of a thick fleshy lining continuous with the internal tunic. This lining has numerous, large, round, nucleated cells distributed through its substance, and internally it presents a rough, uneven surface. The two tunics of the gemma are to become the external and internal tunics of the future cell.

"By this time the gemma has become considerably elongated, and has acquired a clavate form, and its cavity begins to be cut off from that of the parent cell, by the formation of a septum. We next perceive that a rounded mass has formed in the substance of the lining tunic, near the wide extremity of the gemma, and projects into the interior of the latter. In this mass we soon perceive a cavity surrounded by a slightly waved oval ring, which is afterwards to become the tentacular crown of the adult. The ring is at first quite simple, resembling a mere fold of thickish membrane, but in a short time it presents all round a series of minute tubercles, the rudiments of the future tentacula. Delicate fibres may now be distinctly seen passing from the little mass, in which these appearances have been presenting themselves, to the walls of the cavity of the gemma; these fibres are the rudimental retractors of the alimentary canal. Circular fibres may also be now seen in the lining membrane of the gemma; these are chiefly collected near its proximal end, and are to become the parietal muscles of the adult. The tentacular sheath also may now be perceived extending from the base of the rudimental tentacula to the walls of the cavity in which the young polypide is suspended, and fibres which are to become the superior parieto-vaginal muscles may be observed in connexion with it. The rudimental polypide has now become somewhat enlarged below the tentacular ring, and here presents in its interior a cavity. This cavity is at first simple and continuous, but as the inferior extremity of the polypide continues to elongate, we soon find it divided into three distinct regions, which are the first indications of œsophagus, stomach, and intestine. By the elongation of the tentacula, the tentacular crown has now acquired nearly its full development. Up to this period the young polypide has been entirely shut off from all communication with the external water, and its nutrition must have been effected through the general nutrition of the colony; now, however, an opening occurs in the gemma, just over the tentacular crown, and the last stage of development is entered on. The tentacular crown rapidly acquires its complete form, the inferior extremity of the alimentary canal becomes elongated into the great *cul de sac* of the stomach, the muscles are by this time all formed, and the polypide is capable of exsertion and retraction. It is now no longer dependent for its growth on the general nutrition of the colony, but has become an independent being, obtaining its food from without, and submitting it to the action of its own digestive system."

The following Resolution of Council was read:

"That the Report of the Committee of Antiquities, which was presented to the Council on the 1st of July, be read at the next meeting of the Academy, together with the Resolution of October 7th, referring thereto, viz.:

"That the Report of the Committee of Antiquities, received on July 7, be adopted."

It was, however, resolved that the Academy do adjourn.

NOVEMBER 30, 1850.—(STATED MEETING.)

HUMPHREY LLOYD, D. D., PRESIDENT,
in the Chair.

ON the recommendation of Council,

IT WAS RESOLVED,—"That the rule of the Academy limiting the number of Honorary Members to sixty, be not considered as applying to the President and Ex-Presidents of the Royal Society."

The following Gentlemen were elected Honorary Members of the Academy:—*In Science*—Alexander D. Bache, Washington. *In Polite Literature*—Washington Irving, New York; Augustus Boeck, Berlin; Victor Cousin, Paris. *In Antiquities*—L. C. F. Petit-Radel, Paris; and C. T. Grotefend, Hanover.

The President read the following paper on the position of the Isogonal Lines in Ireland, as deduced from the observations of Sir James Ross, in 1838.

"In the year 1835 I laid before the British Association, then assembled in Dublin, a Report on the Direction and Intensity of the Terrestrial Magnetic Force in Ireland, based upon observations made by Lieut.-Colonel Sabine, Sir James C. Ross, and myself.* In these observations Mr. Robert Were Fox and Professor Phillips afterwards took part; and the survey was subsequently extended to the whole of the British Islands. The details of this extended survey are given in a Memoir on the Magnetic Isoclinal and Isodynamic lines in the British Islands, drawn up chiefly by Lieut.-Colonel Sabine. †

"The observations contained in these Reports are limited to the Magnetic Inclination and Intensity. Observations of the Declination, as well as of the other two elements, were

* Fifth Report of the British Association for the Advancement of Science.

† Eighth Report.

indeed made by Sir James Ross; but they have only lately been given to the public in a Memoir by Lieut.-Colonel Sabine, on the lines of Magnetic Declination in the Atlantic.* In this Memoir, the observations referred to are combined with a large mass of other materials, and the position of the isogonal lines inferred from the whole by a graphical process. The Irish portion of these observations is, however, so distinct, and so complete in itself, that it seemed to me desirable that they should be discussed by the same method which had already been applied to the observations of the other two elements, in the Reports above referred to; such a discussion serving to complete the Magnetic Survey, so far as Ireland is concerned, and to furnish a formula for the Magnetic Declination at any point in the island whose position is known.

"The following is the mode of doing this:

"If δ denote the magnetic declination at any place; δ_0 that at some near station which is taken as the origin of co-ordinates; and x and y the actual distances (in geographical miles) between them, measured on the parallel of latitude and on the meridian, respectively,—or the co-ordinates of position of the former station referred to the latter as an origin; the relation of these quantities is expressed approximately by the equation

$$\delta - \delta_0 = Mx + Ny,$$

in which M and N represent the increase of declination corresponding to each geographical mile of distance in the two directions. If λ and μ denote the latitude and longitude of the former station, λ_0 and μ_0 those of the latter,

$$y = \lambda - \lambda_0, \qquad x = (\mu - \mu_0) \cos \lambda.$$

"It is evident, that if x and y be treated as variable, δ being constant, the preceding equation is that of the *locus* of all the points of given declination. It is that of a right line, making the angle with the meridian,

* Philosophical Transactions, 1849, Part ii.

$$\text{ang.}\left(\text{tang} = -\frac{N}{M}\right);$$

and the increase of declination corresponding to each geographical mile of distance, in a direction perpendicular to this line, is

$$\sqrt{(M^2 + N^2)}.$$

"It is evident then that, to obtain the values of M and N, observation must give the values of the declination at *three*, or more, stations. The observations of Sir James Ross were taken at twelve stations, well distributed throughout the island; and as they were all made during the months of October and November, 1838, no correction is required to reduce them to a common epoch. For convenience of reference, they are here extracted from Colonel Sabine's Memoir, together with the longitudes and latitudes of the places of observation.

STATION.	λ	μ	δ
Valentia, . . .	51° 56′	10° 17′	28° 42′
Killarney, . .	52 2	9 30	28 11
Westport, . .	53 48	9 29	29 9
Limerick, . . .	52 40	8 36	28 3
Cork, ...	51 54	8 28	27 44
Markree, . . .	54 14	8 28	29 15
Shannon Harbour,	53 14	7 53	28 3
Edgeworthstown,	53 42	7 33	28 8
Londonderry, .	54 59	7 19	28 47
Waterford, . .	52 15	7 8	26 44
Armagh, . . .	54 21	6 39	28 8
Dublin, . . .	53 21	6 15	27 35

"Taking Dublin as the origin of co-ordinates, and substituting the values of $\lambda - \lambda_0$, $\mu - \mu_0$, and $\delta - \delta_0$, given by this Table, in the equation above given, we obtain eleven equations of condition, from which the values of M and N are obtained by the method of least squares. They are the following:

$$M = 0'{\cdot}690, \quad N = 0'{\cdot}585.$$

We may now test the accuracy of these numbers, by employing the formula to *calculate* the values of the declination at each of the eleven stations. The result of this calculation gives, at Waterford, a difference between the observed and calculated values amounting to 34′,—which far exceeds the probable error of observation. This difference is, therefore, probably due to some local irregularity of the magnetic force. But, whatever be its cause, it is obvious that it tends to vitiate the general result; and that a nearer approximation to the values of M and N will be obtained by excluding that observation from the computation. We thus obtain, from the remaining ten equations,

$$M = 0'\cdot 689 ; \quad N = 0'\cdot 527.$$

And substituting these values, we find

$$\text{ang.}\left(\text{tang} = -\frac{N}{M}\right) = -37^\circ 25'; \quad \sqrt{(M^2 + N^2)} = 0'\cdot 867.$$

Accordingly, the isogonal lines in Ireland lie to the *east* of north, making an angle of 37° 25′ with the meridian of Dublin; and the declination increases as we proceed in the north-westerly direction, the increase being 52″ for each geographical mile, in a direction perpendicular to these lines.*

" Finally, the declination at any point of the island, whose longitude and latitude are known, is given by the formula

$$\delta - \delta_0 = 0'\cdot 527\,(\lambda - \lambda_0) + 0'\cdot 689\,(\mu - \mu_0)\cos\lambda ;$$

the declination at Dublin, δ_0, being supposed known. Or, if we substitute for $\cos\lambda$ the value corresponding to the mean latitude ($\lambda = 53^\circ\, 17'$),

$$\delta - \delta_0 = 0'\cdot 527\,(\lambda - \lambda_0) + 0'\cdot 412\,(\mu - \mu_0).$$

" The mean declination at Dublin, for the year 1850, is

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* " This result agrees very closely with Colonel Sabine's map of the isogonal lines in the Atlantic, as to the *direction* of the lines; but gives a more rapid rate of increase."

$26° 29'$ west; and as the yearly value of the secular change of the declination is $-6'\cdot 06$, the mean declination, in any not very remote future year, will be given by the formula

$$\delta_0 = 26° 29' - 6'\cdot 06 \times n;$$

n being the number of years, counted from the present. If greater accuracy be desired, the diurnal and annual variations of the declination, corresponding to the time of the day and of the year, must be added."

The Secretary, on the part of Mr. M. J. Anketell, presented to the Museum of the Academy a man's shoe made of three pieces of thin plate bronze or brass. This shoe, Mr. Anketell states, was found, with about two dozen pair of the same kind, near an old heap of stones in the vicinity of the Giant's Causeway.

"This shoe (A), with another (B) of the same kind, exhibited, was purchased in the year 1831, by Mr. Anketell, from a brazier in Coleraine, who had melted down or worked up all the others found, he not considering them to be of any peculiar value.

"Along with the shoes were found the two small vessels exhibited. They are made apparently of the same materials, but they are differently fabricated, and put together with great care, and are evidently intended for use; while the shoes, on the contrary, are only fastened together so very imperfectly with lead, used as solder, that the least wear, or motion of the foot of a person attempting to walk in them, would break the soles away from the uppers.

"One of the vessels is a cylindrical cup, having the following dimensions, its bottom being slightly convex:

Diameter, ...	$1\frac{1}{4}$ inches.
Depth, ...	$3\frac{1}{2}$,,

"This cup is brazed, and the edges of the brass plate, at the side, are so cut that they form a sort of continuous mortising, which prevents their being drawn apart, independently of the brazing.

"The other vessel is constructed in the same way. Its shape is very peculiar, and its dimensions are as follow:

Greatest breadth,	about 1	inch.
,, length,	$4\frac{1}{2}$	inches.
,, depth,	5	,,

"The bottom consists of one piece of metal, five and a half inches long, bent, however, unequally to an angle at the greatest depth of the vessel. One side of the angle measures about three and a half, and the other two inches; and the oval ends of the box, to which these are attached, measure severally three and four and a quarter inches.

"The measurements of the shoes are as follow; they may be of use to help parties to compare these with similar shoes found elsewhere in Ireland:

Length,	$13\frac{1}{4}$	inches	in sole.
Breadth,	$4\frac{1}{2}$	,,	,,
Height of upper behind,	$2\frac{1}{2}$	,,	,,
Height of instep of A,	$3\frac{3}{4}$	,,	,,
Ditto of B	$2\frac{3}{4}$	,,	,,

"The shoes weigh as follow:—A, $9\frac{3}{4}$ oz., and B, 8 oz. only.

"It has been suggested that these shoes might have been originally intended for the purpose of being put on the feet of deceased persons of rank; but as we know of no body having been found interred with shoes of this kind on it, we can attach but little weight to this suggestion. It has also been suggested that they might have been intended as a measure of capacity for wheat; but as the two shoes (A) and (B) differ materially in their capacity, that notion also appears not to hold good either.

"The above facts and surmises are communicated, in the hope, that the attention of antiquaries may be drawn to the subject, which promises to be of general interest, as I understand that shoes composed of brass or bronze, more or less like those, have been found in other parts of Ireland."

DECEMBER 9, 1850.

HUMPHREY LLOYD, D. D., PRESIDENT, in the Chair.

THE President communicated the following account of the Cyclone of the 19th of November.

"The leading phenomena of revolving storms at a given place are,—1. the veering of the wind through an angle ranging from 0° to 180°, its magnitude depending on the proximity of the centre of the cyclone; 2. the gradual increase and subsequent decrease of its force; 3. the fall and rise of the barometer. All these characters were distinctly exhibited at Dublin on the 18th and 19th of last month. The gale commenced about 12 P. M. of the 18th, and gradually increased in force until 1 or 2 P. M. of the following day, after which it diminished again. Before it commenced, in the afternoon of the 18th, the direction of the wind was singularly variable, shifting rapidly between S. and E. During the greater part of the forenoon of the 19th, it blew from the S.; at noon from S.W.; at 6 P. M. from W.; and between 1 and 2 A. M. of the following day its direction shifted *suddenly* to N.N.W., and it continued between N. and W. the whole of the day. The barometer underwent a corresponding series of changes, the mercury falling rapidly until near noon, and then rising again. The least observed height was 28·290 inches, at 10 A. M.

"I soon after received from Dr. Robinson and Mr. Cooper detailed accounts of the gale, as observed at Armagh and Markree, from which its rotatory character was still more evident; but I deferred laying them before the Academy, until I could combine with them the observations made in other parts of Ireland according to the system recently organized. The following are the observations of the direction of the wind, and of the height of the barometer (reduced to 32° Fahr.),* at all the stations from which the results have been as yet forwarded to the Academy. The hours of observation are 9 A. M. and 9 P. M.

Station.	Lat.	Long.	Height of Barometer.				Direction of Wind.			
			18, P. M.	19, A. M.	19, P. M.	20, A. M.	18, P. M.	19, A. M.	19, P. M.	20, A. M.
Portrush.. . .	55° 13′	6° 41′	29·100	28·339	28·518	29·044	S.E.	S.E.	N.E.	N.E.
Buncrana, . .	55 8	7 27	29·094	28·300	28·500	29·061	S.S.E.	S.	N.E.	N.N.E.
Killybegs, . .	54 38	8 27	28·928	28·242	28·650	29·150	S.E.	N.	N.	N.
Donaghadee, .	54 38	5 33	29·131	28·376	28·346	28·937	S.E.	S.	N.E.	N.E.
Armagh, . . .	54 21	6 39	28·782	27·975	28·298	28·823	S.E.	S.S.E.	N.W.	N.N.W.
Markree, . . .	54 12	8 26	28·656	28·126	28·536	29·088	S.E.	N.N.W.	N.W.	N.W.
Dublin, . . .	53 21	6 15	29·105	28·362	28·528	28·982	S.S.E.	S.	W.	N.N.W.
Courtown, . .	52 39	6 13	29·192	28·566	28·562	28·924	S S.W	S.S.W.	W.S.W.	N.N.W.
Kilrush, . . .	52 38	9 30	28·830	28·455	28·706	29·267	S.E.	W.N.W.	W.N.W.	N.W.
Dunmore, . .	52 8	6 59	29·070	28·593	28·633	28·993	S.W.	W.	W.N.W.	N.W.
Caherciveen, .	51 56	10 13	28·855	28·756	29·080	29·370	S.W.	W.N.W.	W.N.W.	N.
Castletownsend,	51 33	9 9	29·115	28·831	28·940	29·207	S.W.	N.W.	W.	N.

"It will be seen from these observations that, at 9 A. M. of the 19th, the wind was blowing from N. at Killybegs, and from S. at Donaghadee; that it was blowing from S.E. at Portrush, and from N.W. at Castletownsend; from S.S.E. at Armagh, and from N.N.W. at Markree. The centre of the vortex was therefore over Ireland at that time, and between the stations mentioned.

"But the most satisfactory mode of discussing these observations is to lay down, on a map, lines in the direction of the wind at the same moment of time at the several stations. It is thus evident that these directions are, very nearly, tangents to concentric circles, the common centre of the circles

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* "The reduction to the sea-level has not been applied. The heights of the cisterns above the sea are small at all the coast stations. At Armagh this height is 211·0 feet; at Markree 131·5 feet."

being of course different at the different epochs. We thus find that the centre of the vortex had a progressive motion from W. S. W. to E. N. E.; and that it reached the western shores of Ireland about 3 A. M. of the 19th, and quitted the north-eastern about 3 P. M. of the same day. The position of these circles at 9 A. M. of the 19th, together with the direction of the wind at the several stations, is shown in the annexed

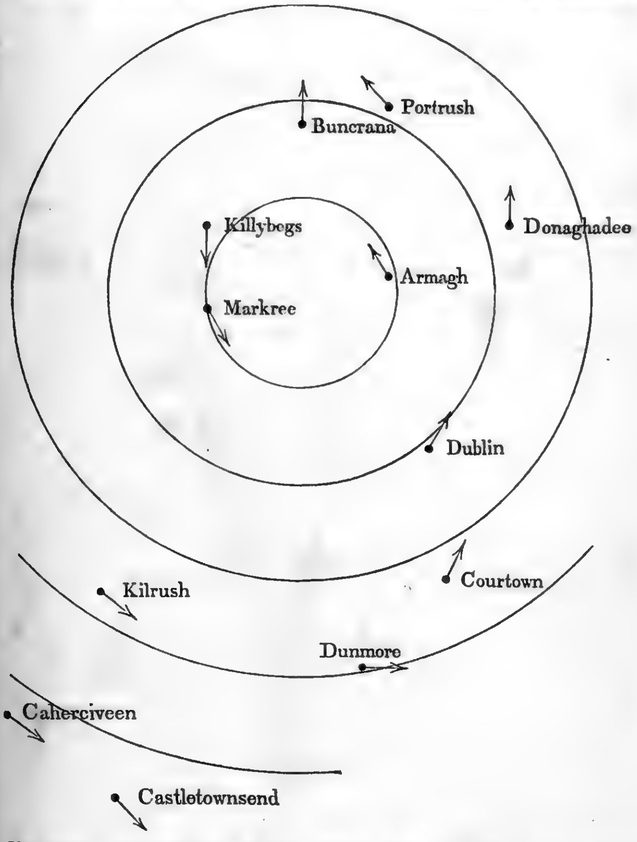

diagram. The centre of the vortex was then over the north of the island, in lat. 54° 20′, long. 7° 30′, very nearly.

"It will be seen that the direction of the wind is well represented at all the stations, excepting Buncrana; and the anomaly at this station is readily accounted for by the modifying influence of Lough Swilly, and its double chain of mountains.

"We have seen that the centre of the vortex was between Armagh and Markree at 9 A. M. of the 19th; and, as the direction of its progressive movement was not far from the line connecting these places, it must have passed nearly centrally over both. Hence we should expect there the peculiar phenomena—the *lull* of the wind, and the *sudden reversal* of its direction—which are observed to occur at places in the path of the centre of a cyclone. I shall therefore briefly describe the series of changes at these two stations, which have been kindly furnished in much detail by Dr. Robinson and Mr. Cooper. The observations at Armagh are from the records of the self-registering anemometer, and are consequently *continuous;* those at Markree were taken at short intervals.

"At Armagh the wind began to blow at 7 P. M. of the 18th, with a velocity of 22 miles an hour. The maximum velocity (with the exception of that of a short squall* at 5 A. M.) occurred at 7 A. M. of the 19th, and amounted to 30 miles an hour. From this time the wind abated rapidly *almost to a calm,* its velocity at noon amounting only to 4 miles an hour; and at 3 P. M. it rose again, with a velocity of 15 miles. The initial direction of the gale was from the E. S. E. From 9 P. M. on the 18th, to 1 A. M. on the 19th, it veered to S., at which point it continued for several hours, including the period of greatest force of the gale. At 11 A. M. its direction had returned to S. E., and it then *suddenly shifted to W. N. W.*, altering through 160° in 24 minutes. The *minimum pressure* took place at $11^h\ 30^m$, at the close of this movement; its amount was 27·930 inches.

* During this squall, which lasted only three minutes, the velocity reached 60 miles an hour.

"At Markree the gale commenced at 4^h 30^m P. M. of the 18th, with a rapidly falling barometer. At 7 P. M. the wind abated to a breeze, the barometer still falling. It recommenced at 10 P. M. from the S. E.; and at 3 A. M. on the 19th it appears to have attained its *maximum*. At 6 A. M. the wind again abated; and at 7 A. M. *there was a calm*. The *minimum pressure* took place at this time, and amounted to 28·058 inches. At 9 A. M. the wind rose again from the N. N. W., but not with such force as before; and in the afternoon there was a strong gale again.

"From these facts it is evident that the centre of the vortex passed nearly over Markree at 7 A. M., and over Armagh at 11^h 30^m A. M. At Donaghadee, which is nearly in the prolongation of the line connecting the two former places, the wind ceased at 1 P. M., and recommenced at 5 P. M.; so that the vortex passed nearly centrally over this station at about 3 P. M. From these data we learn that the cyclone moved from W. S. W. to E. N. E.; and that the velocity of the progressive movement was about 14 miles an hour.*

"The dimensions of the vortex may likewise be collected from the same data. The interval between the commencement of the storm, and the passage of the centre, at Armagh, was $16\frac{1}{2}$ hours; and, the velocity being 14 miles an hour, the distance between the front of the vortex and the centre was 230 miles. We have grounds for believing that the posterior portion of the vortex was more considerable, and, conse-

* "The *direction* of the progressive movement may also be inferred, although not so satisfactorily, from the initial and final directions of the wind, in veering, at any one station. And, the time of the nearest approach of the centre of the vortex being that of least pressure, the *rate* of the progressive movement may be ascertained by a comparison of the heights of the barometer at two distant stations, the direction being known. Thus, the time of the minimum pressure at Caherciveen (deduced by interpolation) was about 3 A. M., and that at Donaghadee about 3 P. M.; which gives a velocity of 18 miles an hour."

quently, that it deviated from a circular form; but the gradually diminished force of the gale in the latter portion renders it impossible to fix its close with precision. The total diameter, in the direction of the progressive movement, probably exceeded 500 miles. The magnitude of the (nearly) quiescent portion of air in the centre of the vortex is better defined. At Armagh the lull lasted from three to four hours; at Markree three hours; and at Donaghadee four hours. The diameter of the quiescent central portion was therefore about 50 miles.

"I shall now refer to some particulars connected with this gale, which appear to merit attention—although probably, in the present state of knowledge on this subject, we should not be justified in offering any suggestions in explanation.

"Among the first of these are the abnormal irregularities in the rotatory movement, especially along the track of the centre. Thus we have seen that, at Markree, there was a subsidence of the gale from 7 P.M. to 10 P.M. of the 18th. There was, in like manner, a *temporary lull* at Armagh, between 3 and 4 A.M. of the 19th. But the most curious irregularity is that of the direction. At Armagh this began to change rapidly at 9 P.M. of the 18th. At 9 P.M. it was E.S.E.; at 10 P.M., S. E.; at midnight, S.S.E.; and at 1 A.M. on the 19th, S. At this point it remained for several hours; and the *direction then retrograded* through an arc of about 45°. At 9 A.M. on the 19th, it was S.S.E.; and at 11 A.M. it came back to S.E., after which the *sudden* shift to W.N.W. already noticed, took place.

"The next point which seems to merit notice is the fact, that the force of the gale was considerably greater to the *south* of the line of passage of its centre, than on that line itself, or to the north of it. Thus, at Killiney, where I made frequent observations during the gale, I found the maximum velocity to be 55 miles an hour; at Armagh it was but 30 miles. It would be easy to account for this, if we could suppose that the whole revolving mass of air was transferred *bodily*, in virtue of the progressive movement. But this assumption seems to be negatived by other facts.

"It has been already mentioned that the greatest force of the storm occurred at Armagh and Markree, *before* the epoch of minimum pressure, the interval at both places being about four hours and a half. A similar interval took place at Killiney, but in the *opposite* direction, the epoch of greatest intensity *following* that of least pressure by four hours and a half.

"The last point which appears to demand notice is the curious fact, that there was a considerable interval between the epochs of the greatest intensity of the storm at Dublin and at Killiney, places only ten miles apart. The greatest force of the gale, at Dublin, took place between 1 and 2 P. M.; at Killiney it occurred between 5 and 6 P. M. There is a similar interval between the times of *minimum pressure* at the two places, the least height of the barometer occurring at Killiney at 1 P. M.,—or later than at Dublin by two or three hours. These differences are probably connected with the difference of altitude of the places of observation.

"I have thought it right to bring this subject under the notice of the Academy, not only on account of the general interest which attaches to it, but also as a specimen of the results which may be expected from the observations recently instituted by this Society. And I gladly avail myself of this opportunity to testify to the fidelity and accuracy with which the observations are now made by the men belonging to the Coast-guard service. So far as regards the meteorological part of the undertaking, little more seems wanting than that, on occasions such as that which forms the subject of this paper, the observations should be taken at shorter intervals."*

* "Extra observations were taken during the gale at the Coast-guard stations at Caherciveen and Kilrush."

Dr. Petrie exhibited an ancient brooch belonging to Mr. Waterhouse, of Dame-street.

"Sir,—By permission of Mr. Waterhouse, of Dame-street, I have the pleasure of exhibiting to the Academy a very remarkable specimen of ancient Irish art,—a fibula, or brooch, which came, a few months since, into that gentleman's possession. In availing myself, however, of this permission, I must confess my incompetency to treat of the skill exhibited in the workmanship, or of the taste in the design of this surpassingly beautiful article, which, though not much differing in its general form from various specimens of the Irish fibulæ in our own and other collections of antiquities, is superior to any hitherto found in the variety of its ornaments, and in the exquisite delicacy and perfection of its execution. From such acquaintance as I have been able to acquire with the progress of ornamental art in Ireland, I may, perhaps, venture an opinion as to the age to which, with the greatest probability, this article may be ascribed; but to treat of, or properly illustrate, the various mechanical arts exhibited in its manufacture, would require a greater amount of knowledge than I can pretend to, and a greater expenditure of time in the preparation than, from peculiar circumstances, I have lately had at my disposal; and besides I have no doubt that there are, within our Academy, many members who are better qualified than myself to undertake and accomplish this difficult and peculiar task. In short, my present object is little more than to present this beautiful remain to the notice of the Academy, and to direct their attention to a few of its more striking peculiarities.

"Of these peculiarities, perhaps, the first that should be noticed is that of the metal of which the brooch is chiefly composed. This metal is apparently, and was for some time supposed to be silver; but this supposition has been found to be erroneous, and that it is in reality that harder metal formed by a combination of copper and tin, and usually known by the appellation of white bronze.

" Another peculiarity of this brooch, not hitherto found in any other specimen of the kind, is the attached chain, unfortunately broken, which was intended to keep the pin tight, and in its proper position. This chain, which is of silver, is of that peculiar construction usually known as the Trichinopoly work; but it is not the only example of the manufacture of such chains in Ireland which has fallen under my notice, and which I believe to be examples of art of a very considerable antiquity.

" It is scarcely necessary to call attention to the beautiful taste in design exhibited in the various ornamental patterns with which this work is overlaid, and which are not, as usual, confined to the front or exposed side, but almost equally enrich its reverse; nor is it necessary to call attention to the beauty of workmanship exhibited in the execution of these ornaments; but to appreciate fully the perfection of this beauty, the ornaments must be studied through a lens of no moderate power: and the drawings on an enlarged scale, which I hold in my hand, and which have been made by Mr. Nelson, the very intelligent conductor of Mr. Waterhouse's business, will assist the Academy in tracing the various designs of the ancient artistic workman.

" Of these designs or patterns it has been found that there are no less than seventy-six varieties, all of which exhibit an admirable sense of ornamental beauty, and a happy fitness for their relative situations; and it should be observed that in all the smaller ornaments the only fastening used to keep them in their places is a delicate bur, not perceptible to the naked eye. In other places, however, and particularly in the circular insertions of amber, the gold rosettes placed upon them are fastened by pins, which pass through the brooch, and are rivetted also on the opposite side.

" It should be observed, that the insertions of amber and variegated glass are not of unusual occurrence in the remains preserved to us of the jewellery art in Ireland; nor is the example of Niello, upon the reverse of this brooch, a solitary instance, though we have seen none before of such delicate beauty; but of the carving or casting of glass into the forms of human faces, as seen in this brooch, no other example is, I believe, to be found.

"I have now stated the principal points observable in this beautiful remain, to which it seemed to me desirable that the attention of the Academy should be drawn, and I shall only add a few words more.

"The general form and character of this brooch is that usually recognised as peculiarly Irish, or perhaps more properly Celtic, for it was, at all events, common to Scotland; and if we can trust to the authority of the author of 'The Pillars of Hercules,' it is also common to Moorish tribes of Africa, and derived from thence; but, be that as it may, it is certainly of a very great and unknown antiquity in Ireland. Not so, however the various arts displayed in its manufacture, which, however derived from an earlier period, are those of Christianized Greece and Rome, as practised on the decline of the higher and nobler arts of design, when, as St. Chrysostom acquaints us, 'all admiration was reserved for goldsmiths and weavers.' And as to the age to which this exquisite specimen of those arts should be assigned, I should with little hesitation state as my opinion, founded on the peculiar character of most of the ornaments found upon it, though examples of a few of them may be found of an earlier antiquity, that it should be assigned to that period when such arts were carried to the greatest artistic perfection, namely, the eleventh, or, perhaps, the early part of the twelfth century.

"And further, should it be an object of inquiry what the probable rank of the owner of such a costly ornament had been, I would with as little hesitation express my opinion that the rank must have been a princely one; as we have the authority of a tract of our most ancient Brehon laws that the size and value of the Aicde argoit, or silver brooch, should be in proportion to the rank of the wearer.

"And lastly, I would fain refer to the preservation of this valuable memorial of the ancient art of Ireland as an important result of the efforts made by the Academy to illustrate the past history of our country, and place it upon a solid basis. I shall not easily forget that when, in reference to the existence of a similar remain of ancient Irish art, I had first the honour to address myself to a meeting of this high Institution, I had to encounter the incredulous astonishment of the illustrious Dr. Brinkley, which was implied in the following remark: —"Surely, Sir, you do not mean to tell us that there exists the slightest evidence to prove that the Irish had any acquaintance with the arts of civilized life anterior to the arrival in Ireland of the English.' Nor shall I forget that in the scepticism which this remark implied nearly all the members present very obviously participated. Those, at least, who have seen our museum, will not make such a remark now.

"I need scarcely say that I very deeply regret that this beautiful remain of art is not as yet placed in our museum, its proper resting-place. Such a memorial should never be abstracted from the country which produced it, and I do trust that to our museum it will find its way. As I have been informed by Mr. Waterhouse, a prince merchant, who is a member of our Academy, very shortly after the brooch had come into Mr. Waterhouse's possession, offered for it a sum vastly more than that which the Academy has latterly appropriated annually to the increase of its museum, in order to place it in this national depository; and such noble and generous spirit was only such at least as I could not be surprised at on the part of Mr. Charles Haliday. And I have been also told that another distinguished member of our body, the future chief of our nobility, has, in a spirit worthy of his station, endeavoured to purchase it at any reasonable cost, with the same object in view. With such examples before him of generous and patriotic zeal in furthering the objects which the Academy have done so much to promote, I cannot but feel assured that Mr. Waterhouse, who has derived a great pecuniary benefit from our exertions to create an interest in such remains, will feel it due to us, in return, to give a deaf ear to all temptations to seduce him to let this brooch out of Ireland, and that he will have a pleasure, as well as feel it his interest, to see it placed in its proper depository."

Dr. Apjohn made an oral communication in relation to a process recently employed by him for the artificial production of valerianic acid.

He stated that, as must be well known to many members of the Academy, the root of the *Valerianas officinalis*, or native plant, is much employed for medical purposes, and that different pharmaceutic processes have been devised for extracting from it powerful antispasmodic medicines. Now, of the substances existing in the root, and which admit of being separated from it, the most remarkable are a peculiar volatile oil, and an acid of a fatty nature; the former being the essential oil of valerian, the latter the valerianic acid. The valerianic medicines of the Pharmacopœia contain both these, and the therapeutic virtues they exert, they owe, undoubtedly, to these principles. Reasoning from these facts, Prince Lucien Bonaparte, who is well known to have devoted much attention to certain departments of chemistry, first suggested the manufacture of the valerianates as curative agents, and their introduction into medical practice. But there is one great difficulty in the way of employing these salts extensively in the treatment of disease; they are very expensive, the cheapest of them, the valerianate of zinc, costing so much as eighteen or twenty shillings an ounce. It may be added that, from their high cost, a strong inducement exists to their fraudulent adulteration; and that, in point of fact, much of the valerianate of zinc at present in the market is nothing but the *butyrate* of the same metal, upon which a very minute quantity of a spirituous solution of the oil of valerian has been poured. Impressed with the conviction that, as long as valerianic acid is derived from the root of the valerian, the price of the valerianates could not be materially reduced, and occupied, at the desire of the College of Physicians, with the task of bringing out a new edition of the Dublin Pharmacopœia, it became his duty to inquire whether valerianic acid could not be obtained from some other source, and at such reduced cost as would permit of the valerianates being more generally used in the practice of medicine.

The well-known method of Dumas and Stass was first tried, which consists in passing the vapour of fusel oil over the hydrate of potash at a certain temperature, but the result was such as to forbid its being recommended as a pharmaceutic process. The conversion, however, of fusel oil, $C_{10}H_{11}O, HO$, into valerianic acid, $C_{10}H_9O_3, HO$, being obviously a process of oxidizement, it naturally occurred to him to try whether the oxidation in question could not be effected by agents frequently applied in other departments of organic chemistry to a similar purpose, viz., bichromate of potash and oil of vitriol; and upon subjecting, in November, 1847, this idea to the test of experiment, operating on small quantities, a tolerably satisfactory result was obtained. The subject, however, was not then prosecuted further; but as the Pharmacopœia approached completion, he had again to return to it, and working with the same materials, but by a somewhat different method, he had such success as, he conceived, would justify him in communicating his results to the public, through the medium of the Academy. The following process succeeds well:

Take of Bichromate of potash, nine ounces;
Oil of vitriol, six and a half fluid ounces;
Fusel oil, four fluid ounces;
Water, half a gallon:

Dilute the oil of vitriol with a pint, and dissolve the bichromate of potash, with the aid of heat, in the remainder of the water; and, when both solutions have cooled to 80°, mix, and having then added the fusel oil, shake the mixture, and continue the agitation until the temperature, which at first rises to 150°, has fallen to 70° or 80°. Draw over now by distillation about half a gallon of liquid, and having saturated this with caustic soda, and separated any unoxidated fusel oil, evaporate down to about the bulk of four ounces, and, placing the valerianate of soda in a retort, with an equivalent quantity of oil of vitriol diluted with twice its bulk of water, again distil. The valerianic acid thus obtained, when rendered anhydrous by the usual methods, was found to have the same chemical composition, specific gravity, and boiling point, with the acid extracted directly from the root of the valerian, so that there can be no doubt of their identity.

The fusel oil used in his experiments is found in the spent wash of the distillers, from which it may be separated by continuing the distillation after the spirit has ceased to come over. The discovery of it in this liquid Dr. Apjohn stated that he communicated to the Academy so far back as the year 1840.

The valerianates of zinc, quina, and iron, should be prepared from the valerianate of soda by double decomposition. The valerianate of zinc may also be made by neutralizing valerianic acid with the hydrated carbonate of zinc; but this direct method is scarcely applicable in the case of the two other salts.

Dr. Apjohn, in conclusion, stated that he did not claim to be original in converting fusel oil into valerianic acid, such having been previously effected through the agency of potash. At the time, however, he first accomplished this metamorphosis (November, 1847), by the oxidating influence of chromic acid, he was not aware that such method had been tried by any other chemist; and the attempts since made on the Continent would seem not to have been very successful, as Regnault, in his fourth volume, not long since published, immediately after describing a process of this kind, observes, "that the best process still for the conversion of fusel oil into valerianic acid is that by potash, originally given by Dumas and Stass."

On the part of Richard Caulfield, Esq., the Secretary exhibited an inscription on a silver ring found in the county Galway: the letters are as follows:

✠ AVENMGAONEAIME.

He also presented, on the part of the same gentleman, a lithograph representing a silver buckle, and other ornaments, in the possession of Thomas Ronayne Sarsfield, Esq.; and a rubbing from a stone in the church of Mallow, with the following inscription: "Hic jacet Jacobus filius Wilhelme de Barry, in temporalibus dominus Kilmaclenyn."

In the absence of Dr. Stokes, Dr. Petrie presented, from Rev. William Demoleyns, to the Museum, a large bronze vessel, found in the lands of Lahern, in the parish of Killorglan, in the county of Kerry, in 1849.

Rev. Charles Graves, on the part of Sir Robert Gore Booth, M. P., presented an ancient wooden crucifix, found in a font in the demesne of Lissadell, County Sligo.

January 13, 1851.

JOHN ANSTER, LL. D., Vice-President, in the Chair.

Sir Francis Waskett Myers, Bart.; Rev. Orlando Dobbin, LL.D.; Samuel Gordon, M.D.; Daniel Griffin, M.D.; Ewing Whittle, M.D.; St. George Williams, M.D.; Robert Clayton Browne; James Gibson; Henry Hennessy; Andrew John Maley; and William Harvey Pim, Esquires, were elected Members of the Academy.

The following letter from R. Lepsius was read:

"*Berlin, le* 27 *Décembre*, 1850.

"MONSIEUR LE PRÉSIDENT,—L'Académie Royale Irlandaise m'a fait l'honneur de me nommer un de ses membres honoraires. En présentant mes humbles remercimens pour cette distinction, si flatteuse pour moi, je dois, avant tout, vous prier de vouloir bien faire mes excuses à l'honorable Académie, du retard, bien pénible à moi, mais involontaire, que cette lettre de réponse a éprouvé. Je suis loin d'attribuer cette nomination à mes mérites personnels, trop insignifiants pour avoir motivé une semblable résolution de votre corps savant; mais je crois y reconnaître un témoignage précieux pour la position, toujours plus éminente, que la science égyptienne, à laquelle je me suis voué de préférence, gagne partout, notamment, dans les siéges principaux des études scientifiques. En effet, des recherches qui ont pour but la connaissance d'un peuple qui à présent est généralement reconnu pour celui qui nous a laissé les monumens contemporains les plus anciens, et dont, par conséquent, l'histoire, scientifiquement entendue, remonte plus haut que celle de tous les autres peuples d'antiquité,—d'un peuple qui, depuis les temps d'Abraham et de Moïse, restait toujours en des relations intimes et remarquables avec le peuple de Dieu,—d'un peuple, enfin, qui fournissait sans contredit un grand nombre d'élémens très essentiels et très fertils à la civilisation des peuples classiques des Grecs et des Romains,—de telles recherches ne peuvent manquer d'attirer l'attention de tous les hommes de science, depuis le moment où elles promettent des resultats, et l'attireront toujours plus à mesure qu'elles réussiront d'avantage. Il est vrai que précisément les questions chronologiques, qui présentent un intérêt tout particulier à cause de l'antiquité inattendue ou elles paraissent vous conduire, sont encore controverses à un point qui leur semble ôter toute confiance; et vous possidez vous-mêmes, parmi vos membres indigènes, des savans célèbres par leurs travaux pleins d'érudition et de sagacité sur l'Egypte ancienne, qui vous l'attesteront. Mais il n'y aura guère un seul parmi tous ceux qui se sont occupé de ce grand problème, qui ne serait d'accord, que les élémens de cette question immense existent et sont accessibles dans un si grand nombre, que, dans un temps pas trop éloigné, la science pourra et devra se décider pour l'une ou l'autre des solutions nombreuses qui ont été proposées dans les derniers temps, et accepter, je ne dis pas toutes les particularités, mais bien les principes fondamentaux d'une d'entre elles. Dès lors seulement l'importance des études égyptiennes, et leur influence puissante sur toutes les sciences historiques et antiquaires, sera mise en pleine évidence.

"Veuillez être, Monsieur le President, l'interprète de sentimens sincères de ma profonde gratitude auprès de MM. vos savans collégues, et agréer pour vous-mêmes l'expression de la haute considération avec laquelle j'ai l'honneur d'être,

"Monsieur le President,

"Votre trés humble Serviteur,

"R. Lepsius."

Dr. Ball exhibited some articles made of stone, now in use amongst nations in an early stage of civilization in distant parts of the world, with the view of showing, that antiquities found in Ireland may be illustrated by comparison with objects of this nature.

Dr. Petrie restored to the Academy the original wooden covers, with their ornaments, belonging to the MS. known as the Book of Lecan, and now in the Library of the Academy.

Rev. Dr. Reeves read a paper descriptive of a certain Irish MS. of the four Gospels, examined by him in the British Museum.

Among the manuscripts in the British Museum is one which, though neither so ancient nor so brilliantly illuminated as some others of the Irish school, is yet of peculiar interest, on account of its exquisite penmanship, and the precision with which its date has been ascertained. It belongs to a period in Irish history of which there are scarcely any other biblical remains, and is further valuable in that it serves as an excellent standard of the handwriting which was practised in this country in the early part of the twelfth century. It is in the Harleian collection, No. 1802, small quarto, consisting of 156 folios, the page measuring $6\frac{1}{2}$ by $4\frac{7}{8}$ inches. It contains the Latin text of the four Gospels, agreeing very nearly with the Vulgate, accompanied by preliminary matter, and a running commentary in the form of marginal and interlinear scholia.

Fol. 1 commences with the prologue of St. Jerom, beginning "Novum opus facere me cogis." At folio 3 follows the "Argumentum Evangelii Matthei." In a note on the upper margin the following scrap of etymology occurs: "Argumentum, argutum inventum; argumentatio, argutæ mentis ratio."

Fol. 3 *b*. The genealogy of our Saviour, with notes. Upon which Wanley observes: "This is written separately from the rest of the Gospel, and amongst other prefaces; as being looked upon but as a preface. I have seen other ancient copies of the Evangelists, written in Ireland, or coming from books written by Irishmen, wherein, although the sacred genealogy was not rejected or misplaced, there would nevertheless appear a great distinction between it and what followed; the words 'Christi autem Generatio' being illuminated again, as if the Gospel had begun there."*

Fol. 4 *b*. An interpretation of the Hebrew and Syriac names which occur in the Gospels, "perhaps," says Wanley, "taken from St. Hierom."

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* Catalogue of the manuscripts in the Harleian Collection, vol. v. pp. 180–207. MS. Brit. Mus.

Fol. 5 *b*. An Irish poem on the Wise Men of the East who were led by the star to Bethlehem, consisting of eleven quatrains. Notwithstanding the assistance of Toland, who professed to be well versed in the Irish language, Wanley has so far erred in his estimate of this composition that he styles it "Glossariolum quoddam Hebraice, Latine, et Hybernice;" and Mr. Westwood, in his Palæographia Sacra, repeats the statement. The poem is as follows, and the accompanying translation is from the accurate pen of Mr. Eugene Curry.

Aurilius humilis ard
Malgalad nuntius nſrtgarg
Melċo mong liaṫ cen mebail
Go nulcha lech lanlebuir

Senoir broit buide
Inair glais go glanmet
Ialaċraind bric glais gen bron
Ni ro erb in ri gen rig or

Arenus fidelis fial
Galgalad deuotus dian
Ruad ḟer Cassar iar cumtach
Gilla nua-gel nemulcaċ

brat corcra imman curaid caim
Inair buide cſṛ brecur
Glais ialacraind inraic
Tuir do Dia dodeg tidnaic

Damascus in tres fer dib
Misericors gen imḟnim
Sincera gratia cen cacht
Patifassat fir uallach

Fer odor broit corcra brecgil bladmair
Corcra uascach cen imraid
Im ialacrind buic buide
Do rat mirr don mor duine

A teat so anmand na druad
In Ebra hi Greic ria grad luad
Illatin nach gluais grada
I m berla uais Arabda

Dath a netaic estid lib
Ria cantain in cech coemthaig
Selua for gaessa gala
Debdae Asrae Éscidae

Triar dona drudib gen dós
Treda ind ascaeid ba ard nós
Tri etaige im cach fer dib
Don bi ċrſtade cſn dimbrig

Maire, Ioseph, Semion saer
A treb Iuda na nard maſr
Is in tig danad caer cech doit
Aroſn frisi Trinoit

Co nernum do rer a ri
Issi domen rarmorgni
Is maiṫ diar cobair acus
O rotadair Aurilius.

Aurilius, Humilis, the noble,
Malgalad, Nuntius, of fierce strength,
Melcho the grey-haired, without guile,
With his grey and very long beard.

A senior with a graceful yellow cloak,
With a grey frock of ample size,
Speckled and grey sandals without fault,
He approached not the King without royal gold.

Arenus, Fidelis, the munificent,
Galgalad the devout and fervent;
A red man was Caspar in his vesture,
A fair, blooming, beardless youth.

A crimson cloak round the comely champion,
  A yellow frock without variety,
  Grey and close-fitting sandals:
  Frankincense unto God he freely presented.

Damascus was the third man of them,
  Misericors, without dejection,
  Sincera gratia without restraint,
  Patifarsat the truly-grand.

A grizzled man with a crimson, white-spotted cloak:
  Crimsoned stood he, above all without competition,
  With soft and yellow sandals,
  Who presented myrrh to the Great Man.

These are the names of the Druids
  In Hebrew, in Greek to be quickly spoken,
  In Latin which runs not rapidly,
  In the noble language of Arabia.

The colour of their clothes hear ye,
  As spoken in each of their countries:
  Selva, for the performers of heroic deeds,
  Debdae, Aesae, Escidae.*

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* The descriptive materials of this poem were probably derived from the *Excerptiones Patrum*, ascribed to Venerable Bede, and printed among his works. "Magi sunt, qui munera Domino dederunt: primus fuisse dicitur Melchior, senex et canus, barba prolixa et capillis: tunica hyacinthina, sagoque mileno, et calceamentis hyacinthino et albo mixto opere, pro mitrario variæ compositionis indutus: aurum obtulit regi Domino. Secundus nomine Caspar, juvenis imberbis, rubicundus, milenica tunica, sago rubeo, calceamentis hyacinthinis vestitus: thure quasi Deo oblatione digna, Deum honorabat. Tertius fuscus, integre barbatus, Balthasar nomine: habens tunicam rubeam, albo vario, calceamentis milenicis amictus: per myrrham filium hominis moriturum professus est. Omnia autem vestimenta eorum Syriaca sunt. Mundorum namque est munda contingere."—Opera, vol. iii. col. 649. (Bas. 1563.)

Zacharias Chrysopolitanus, or Goldsborough, who flourished A. D. 1150, gives their names thus: "Nomina trium magorum Hebraice, Apellius, Amerus, Damascus. Apellius interpretatur fidelis, Amerus humilis, Damascus misericors. Græca lingua vocati sunt Magalath, Galgalath, Saracin: Maga-

Three were the Druids without gloom;
Triple were their gifts in noble fashion;
Three garments were upon each man of them;
From three worlds they came without debility.

Mary, Joseph, and noble Simeon,
Of the tribe of Judah of the noble kings,
Are in the house in which every hand is a lighted torch,
All together with the Trinity.

May we do thy will, O King,
And desire it with all our heart:
Thou art gracious to relieve us in our distress,
Since the day thou wast adored by Aurelius.

At the foot of same page are two notes, the former purporting to be taken from St. Gregory; the latter from St. Jerom, in these words: "Augeant sacerdotes scientiam magis quam divitias, et non erubescant discere a laicis, qui noverint quæ ad officium pertinent sacerdotum."

Fol. 6. The Prologue to St. Mark, beginning "Marcus Evangelista Dei."

Fol. 6 *b*. The Prologue to St. Luke, beginning "Lucas Syrus natione."

At the extreme top of fol. 7 *a* the following quatrain occurs, written in a very minute hand, and apparently as an exercise of the pen, or a burst of the fancy:

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lath interpretatur nuncius, Galgalath devotus, Saracin gratia."—Concord. Evang., lib. i. p. 47. (1535.)

Petrus Comestor, A. D. 1170, writes thus: "Nomina iii. Magorum hæc sunt *Hebraice* Appellus, Amerus, Damascus. *Græce*, Galgalat, Magalath, Sarachim. *Latine*, Balthasar, Jaspar, Melchior."—Hist. Evang. cap. viii. "Quæ sane commenta sunt hominis Hebraice et Græce æque imperiti. Nominant alii Atorem, Satorem, Paratoram: ludibria omnia, et minime ante duodecimum sæculum procusæ fabellæ."—Calmet, Commentar. tom. vii. p. 65. (Aug. Vindel. 1735.) Casaubon, Exercitat. p. 136. (Francof. 1615.) In the Calendar they appear in this order: Gaspar, Jan. 1 (Act. SS. Jan. i. p. 8); Melchior, Jan. 6 (Ib. p. 323); Balthasar, Jan. 11 (Ibid. p. 664).

Ber̃. c.—Celebrad en ar mairi
Maith do thabairt dſŕ duine
Cach dib ro caras araili
In da ni an eclais huile

Berchan cecinit.—'The warbling of birds I observe,
It is good to give tears to a man;
Each of them loves the other,
As does the entire Church.'

Fol. 7 *b*. The Prologue to St. John, beginning "Hic est Johannes."

Fol. 8 *b*. A collection of extracts from Jerom, Gregory, and Bede.

Fol. 9. Notes, wherein the Evangelists are fancifully compared to four liquors, four elements, four quarters of the world, four winds, four pillars.

Fol. 9 *b* is entirely occupied by an Irish poem on the personal appearance, and the manner of death, of Christ and his Apostles. It seems to be framed according to certain rules which guided the ancient scribes in the illumination of their biblical manuscripts, and may possibly find a partial illustration in the figures which appear in the Book of Kells and other manuscripts of that class.

Becca na delba aċt delb De
Ni delb do fogain doſn gne
Folt dond tri nonnual boi occa
Ocus ulcha ruad ro atta.

Delb Petar abstail ro niath,
A mong glan robo gle liaċ
Finn connail in fer sanaa
Gar iumcumair a ulcha.

Pol apstal alaind a drech
Go folt ſrcain ussinech
Aes cumtha gor do chotta
Ulcha Poil ba fir fotta.

Iacob Anꝺꞃeaꞅ aeꞅ cumꞇha
Ꝼınꝺ a ꝼoılꞇ ꝼoꞇꞇa a n-ulcha
Inmaın ꞃo ꝺıacon ın ꝺıaꞅ
Eꞇıꞃ Iacob ıꞅ Anꝺꞃıaꞅ.

Eoın bꞃunne ꝺalꞇa De ꝺıl
Robo ꝺonꝺ a ꝼolꞇ ecın
Rob bo chıunın cuınċach
Rob beımꞇeın oc amulcaċ.

Pẏlıpp, ulcha ꝼoꞇa ꝼaıꞃ
Ocuꞅ ꝺꞃech ꝺeꞃᵹ ꝼo ꝺeᵹbaıl
Ꝼolꞇ ꝺeꞃᵹ uaꞅ ulċa ᵹıꞃꞃ
Ꝼoꞃ Poꞃċolon paꞇeꞃ-bınꝺ.

Ꝼolꞇ caꞅꞅ ꝺub aꞃ cınꝺ Maꞇha
Ᵹan ᵹınn ꝺulċa anꝼlaċa
Ꝼolꞇ caꞅꞅ aꞃ Taꞇha cen ꞇaꞃ
Ulcha comꝼaꞇꞇa comlan.

Iacob ᵹlunech ᵹo ᵹuċ ᵹlan
Mac Albeı nıꞃ beꞇꞃocaꞃ
Ꝼolꞇ lıaċ aꞃ Iacob hule
Ocuꞅ ulcha ꝼınn-buꝺe.

Thomaꞅ, ꞇoᵹa ꝺelbe a ꝺelb,
Donn caꞅ a ḟolꞇ nı ınnꞅꞃb
Nıꞃ bo anıb ꝺom mıꞃ cumꞇha
Ᵹaꞃb ᵹaꞃıꞇ a ᵹlan ulcha.

Ꝼolꞇ ꝼınn aꞃ Sẏmon ꞅoeꞃ ꞅeñᵹ
Ocuꞅ cneꞅ oꞅnᵹel ımꞇenꝺ
Ocuꞅ ulcha cıꞃꝺub caꞅꞅ
Aıᵹıꝺ ꞃuꞇech, ꞃoꞅc ꞃo ᵹlaꞅ.

Eoın baꞅꞇı nıꞃ bo bochꞇ
Donꝺ a ulcha ꝺonꝺ a ꝼolꞇ
Delba na ꝼeꞃ ꞅenᵹ ꞅeꞇa
Daꞃlem nıꝺaꞇ lan becca.

✠ Eol dain aidid Crist na cét
Ocus a da apstal deac
A marbad bamonur mer
Is iolur gan nister

Crochad ro crochad Crist cain
Gar sia crocad Pétair
Laimcladib do marbad Poil
Rob aidid anfail ecoir.

Crochad Pylipp rudar mor
Ocus fennad Portholon
Do claidiub ro glan ger glas
Ro marbad go trén Tomas.

Matha in toscela rom tog
Frith oen nambas damarbad
Do cloich datha ba ruad rind
Soeth lem Tatha do thutim.

Iacob mac Alphi, echt noll
Ros forraig farchi fir trom
Andreas apstal can coll
Fuas hi croich eccamlond

Iacob mac Cleopa ocus Maire
Cenn na napstal nuasal nard
Iacob mac Zebit demneirc
Amarmaith ba gnim garg

Eoin na ṫuath ocus na treb
Ba luath ro choirc in claideb
Eoin brune can breiṫ don muth
Cen bulle act ce a oénur.

Iuda ro marb Simon slan
Ocus cloch ro marb Stephan
Mo din don cach masa cet
Tre raṫ in Rig nac ro bic. b.

Anaig a Crist cen chaire
  Anmain hua Maelconaire,
  Ar iffernn sectha secti
  Ni ḟil lertha lan becca. b.

Despicable all faces but the face of God:
  His was not a face adorned but by one complexion:
  An auburn, tripartite [head of] hair had he,
  And a beard red and very long.

The face of the Apostle Peter was most venerable,
  His glossy hair was of shining grey;
  Fair and old was the favoured man;
  Short and close was his beard.

Paul the Apostle, brilliant was his face,
  With beautiful glossy hair;
  Until his companions had cut it off,
  The beard of Paul was very long.*

James and Andrew were companions,
  Fair their hair, long their beards;
  Beloved deacons were the two,
  Both James and Andrew.

John of the bosom,† the adopted of the loving God;
  Lightly auburn was his hair,
  Calm and placid was his countenance;
  He was very gentle, young, and beardless.

Philip,—a long beard had he,
  And a florid countenance of gracious aspect.
  Red hair, with a short beard,
  Had Partholan of the sweet prayers.

---

* The allusion may be to Acts, xviii. 18, or xxi. 24.

† The epithet is borrowed from John, xiii. 23; xxi. 20.

Black curly hair upon the head of Matthew,
Without the sign of a tyrant's beard.
Curling hair upon reproachless Thaddeus,
With a full and long flowing beard.

James of the knees,* of the clear voice,
The son of Alpheus, who was not merciless;
All grey was the hair of James,
With a beard of light yellow.

Thomas,—choicest of faces was his face;
Brown and curly was his hair without doubt;
It was no blemish to my companion
That coarse and short was his clean beard.

Fair hair had Simon the noble, tall,
And a pure white and robust body,
And a jet black curling beard,
A florid face, and a grey blue eye.

John the Baptist was not poor,
Brown his beard, brown his hair.
Such were the visages of the slender, tall men,
And I think they were not despicable.

✠ I know the fate of all-ruling Christ,
And of his Twelve Apostles;
To kill them was a deed of madness;
Many are the authorities that relate it.

On a cross was crucified the gentle Christ,
Shortly before the crucifixion of Peter.
A sword-girt hand to have slain Paul
Was a fate both awful and unjust.

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* St. James the Less, so styled in allusion to the ancient tradition: *ἀπεσκληκέναι τὰ γόνατα αὐτοῦ δίκην καμήλου, διὰ τὸ ἀεὶ κάμπτειν ἐπὶ γόνυ προσκυνοῦντα τῷ Θεῷ.*—Euseb. Hist. Eccles. ii. 23. Hieronym. in Jovin. ii. 24. Alban Butler, Lives of the Saints, May 1.

The crucifying of Philip was a great pity;
And the flaying of Partholan.*
With a bright, blue, sharp sword
Was fiercely killed Thomas.†

Matthew the Evangelist, my favourite,
One single soldier was found to kill him.‡
By a coloured, red-pointed stone
I grieve that Thaddeus fell.§

James, son of Alpheus, awful deed!
Was killed by a weighty mallet.‖
Andrew, the guiltless Apostle,
Upon a cross received an unfair death.¶

James, the son of Cleopas and Mary,
The head of the noble illustrious Apostles.**
James the son of Zebedee the guiltless,—
To kill him was a dreadful deed.

John of the lands and of the houses††
Quickly was he cut off by the sword;

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* An Irish form of the name Bartholomew. See Butler, Aug. 24.

† The tradition is that he was pierced with a lance. Dec. 21.

‡ Tradition says he was thrust through with a spear, while at the altar, by order of King Hircanus.

§ This is St. Jude, called by St. Matthew "Lebbæus, whose surname was Thaddæus." Greek writers state that he was shot with arrows, and others add, while on a cross. Octob. 28.

‖ *Καὶ λαβών τις ἀπ' αὐτῶν εἷς τῶν κναφέων τὸ ξύλον ἐν ᾧ ἀπεπίεζε τὰ ἱμάτια, ἤνεγκε κατὰ τῆς κεφαλῆς τοῦ δικαίου.*—Euseb. Hist. Eccl. ii. 23; also, ii. i. "Fullonis fuste, quo uda vestimenta extorqueri solent, in cerebro percussus interiit."—Hieronym. de Scriptor. Eccles. Butler, May 1.

¶ So Hieronym. Catalogus Scriptorum Ecclesiasticorum.

** These two lines refer to the subject of the preceding quatrain, namely, James the Less, whose father Alpheus was supposed to be the same as Cleopas, and whose rank among the Apostles is implied in Acts, xv. 13, 19.

†† This designation may be *per antiphrasim*, or an application of the promise in Mark, x. 29, 30. In a preceding verse it is said "John the Baptist was not poor."

John of the bosom without being brought to the green,*
Without a stroke, the only one to die.

The Jews that killed the perfect Simon;
And with stones was Stephen killed;
May my protection be on them all if they will,
Through the grace of the King who is not despicable.

Save, O spotless Christ,
The soul of O'Maelchonaire
From the awful blasts of hell,
In which are habitations very despicable.

With fol. 10 commences the narrative of St. Matthew's Gospel, accompanied by a most copious catena, which, however, stops at the beginning of the twenty-seventh chapter. In some cases the matter of the notes grew to such an extent upon the scribe that the margins were insufficient to contain them, and he was obliged to insert between the regular folios slips of vellum, of half the breadth of the ordinary page.

On upper margin of fol. 11 *b* are introduced two quatrains in a delicate hand, comprised in two lines:

Cóic mile mar in cath
Secca mile fer narmach
Do sil Iacoib is eol dam
Imm oen mnai do rochratar

Timcell ban ocus macc min
Trebe beoda Beniamin
Ocus timcell ind air rolad
For muintir Iabis galad.

Five thousand, great the battalion,
And seventy thousand armed men,
Of the seed of Jacob, it is known to me,
On account of one woman they all fell.

* The green or plain of execution.

About the women and tender children
Of the lively tribe of Benjamin,
And about the slaughter that was brought
Upon the people of Jabes Galaad.*

Fol. 13, lower margin:

.i. Mac in tagairt Tuighnetha.

Line moite hi tus indlechtinnig sea. Rob cennais Dia forn anmain Maelissa. Pr̄.

'Mac-intagart of Tuighnetha.'†

'The writing of my tutor is at the beginning of this page. May God be gentle to the soul of Maelissa.' Pater.

Fol. 34 *b*, lower margin:

.i. g. fē.—Neptis Arethae gnim glicc
Ingen pectach do Philip
Sa lis a tend nir batair
Do chunnig cenn mic Zachair.

'The grand-daughter of Aretas,‡ of the cunning deed,
The sinful daughter of Philip,
In the court her power was not despicable,
It was she that craved the head of Zacharias' son.'

Fol. 36, lower margin:

Fotuch. c.—Eccna intliuct comairle
Fis nert gaire gus
Omun fiadat for bith ċe
Secht dana De dun.

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* These lines refer to the events recorded in Judges, caps. xix.–xxi.

† Now Tynan, a parish in the diocese and county of Armagh. The name occurs in the Calendar of the O'Clerys, at the 29th of August, in connexion with St. Winnoc: Uindic Tuighneata. "Vulgo *Tuighnean*, sed rectius *Teaghneatha* appellata."—Colgan, Trias Thaum., pp. 34, n. 69; 183, n. 222.

‡ Herod Antipas' first wife was daughter of Aretas, King of Petræa; but she fled from her husband's court as soon as Herodias, with Salome, obtained the ascendency there. Jerom (in Matt. xiv.) falls into the same error with the writer of the above poem, in making Herodias daughter of Aretas instead of Aristobulus.

Fothadh cecinit.*—'Wisdom, Understanding, Counsel,
Knowledge, Might, Stern watchfulness,
The Fear of the Lord in this passing world,
Are the seven gifts of God unto us.'†

Fol. 50 is an inserted slip, having a long note, at the foot of which is written in an extremely minute hand:

Diamad ail lem ro scribabaind in tractad uli amal so.
'If I wished I could write the whole commentary like this.'

The Gospel according to St. Mark begins at fol. 61, and is introduced with the usual symbol of the Lion, drawn, however, as Wanley observes, "by one who never saw the creature." The marginal catena recommences with this Gospel, but only proceeds for seven pages, stopping at fol. 64, and not so delicately written as in the preceding. The Gospel ends at fol. 86, with the signature:

Or̄ do Maelbrigte qui scribsit hunc librum.
'A prayer for Maelbrigid who wrote this book.'

St. Luke begins at fol. 87, and has the symbol of an Ox, rudely executed. The catena on this Gospel goes no further than four pages, breaking off at foot of fol. 88 *b*.

Fol. 97 *b*, in a single line in margin is:

Quidam c.—Triar ro thodiusc Crist cain
Diarabai trist hi talmain;
Ingen Iaruis ain,
Mac na fedba, ocus Lazar.

Quidam cecinit.—'Three that were resuscitated by the gentle Christ
When he was for a time upon earth;
The daughter of Jairus the noble,
The son of the widow, and Lazarus.'

St. John's Gospel begins at fol. 128, and ends at fol. 156. It has neither the evangelical symbol, nor any scholia.

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* Fothadh na Canoine, who flourished A. D. 804. See Four Masters, 799.

† Borrowed from Isaiah, xi. 2, 3.

The scholia, which profess to be taken from various writers, are generally prefixed with the author's name, or a portion of it. Thus, the extracts from St. Jerom are marked with the signatures h., Iꞃ., hiꞃ̄., hiꞃonimuꞅ; those from Venerable Bede by b., bē., beā., beaꝺa; Gregory, ᵹ̃ᵹ. Besides these, the names of Origen, Cyprian, Eusebius, Priscian, Isidore, and Leo, occur. The most frequent references are to Manchanus, under the signatures m̃., mā., man̄. At fol. 44 *b*, marg., is a note on Matt. xxi. 25:

bapꞇiꞅm̄ Iohon̄. .i. coꞃnuꞇa queꞅꞇio oꞃiꞇuꞃ .i. ba ꞇuaꞅlucuꝺ ꝺia cꞅꞇae ꞅeom in ceiꞅꞇ ꝺo ꞃaꞇ Cꞃiꞅꞇ ꝺoib, nam ꞅi ꝺixiꞅꞅenꞇ bapꞇiꞅ. Iahon̄ eꞅꞅeꞇ ꝺe celo ieꝺ̇ ꞃo bochoiꞃ ꝺoib ꝺo ꞃaꝺ quia ꝺixiꞅꞅeꞇ eiꞅ ille ꝺe me eꞇ ꝺe mea poꞇeꞅꞇaꞇe, ꝺicenꞅ ecce aᵹnuꞅ, ꞃl.

'*Baptismus Johannis, i. e. cornuta questio oritur, i. e. the question which Christ put to them was a solution to their own question, nam si dixissent Baptismus Johannis esset de cœlo, what they ought to have said was, quia dixisset eis ille de me et de mea potestate, dicens Ecce Agnus, &c.*'

At lower margin of fol. 48 *b* is a short note on Matt. xxiv. 26, from the same writer:

Man̄. Si auꞇem ꝺixeꞃinꞇ, ꞃl̄., Ecce in ꝺeꞅeꞃꞇo .i. uꞇ ꝼiunꞇ anchoꞃiꞇae.

'*Manchan. Si autem dixerint, &c. Ecce in deserto, i. e. ut fiunt anchoritae.*'

At foot of fol. 49 is the following note on Matt. xxiv. 21:

Man̄. Eꞃiꞇ enim · hē · oꞃaꞇe Ꞇꞃibulaꞇio .i. uꞇ maꞇeꞃ ꝼilium comeꝺaꞇ in obꞅeꞅꞅa ciuiꞇaꞇe .i. Maꞃia nomen eiuꞅ .i. aꞃ cia ba moꞃ ꝺiliu ꞇoꞅꞅaiᵹ ꝺomain moian ꞃomboi ocuꞅ iꞅ oen ꞃian ꞃo boi inꞇi biꝺ anꝺꞅu ꝺin ꝺilꞃianꞇaib cꞃiꞅꞇ · iiii · anniꞅ eꞇ ꝺimeꝺio ocuꞅ biꞇilaꞃꝺa iaꞃianai ocuꞅ anꝺiᵹlai · uꞅque moꝺo .i. aꝺ ꞇempuꞅ quoꝺ moꝺo.

'*Manchan. Erit enim · hyeme · orate . Tribulatio, i. e. ut mater filium comedat in obsessa civitate, i. e. Maria nomen ejus, i. e. for, though great the loveliness of the beginning of the world, greater was the pain* [*i. e. the deluge*] *that came on it; but it was only one pain that came on it. The many pains of Christ were more intense* .IIII. *annis et dimedio, and the pains and vengeance for them shall be more numerous and intense. us̃ modo, i. e. ad tempus, quod modo.*'

Of the subscriptions to the Gospels that after St. Mark has been given above. At the end of St. Matthew is the following:

Oṙ do Maelbrigte qui scribsit hunc librum. Is mor in gnim Cormac mac Carthaig do marbad o Tairdelbach .h. Briain.—Fol. 60.

'A prayer for Maelbrigid *qui scripsit hunc librum.* Tis a terrible deed, Cormac Mac Carthy to be killed by Turlogh O'Brien.'

The allusion is to an event which the Four Masters thus record at the year 1138: "Cormac, son of Muireadhach, son of Carthach, King of Desmond, and bishop of the kings of Ireland for bestowal of jewels and wealth upon the clergy and the churches, an improver of territories and churches, was killed in his own house by treachery, by Toirdhealbhach son of Diarmaid Ua Briain, and by the two sons of O'Conor Kerry."

At the end of St. Luke, the scribe's name appears again, but with a different chronological note:

Oṙ do Maelbrigte qui scribsit h. l. in xx°uiii° anno aetatis suae. In dara bliadain iairsin gofthaig moir sin.—Fol. 127 *b.*

'A prayer for Maelbrigid *qui scripsit hunc librum in* xxviii° *anno ætatis suæ;* The second year after the great storm was this.'*

* John Toland, whose real name was O'Toolan, was a native of Eskaheen in Inishowen, near Derry, where Irish was the language commonly spoken in his time. (See O'Donovan, An. Four Mast. 464.) He undertook to interpret this passage, and his autograph, which is pasted on p. 194 of Wanley's Catalogue, vol. v., contains this translation: "Orate pro Brigidiano qui scribsit hunc librum in vicesimo octavo anno aetatis suae secundo anno ab *aedificatione magnæ domus.*" Mr. Westwood, who translates from Wanley's Catalogue instead of the original, places the occurrence "in the second year after the building of the great house."! At least he should have followed Dr. O'Conor, who interprets the passage correctly.

Here he reckons inclusively, and refers to an event which is thus described by the Four Masters at the year 1137 : "A great storm throughout Ireland, which prostrated many trees, houses, churches, and [other] buildings, and swept men and cattle into the sea, in Moy-Conaille" [the present county of Louth]. So far the writer of this manuscript is not only at one with himself, but also bears testimony, the more honourable as it is undesigned, to the correctness of our native chronicles: but there remains another subscription, which, as the colophon of the whole volume, exceeds the others in detail, and contains a number of collateral criteria for fixing its date. It has been already printed by Dr. Charles O'Conor, in evidence of the historic fidelity of the Irish annals,* and by Dr. Petrie† for another purpose, but it may be well to adduce it a third time, in order to complete the present description:

✠ Or̄ do Maelbrigte h-Ua Maelúanaig, qui scribsit hc̃ librum .i. in nArd Macha. Ocus in n-aimsir Donnchadha hUa Cerbáill ardríg Airgiall ro scribad, .i. inbliadain dan seside deac for Kal. Enair .i. is in bliadain ro marbad Cormac mac Cardaic rigescop Muman ⁊ hErenn ar chena in na aimsir.

Ateat ro ħ rigra hErenn is in naimsir sein .i. Murcertaċ mac Nel ua Lochlaind Ailiuch. Cuulad mac Conchobuir rig Ulad. Murcath ua Maelḟechlaind rig Mide. Diarmait mac Murchada rig Lagen. Conchobor ua Briain rig Muman. Tairdelbach ua Conchobair rig Connacht.

.i. mac ind ir dana do ib birnn

Gilla mac Liac mac mic Ruaidri hi comarbas Patraic.

Bennacht ar cech oen legfas fris in lebur sa, gebed paitir ar anmain in scribaeda, uair is mor haċeṫer etir corp ⁊ trac-tad.—Fol. 156 *b.*

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* Rerum Hibernicar. Scriptor. vol. i., Prolegom. pars ii. p. 143, where a fac-simile is given. It has also been partly given by O'Brien, in his Irish Dictionary, voce *Curmac.* A fac-simile is among the specimens of Irish MSS. in Mr. Purton Cooper's unpublished "Appendix A" to the Report of the English Record Commissioners.

† Inquiry into the Origin, &c., of the Round Towers of Ireland, p. 303.

'A prayer for Maelbrigid O'Maeluanaigh *qui scripsit hunc librum,* i. e. at Armagh. And in the time of Donough O'Carroll, chief king of Oriel, it was written, i. e. the year in which the 16th was on the Calends of January, i. e. the year in which Cormac Mac Carty, King-bishop of Munster and of Ireland generally in his time, was killed.

'These also are the kings of Erin at this time, namely, Murchertach son of Niall O'Lochlain, at Ailech; Cooley son of Connor, King of Uladh; Murchadh O'Melaghlin, King of Meath; Dermod MacMurrough, King of Leinster; Connor O'Brien, King of Munster; Turlogh O'Connor, King of Connacht.

'Gilla-mac-liag, the son of the son of Roory (i. e. the son of the poet of the Ui-Birinn), in the successorship of Patrick.

'A blessing on every one who will pardon the faults of this book, let him say a *pater* for the soul of the scribe; for it much requires indulgence both in text and commentaries.'

Dr. O'Conor has entered into a full examination of this record, and has shown, by a comparison of its details with notices in the Irish annals, what harmony exists between these independent records, adding, as well he might: "A sæculo inauditum esse existimo, in rebus præsertim Septentrionalibus, veritatem facti cujuscumque antiqui tanta rerum in uno anno concordantium varietate, totque personarum, locorum, et circumstantiarum adjunctis, quæ alibi quam in nostris Annalibus inveniri nequeunt, possit tam dilucide et inconcusse demonstrari."

Of the subsequent history of this manuscript nothing is known till the commencement of the last century, at which period it was shown as a Saxon manuscript in the Royal Library at Paris. This we gather from the following statement of Pere Simon: "On trouve dans la Bibliotheque du Roi un beau Manuscrit Latin des quatre Evangiles ècrit il y a pour le moins 800 ans en vieux caracteres Saxons. Le Copiste qui étoit un Moine Benedictin prend le nom de Dom Ælbrigte, & il ajoûte à la fin de son Exemplaire plusieurs lignes en langage Saxon. Outre le texte des Evangiles, cet exemplaire contient de petites gloses interlinéaires en Latin sur de certains mots, avec quelques notes marginales qui composent une espece de petite chaine recüeillie de Saint Hilaire, de Saint Ambroise, de Saint Augustin, de Gennadius, et ce me semble de Bede, qui est indiqué par la seule lettre B. comme Saint Jerome est indiqué par la lettre H. Ces notes, dont il y en a quelques unes fort impertinentes, & qui sont apparement du Compilateur, viennent de deux mains ; car les unes sont en caracteres Saxons, & les autres en caracteres Latins : celles-ci sont beaucoup plus recentes."*

Simon's error in the division of the original words ꝺomaelbꞃiꝣꞇe was natural enough to one unacquainted with the practice of Irish scribes ; and, though a little too venturesome in describing the handwriting and language as Saxon, he did no more than err with Mabillon, Muratori, and other great authorities in *re diplomatica.* It has been the misfortune of ancient Irish literature that its remains, through the subordinate condition of this conntry, have, both in England and abroad, been, almost without a dissentient voice, adjudged to the Anglo-Saxon school, whereby not only has the merit of the teacher been transferred to the disciple, but a great obstruction has been placed in the way of an acquaintance with Irish manuscripts which are scattered through Europe; the Irish scholar neglecting to examine them, because they are called Saxon; and the English to consult them, because unable.

What notes Simon intended as the *fort impertinentes,* he has not mentioned: possibly that already cited at p. 50, from fol. 5 *b*, and the following :

Puplıcanı a Puplo ꞃeꝣe, uꞇ heꞃoꝺıanı ab heꞃoꝺe, eꞇ Cꞃıꞅꞇıanı a Cꞃıꞅꞇo.—Fol. 3.

On Matt. xvi. 18, Eꞇ eꝣo ꝺıco ꞇıbı quıa ꞇu eꞅ Peꞇꞃuꞅ ⁊ ꞅupeꞃ hanc peꞇꞃam eꝺıꝼıcabo eccleꞅıam. Ex hoc loco epıꞅcopı

* Bibliotheque Critique, par Mr. De Sainjore, vol. i. p. 271-5. (Par. 1708.)

et presbiteri iactant et assumunt aliquod de superbia fariseorum, ut uel dampnent innocentes uel soluent, cum apud Dominum non sententia sed eorum uita queratur. Quomodo in Leuitico sacerdos leprosum mundum facit, non quo sacerdotes leprosos mundos uel immundos faciant sed quo habeant noticiam leprosi et non leprosi, sic et hic alligat ⁊ soluit episcopus non eos qui insontes sunt et noxii, sed pro sacrificio suo cum peccatorum audierit uarietates scit qui ligandus sit, qui soluendus.—Super hanc petram .i. super te quia tu es petra, et super petram quia connisus es .i. super me.—Fol. 38.

Again, on Et tibi dabo claues regni celorum, verse 19: Claues misteria scripturarum, uel iiii. claues hominis .i. fidem, spem, cogitationes, et opus. ii. quoque hominis, .i. terricam et actualem uitam. Qui autem soluit indigne uel ligat, ut Gregorius ait, a propria potestate se priuat.—*Ibid.*

Again, fol. 54 (inserted slip): Manchan.—Primo quaeritur si hec assumptio panis ⁊ calicis figura an historia an sensus figura est. Fractio autem panis figurat corpus confractum a militibus in cruce; ⁊ in omnibus sanctis iterata passio est dum patiuntur, a Christo usque ad finem mundi. Sed tamen non ut fiebant figure legis, quae cessauerunt; hec uero figura cotidie iteratur.

Quarto quaeritur an aqua in hac oblatione accipitur eadem causa quia euangelista dixerit inquit de latere aqua et sanguis, item figuram Cristi tenet uinum, aqua uero populi; nam sic iunguntur.

Fol. 55: Cenantibus uero eis. Iesus accepit panem .i. agno utique paschali immolato accipit panem de panibus illius cene, accepit panem ut panem pro carni in sacrificium ab hominibus accepisset Deus. Et benedixit .i. ut mistice corpus eius fieret. Sic dicitur Panis autem quem frangimus Christi corpus est. Fregit .i. significat quia corpus eius in passione frangeretur. Spi. panis hic ecclesia est quia corpus Christi accipitur in fide, benedicitur in habundantia, frangitur in tormentis, datur in exemplis. Deditque discipulis suis ss. significat quod ad eos post resurrectionem uenturus esset. Corpus meum .i. ut sic hec uera hostia, non agnus, non vitulus, non hircus, non taurus. Hec est prima novi testamenti figura. Manchanus. Et hoc dixit ne nostra dubitaret fides de sacrificio cotidiano in ecclesiis quod corpus Christi est, quoniam Christus in dextra Dei sedet.—Et accipiens calicem. In Luca legimus duos calices quibus propinnaret, unum primi mensis, et alterum secundi, ut qui primo mense agnum comederet non potuerit secundo mense inter penitentes.

Simon's "Bibliotheque Critique," which was published in 1708, seems to have drawn some attention to this manuscript; and his account of its age and origin, coupled with its beauty and compactness, recommended it to the cupidity of one who, about that time, was carrying on an infamous traffic in manuscripts, which he purloined from the Bibliotheque du Roi. This was the miscreant John Aymon, whose morality was as loose as his religious principles, and whose depredations on the King's Library have been made the subject of well-earned reprobation.* In 1708 our countryman, John Toland, was living at the Hague, where he became acquainted with Aymon, and obtained a loan of the manuscript under consideration. This we learn from Letter II. in his Nazarenus, where he states that he had it in his custody about half a year, and adds in a note that he wrote his dissertation upon it in the year 1709.† He must have been aware also of the depository to which it

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* See Biographie Universelle, *voce Aymon* (vol. iii. p. 137); Le Prince's History of the Bibliotheque du Roi; Silvestre's Paléographie Universelle, vol. ii. p. 31; vol. iii. under "Bible dite de Saint-Denis," about the middle. A more particular account of the MSS. stolen by him (nearly all of which are now in the British Museum) was printed by Sir Frederick Madden in the Gentleman's Magazine for 1832, translated from the German of Uffenbach's Travels, published in 1753. Uffenbach saw this very MS. with Aymon in Jan. 29, 1711—(Gent. Mag., vol. cii. pp. 30–32.) See also Universal Palæography, by M. J. B. Silvestre, translated by Sir Frederick Madden, vol. i. p. 179; vol. ii. p. 472. (Lond. 1850.)

† Nazarenus, Letter II. p. 15. (Lond. 1718.)

belonged by right, and of the mode in which it was carried away, for he quotes Simon's statement, where it is described as being in the Bibliotheque du Roi, and subsequently remarks that, "The person who conveyed it out of France was under the same illusion with Father Simon, that it was the work of an Anglo-Saxon, till I undeceiv'd him, together with some others of great distinction."

It soon after passed into other hands, for in 1718 Toland writes: "The book is come into England, being purchased by the Earl of Oxford, in whose large collection of manuscripts it is not the least valuable piece." The particulars of the purchase are thus given by Wanley in his MS. catalogue: "Codex membranaceus in 4to minori, quem a Joanne Aymone in Hollandia redemit illustrissimus Dominus meus."

"When Mr. Toland first spake of it to me (for I had the first notice of this and the other manuscripts bought of Mr. Aymon from him), he said it was 900 years old; and upon the large account he gave of its rarity, joyned to 900 years Antiquity, I presently offered 20 Guineas for it."

Wanley, however, had more discernment than his informant, and soon came to the conclusion "that this book was written in or about 1139."

January 27, 1851.

HUMPHREY LLOYD, D.D., President, in the Chair.

The President reminded the Meeting of a Resolution of the Academy,* which had been adopted just previous to his election, limiting the tenure of the office of President to five years, and declaring it to be inexpedient to re-elect the same person President at the expiration of that time.

* See Proceedings, vol. iii. p. 192.

The period for which he was elected had now nearly expired, and he understood that it was the intention of some members to support a motion for the repeal of the law which thus operated against his re-election. He wished, however, in order to prevent any mistake on this matter, to state that he did not intend to offer himself again as a candidate. He had received the office on the condition that he was to hold it only for five years, and he now thought that he was called upon to relinquish it absolutely into the hands of the Academy, and would not, therefore, offer himself for re-election.

Mr. Donovan read a paper, entitled, "Suggestions for the Improvement of Lighthouses."

Professor Allman read a paper on the Structure of the Muscular Fibre in the Polyzoa.

"The muscles of the polyzoa are especially interesting in a physiological point of view, for they seem to present us with an example of true muscular tissue reduced to its simplest and essential form. A muscle may, indeed, in these animals, be viewed as a beautiful dissection, far surpassing the most refined preparation of the dissecting knife, for it is composed of a bundle of elementary fibres, totally separate from one another through their entire course. These fibres are distinctly marked with transverse striæ, a condition, however, which is not at all times equally perceptible, and some of our best observers have denied to the polyzoa the existence of striated fibre. At the meeting of the British Association at Southampton I made known its occurrence in *Cristatella*, and have since, by repeated observation, satisfied myself of the striated condition of the fibre in the great retractor muscle in all the other fresh-water genera. In *Paludicella* I have seen this state beautifully marked through the pellucid cell, in the whole extent of the retractor muscle, while the fibres were on the stretch in the exserted condition of the polypide; and in all the other genera it has, under favourable circumstances of observation, been more or less visible. In order to witness it in perfection the fibre must be on the stretch, for when it is torn from its attachments, or lies relaxed in the bottom of the cell, the striæ become very obscure. When the broken extremity of a fibre is examined, the fracture will be found to have occurred in a plane perpendicular to the axis of the fibre, never exhibiting an uneven or lacerated appearance, and a marked tendency to separate into disks may be recognised in the detached and broken fibre. When the fibre is in an uncontracted state it would seem to be perfectly cylindrical, and the normal act of contraction is so momentary that its condition during this state cannot be witnessed. When, however, the living polypide is torn from its cell, the ruptured fibres, which continue attached to its body, are thrown into a state of spasmodic contraction; and then it will be seen that they lose their cylindricity, and become irregularly swollen at intervals, while the whole fibre has much increased in thickness. In this condition also they may be observed to be obscurely striated. The swellings here visible in the contracted fibre are quite different from the peculiar knots described by Dr. A. Farre in the muscles of the marine polyzoa. Such knots do not exist in the fresh-water species, at least I have never seen them, with the exception, perhaps, of certain little swellings which may be occasionally witnessed in the parietal muscles of *Paludicella*, and in the superior parieto-vaginal muscles of *Plumatella*. In *Paludicella* I have witnessed a curious phenomenon presented by the muscular fibre. In this polyzoon the fibres of the great retractor muscle, while lying relaxed in the bottom of the cell after the retraction of the polypide, may frequently be seen to present a singular motion, impressing you with the idea of a cluster of writhing worms."

Rev. W. P. Moore read a description of the Vitrified Font of Shantamon, in the county of Cavan, and at the same time presented specimens of the stone of which the font is composed.

The Rev. Charles Graves communicated the following elementary geometrical proof of Joachimsthal's theorem.

LEMMA 1.—*If tangent planes be drawn at two points, P, P′, on a central surface of the second order; and if perpendiculars be let fall from the points of contact on these tangent planes; the perpendiculars will be proportional to the perpendiculars let fall from the centre of the surface upon the tangent planes.*

This is evident in the case of the sphere; and the theorem may be extended to the other surfaces by a simple *deformation*. Or it may be proved analytically in the simplest way, by means of the ordinary equation of the tangent plane.

LEMMA 2.—*Let* LL′ *be the line of intersection of the two tangent planes, and let the point* S *be taken on it so that the lines* PS, P′S, *make equal angles with the line* LL′; *then the lines* PS, P′S, *will be reciprocally proportional to the perpendiculars let fall from the centre upon the tangent planes at* P *and* P′.

For the lines PS, P′S, are evidently proportional to the perpendiculars let fall from P, P′, upon the tangent planes; and these, by the preceding Lemma, are proportional to the perpendiculars let fall from the centre upon the tangent planes at P′ and P.

If the point S has been taken in L, L′, so that the angles PSL, P′SL′, are equal, the point S will be that the sum of whose distances from P and P′ is a minimum.

Again, the lines PS, P′S, being tangents, are proportional to the parallel semi-diameters of the surface. We may, therefore, state the result at which we have now arrived in the following proposition.

If two points on a central surface be connected by a shortest line passing over the line of intersection of the two planes which touch the surface at those two points; the semi-diameters of the surface parallel to the two straight portions of the shortest line will be reciprocally proportional to the perpendiculars let fall from the centre upon the tangent planes in which those portions are respectively contained.

If we suppose, now, that the two points approximate indefinitely, we see, as a particular case of the more general theorem just stated, that *For two consecutive elements of a shortest line traced upon the surface, the product of the perpendicular let fall from the centre upon the tangent plane, and the semi-diameter parallel to the element of the curve, remains the same.*

Of this celebrated theorem it would, perhaps, be hard to discover a more elementary demonstration.—*May* 25, 1850.

Sir W. R. Hamilton added some remarks on a very simple proof of the celebrated Theorem of Joachimsthal, derived from the Calculus of Quaternions.

Mr. Mallet exhibited a specimen of Gadolinite from the trap-rock in the vicinity of Galway, at the west side of Lough Corrib, discovered recently by himself, and identified by Mr. William Mallet.

February 10, 1851.

HUMPHREY LLOYD, D. D., President, in the Chair.

William Oliver Barker, M. D., was elected a Member of the Academy.

The Rev. Dr. Todd exhibited an original letter, dated Armagh, October 19, 1680, from George Codan,* a Franciscan Friar, addressed to the Duke of Ormond, the then Lord Lieutenant of Ireland, praying protection and deliverance from imprisonment, and asserting his innocence of the charge of disaffection to the Government, followed by a panegyric of the Duke in Irish verse. The letter is as follows:

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* The name subscribed to the letter is not very easily read. It seems to be either *Codan* or *Cudan*.

ffor his majesties lord
lieutenant in Ireland
th lord James Butler
Duke of Ormond these
be d. d. [i. e. delivered] at
~~Kilkenny~~* Dublin

Endorsed in the Duke of Ormond's hand.

ffranciscan ffriar &
Irish Verses –
19 of Oct^r. 80

Health & heaven &c
My Lord

Bee it knowen vnto yo^r grace that I am a poore old & feeble Franciscan friar, whoe longe before & after his majesties proclamations have endeavoured with all my force to gett out of this kingdom to die quietly in some Catholik country, to which intent I gathered some charges heere & there, & went often tymes to sea coasts, but mist shipinge, fell sick afterwards, & laid soe amonge friends by reason of a rupture I suffer this 30 at least years. Cominge to Ireland about 16 yeares ago, I had an indifferent commission from our Generall,† and lived soe amonge the Christians, nott affixed to friary or convents, wherefore I may not bee called a regular priest. I am & was of Peeter Walshes Remonstrance for w^ch I suffered much to this day from the contrary sort. I am of the Parkers of England by my mothers sid, whose grandfather Captaine Parker fought against ONeill in y^e battle of blackwather. by my mothers syd too I am of the Cassills, Garnons, Doudalls & many others of y^e Englis pale—soe that by originall descent I am bound to defend his majesties crowne, and priviledges to death. I am this whole yeare persecuted with fulminations of censures by one Doctor Henry o Hugh Doctor Plunketts vicar generall, & suborned person in all his bad designs, for not keepinge friary against his majesties proclamations & that by the procuration of one Shean o Neill, owen Roe o Neill's pretended bastard, whoe under the cloake of S. Francisis habit

* *Kilkenny* erased, and *Dublin* written instead, in a coeval hand.

† That is, from the "General" or Superior of the Franciscan Order.

doth all mischief & intends mor & more, a most dangerous man, that keepes Tories of his owne name about him in woods & mountaines to assist him : Cominge of late from the County of Louth to the County of Ardmagh to dispose of my bookes & dispatch myself out of this Kingdome upon occasion of contention I had w^th^ these rebellious sperits, I was betraid by them as a tory to one William Hammilton of Kinderd who apprehended mee layinge sicke, tooke away all my bookes, charges & horse & committed my selfe findinge that in other countries I have been a Regular priest, though I lived as a secular priest in Ireland, albeit hee knew I was betraid as a thory by the kinges enemyes of envy & hatred & sett purpose to represse & hinder my evidence in the Kinges behalfe against them & such like.

Wherefore my earnest request is that yo^r^ grace may bee pleased to writ w^th^ the first post for my releasment & full restitution of all taken from me to appeare before yo^r^ own selfes grace to speake mout to mout, which graunted I will continually pray for yo^r^ graces prosperity whose servant I remaine

George Codan

Ardmagh the 19^th^ of
Oct. 1680.

Here I send yo^r^ grace a panegyricall poem ; respect the poet

Dia ḃeṫa a Ṡémuis ḃutleír,
a ruire ṫrean ṁic na ngrás,
o do geiniod mbroinn do ṁaṫar
dia Aṫair ríot gus an lár.

Fear ionaḋ an ríoġ a nEirinn,
re linn cogaiḋ agus síoḋ,
da ttug na tioḋlaicteaḋ móra
Críost, cora duinne ḃeṫ faoi.

Mac ágmur ḃioconta Tuluḋ,
mo na cu-Uluḋ Neill ṁóir,
fear stiurṫa na ccuig ccuigeaḋ,
fugraḋ deacair molaḋ cóir.

Gaċ ceim os mo cenn ar airde
da bfuil aige feirrde mé,
moiġin fairsing na ccloc naluinn
mfiḋlideoct taluinn buaiḋ sé.

Tangus anoir fo do grasaiḃ
o mo ċaraiḃ fuarguil me,
gaċa gluis agat taoi eoċair,
neart, ceart tfocair—fuarguil me.

A ċead Duic orrḋuirc na nGaiḋil,
o gaċ baoġal fuarguil mé,
a tú a laiṁ deoċur eacceort,
déan orm degḃeort—fuarguil mé.

Bráiṫrin boċt, maoṫ, arraiġ, earlán,
sinn ḋaiṁ do dearlaiṁ, déan maiṫ,
seirḃireaċ dom riġ 'sni treatuir,
misi alaiṁ, cred ud aċt saiṫ.

Treatuireaḋ muiġ 'sinsi ngeiṁiol
mór an teiṁiol, foiriḋ mé,
a ua na ttrenfear o Urṁunn,
scrioḃ umuinn—foiriḋ mé.

The following translation is by Mr. Curry:

All hail to thee! James Butler,
Thou brave champion of the son of grace;
Since thou wast conceived in thy mother's womb
God the Father has been with thee ever till now.

The man in the King's place in Erinn,
In the times of war and of peace;
Unto whom Christ has granted many great gifts,
It is the more proper for us to be under him.

The fortunate son of the Viscount Tullow,
Greater than the Ulster hound[a] of great Niall;

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[a] Cuchulann, the great Ulster champion.

The steersman of the five provinces,
It is difficult to praise him as he deserves.

Every degree above my head
That he possesses, is the better for me,
In the spacious mansion of polished stones
My best poetry he has deserved.

I have now come under your Grace,
From my afflictions I pray you liberate me;
For every lock you have a key,
Might and right you have—liberate me!

Thou illustrious first Duke of the Gaels,
From every danger I pray thee relieve me;
I am under arrest—certainly it is injustice;
Perform a good act towards me—liberate me.

I am a poor little, silly, sickly, old friar,
Extend to me thy right hand—do good,
The servant of my King, and no traitor;
I am under arrest, what is this but misery?

Traitors are at large, and I am in fetters;
Great is the oppression—relieve me from it;
Thou descendant of the brave men out of Ormond,
Write in our behalf—relieve me!

The foregoing curious letter was recently found among the papers of Lord Ormond, who, through the influence of Mr. Graves, of Kilkenny, kindly consented to permit Dr. Todd to exhibit it to the Academy. The letter is sealed with the impression of a groat of one of the Edwards.

Mr. Benmohel read a paper as preface and abstract of his work, "Etymological Criticism." He stated that his object was, to correct erroneous assertions regarding some, and restore identifying kindred to such other words as seem bereaved of every connexion, through the vast ravages of ages and tongues, strictly adhering to historical facts, and evidence of etymology, properly so called.

Whether by thus disposing of genuine titles and pedigrees, which, though varying in dignity of extraction, shall be equal in that of truth, the Author's heraldic services shall deservedly engage the attention of readers, the following few examples will probably decide.

1. *Aghast* occurs in the eighth century as *achust*. Schilteri Glossarium, p. 18, shows that it meant abhorrence, disgust, not merely moral but also physical, as in Levit. xv. 25. Otfried (ninth century) spells it *akust*, our *agast*, without the *h*. He has also *unkust*, the first trace of *uncouth*. A glossary of 1482 renders unkust with untugend (un-virtue) and ungeslacht (degenerate). The last Lexicon that treats of those words defines achust, quod est rejiciendum, impuritas; but chust, without the prefix, quod est eligendum, purum, probatum; chust, kust, being the first source of our word *choice*, of *cur* in curmudgeon (which see), and of the German *Chur*, *Kuhr*, *kühren* (*Churfürst*, *Willkühr*), *kiesen*, *erkoren*, &c. The flat German (Plattdeutsch) has *afkeesen* (choose off, declare off), reject, resign, for which the high dialect would say *abkiesen* (it occurs in Frisch, Berlin, 1741, p. 170); and whilst the *ab* of the latter was at one time simply *a* (see Schilteri Glossarium, asneita-abschneiden), the *af* of the former is our *off*; but since this latter is never used as a verbal prefix, we abide by the mere *a* instead of *off*, in words like ago (agone), alight, aloof, atistaff (see Distaff), awkward, &c. Should this remark obtain the reader's assent in considering these words with me in their turn hereafter, we may then venture to suppose that the said vowel produced a verb, to awn (to keep off), of which the word awning is still in use. See *Disgust* and *Cochrane*.

2. *Apricot*. The word biccoora, "hasty fruit," of Es. xxviii. 4, when, with slight changes and the article, made Arabic, becomes البكيرة *albakeerat*; this, perverted by the

Spaniards into *Albarcoque*, suffered further changes in *Aprikose*, *abricot*, *apricock*, &c. That the Romans called the same fruit not merely after its country (see Gibbon, chap. ii.), but likewise its precocious nature, appears from Dioscorides, i.166.

3. *Bacon.* Anno 813 the plural *baccones* occurs, but the Latin singular has no *n*. It proceeds from the Dutch *backe*, the valued part of the hog, mature for bacon, being his *back*, in which state, accordingly, we find his name in Latin *bacharus*; flat German, *back-beest*; Spanish, cerdo de muerte, different from cerdo de vida, as still allowed to live.

4. *Blackguard.* Of the seven French words, begards, béguard, bégueule, béguelerie, béguin, béguine, béguinage, only two appear in English, namely, biggin (béguin), and béguard; this the untutored speaker, to accommodate his immediate intelligence, has changed into blackguard, joining other formations of his, beefeater, bridegroom, &c. Chronicles and glossaries abound with the various names and scandal of those conversæ and conversi sine voto monastico, &c., who lived by begging, preaching, &c. Among their multifarious verbal offspring (see also Bribe) there are none harmless except biggin, as worn by the female portion called beguina, begyne, beggewine, &c.; who, being sorores *conversæ*, were consequently also novitiæ, and this novitiate of their's was rendered German by the verb beginnen, to begin, whence their name. The Latin name of the men occurs as Begardi, Beghardi, &c.; conversus in German being *bekehrt*, formerly bekahrt (comp. gelahrt for gelehrt, in Göthe's Egmont, ii. 1), of the verb bekehren, to convert. The root of this verb, very frequent in German, is thus discoverable in three English words, awkward, blackguard, and churn.

5. *Burden* answers to *Bürde* and *Bourdon.* In songs on Aurelian, his soldiers repeated "mille, mille, mille occidit," such humming repetition was called fremitus, whence *frédon*, *bourdon*.

6. *Cochrane.* This personal name can have signified Electus. Rhabanus Maurus (ninth century) writes kachoran, which in modern German would be gekoren. See the word *Aghast*, where the participle erkoren is mentioned.

7. *Dairy*, from métairie. See *Curmudgeon* and *Distaff*.

8. *Harbinger.* *Warbürge*, a guarantee, personal security for fulfilment, accomplishment, &c., was composed of *war*, alluding to existence and truth (war and wahr sound alike), —as in gewahr werden (become *aware*), gewähren, grant, accomplish, &c.,—and Bürge. This latter being exchanged for mann, and war gradually for wär, währ, gewähr, &c., the compound now is Gewährsmann, voucher, &c.; so that neither it nor harbinger can now be used in the original sense of an officer appointed by law or mutual agreement. Another obsolete compound with both terminations is *salbürge* and *salmann* (Du Cange has saleburgio), the first syllable of which is our sale, sell, and sel in handsel, which word occurs in old German, as handsal or handsaal, and is explained by *promissio stipulata manu* facta, sal having a more general meaning, such as giving up, delivery.

9–11. *Lad, Lass, Lewd (Leud).* These words, of which the first two are not noble enough to satisfy children of high rank, and the last even synonymous with vulgar, were originally (together with other terms) used among the ancient Germans to designate the people, or third class, *lidi, læti, lassi, leudi,* &c.; whence still the Russian *liudi*, and the German *Leute*, both without a singular, which occurs, however, in Lex Burgundiorum, xviii.: "Quicunque Burgundio optimatis vel mediocris cum alicujus filia se copulaverit," &c., "*Leudis* vero si hoc præsumpserit facere," &c. The plural of this was leudes. It may join the Greek laos, or the word *laut* (loud), the less respectable being generally more *noisy* and turbulent. From the same class, called also ruoda (*root*, up*root*ing, weeding, rendering land arable), the French have their *roturier*.

12. *Mast,* the name for the fattening substance, then applied to its parent tree, when on board a ship, Mastbaum, or simply mast, may find in remote climes and ages such relatives whose family likeness shall be a labial joining a dental, or *s*. Thus the Russians have *maslo* for fat, butter, and their progenitors in the fertile Ukraine were called *Bast*arnae. The famous Basanitis, Batanæa, בשן, with its rich pastures (4 Mos. xxxii., Amos, iv., Ez. xxxix., Ps. xxii.) and forests of oak (Es. ii., Zach. xi., Ez. xxvii.), which has changed *bs* into *ms* in Chaldee (Ps. xii. 13) and Syriac (Eph. Syr. ii. p. 1), may be compared to the *bs* in אבוס, which occurs thrice (1 Kings, iv., Es. i., and Prov. xv.). Both these substantives find no derivation, but, instead of comparing, with Freytag (see his Hist. Halebi, p. 50), the Arabic بثنة, it may be observed that בשל, like coquere, serves both for preparing food and ripening; also in Turkish *bsl* means to nourish; the later Hebrew has פטם (Greek, fatmé, crib), to fatten, after which the labial followed by *t*, *d*, will be more common, futter, food, &c., although the primitive verb, esse (essen), vesci, the Sanscrit अश have the *s*, to which may be added pascere, pastum, feist inGerman, and the Italian basta.

13. *Ouch.* Fragment of piedouche, peduccio, a neat little pedestal, or foot-stool.

14. *Pagoda,* بتكده, Püt-kada, idol-temple, for which Put the Persians prefer But, coming nearer to बुध (budh) of the Sanscrit This, from being the root for wisdom (even विद wissen, wise, wistful, &c.) and pure knowledge, became strongly tinctured with carnal knowledge when Jaina (जन *gin*omai, gigno, &c.) was confounded with Buddha, whence But means not only idol, but also God, truth. If the defiling Pathbag, פתבג (Dan. i. 8), supposing it originated in बुध-भोज (Budh-bhōj), or Buddh-food, contains *p* for *b*, the corruption

has been assisted by the casual circumstance that the Hebrew for bread is Path.

It is possible that Buddhistical principles, in their purity, and those of Zoroaster, wherein divinity and nature are conceived together in the all-enlivening Mithra, fire and light, are identical; although Ammian. Marcellin, xxxiii. 6, mentions the Brahmans instead. See Gibbon, ch. 8.

15. *Prill*, or Brill, Britt, Turbot, probably describes the peculiar motion of the fish, which belongs to the pleuronectes, since *prill* and *purl* were used alike. See Stowe's Survey of London: "In 1598 was set up an image of Diana, and water, &c., *prilling* from her breast."

16. *Skald* was the title of a man who combined the arts of a genuine minstrel, able to perform his own composition, with the knowledge of a divine, historian, &c. The letters *skl* (scl), conveying the idea of division, decision, distinction, are thus used not only of ideas, as in *skald*, *skill*, but bodily, in *skull*, from the division on its surface, and *shilling*, the Northern *skilling* (our penny in value), it being the change, or the small coin which divides the larger piece, and called accordingly Scheide-münze, the Danish *skille*-mynt (*y* sounds like ü, the French *u*). This etymology seems to admit of further extension, *scald* (*separation* of the skin through the action of hot fluid), unless it be from caldo (calidus), *shell*, *scale*, &c.

17. *Spunge*. The Idioticon Hamburgense gives "*Sibungen* gahn," go to extremity, ruin, die, &c., and sibungen as a low corruption of "si bona," the beginning of a cantio sepulchralis. Compare also Hudibras, i., canto 3:

> This any man may sing or say,
> I' the ditty call'd *What if a Day?*

18. *Tattoo* implies la retraite, or battre la retraite, but expresses (with *t* for *p*),—after the obsolete manner of saying "make the door to," for the modern "shut the door,"—*taptoo*, meaning that the *tap* is to be *closed*.

19. *Topsyturvy.* Topside-horway. Spencer writes topside-turvy, but the Anglo-Saxon horvec, horwet, &c., sufficiently accounts for the last two syllables, as meaning dirty road (dirt-way, which is the middle of the road); the entire being conceived with the idea of a person on horseback tumbling headlong into the mud. See *Garlick*, *Ghastly*, and *Hoary*.

20. *Yellowhammer.* Omit the *h*, and take ammer as the German, related to our ember, and descriptive of the colour of that bird, the more specific Goldammer.

Mr. Donovan read the first part of a paper on the early alchemical and chemical physicians.

The principal subjects treated of in Mr. Donovan's paper were as follow:—Professions of the alchemists; origin of alchemy; its effects on chemistry; alchemical books burned by Diocletian; alchemy amongst the Romans; first works on alchemy; treatises of Jamblicus, Heliodorus, and Synesius; Geber the first alchemistic physician; effect of alchemy on his opinions; the universal medicine of Geber anticipated by Empedocles; Albertus Magnus the most celebrated of the alchemistic physicians, and a bishop; his learning; his brazen figure which spoke; Pope John XXII. first practised and then proscribed alchemy; Raymond Lully; his character and acquirements; made gold in England for Edward I., which was coined at the mint; Arnold Villanova; his learning; made gold at Rome which stood the test; his knowledge of medicine; proclamation of Edward III. for the services of alchemists; Pietro d'Apono; his high character as a physician and enormous fees; alchemy and chemistry of King Charles II.; his extreme poverty; Act of Parliament of Henry IV. against, yet patents granted for its practice by Henry VI., in order to pay off crown debts, contrarily to the Act; fifteenth century teemed with alchemists; 4000 writers on the art; state alchemist and state physician in every court of Europe; Basil

Valentine, his real and pretended knowledge of medicine and alchemy; his denunciation of doctors, apothecaries, and surgeons; his process for making the philosopher's stone; his works discovered by a flash of lightning; impositions of the alchemists; how they effected them; their punishments; alchemists in danger from their very popularity; the alchemist and the devil; Butler, the Irish alchemist, and his miracles, testified by Van Helmont; Glauber, his chemical sauces; the Rosicrucian physicians, and their ridiculous pretensions; their origin; Robert Fludd; cures by transplantation; Sir Kenelm Digby; sympathetic cures; George Phædro; tarantism defended lately by Hecker; alchemists becoming useful chemical physicians; Paracelsus an enthusiastic impostor who performed singular cures; his life:

February 14, 1851.

HUMPHREY LLOYD, D. D., President, in the Chair.

On the recommendation of Council,

It was Resolved, — "That the word 'President' be omitted in Chap. V. Sect. 3, of the By-laws; and also, that the following words be omitted in Sect. 4 of the same Chapter of the By-laws: 'Five of which shall be taken from the list of those who are already of the above-mentioned committee.'"

Mr. Donovan continued the reading of his paper on the early chemical and alchemical physicians.

Dr. Petrie exhibited an ancient Irish crozier of great beauty of execution, and supposed to be a work of the tenth century, which had been recently obtained by Cardinal Wiseman in

London; and also the celebrated crozier and mitre of Cornelius O'Deagh or Dea, Bishop of Limerick from the year 1400 to the year 1426, when, as Ware acquaints us, he resigned his bishopric in order to live a retired life. This crozier and mitre are now the property of the Right Rev. Dr. Ryan, R. C. Bishop of Limerick.

Dr. Petrie stated that he had the honour to exhibit these most interesting remains at the request of his respected friend, the Rev. Dr. Russell, of Maynooth College, who had kindly consented to their being deposited for a time in the museum of the Academy, in order that they might be seen by its members, their friends, and those who take an interest in such matters generally; and he added that, as the Limerick crozier and mitre had been very fully described by the late eminent archæologist, Dr. Milner, in a paper published, with illustrations, in the 17th volume of the Archæologia, and the whole of these interesting remains had been recently treated of by Dr. Russell in a very elaborate and able paper which that gentleman intended for publication, it was not his intention, nor did he think it would be proper, to do more than offer a few remarks, such as appeared to him necessary to direct the attention of the meeting to the most striking features in these beautiful remains of ancient Irish Art, and which were so valuable, as presenting the most characteristic specimens of the distinct styles of design and ornamention which belonged to the widely separated periods of their fabrication.

Having described these characteristic features to the meeting, and expressed his concurrence in the opinions formed by Dr. Russell as to the age and country of these remains, Dr. Petrie avowed an ardent hope, in which he was sure the meeting and the people of Ireland generally would warmly sympathize, that the distinguished possessor of the more ancient crozier, which could now be only regarded as an object of historical and national interest, would see the wisdom as well as propriety of restoring this remain to Ireland, and of securing its preservation by placing it in its most fitting depository, the national museum of our Academy.

Dr. Petrie then moved that the warmest thanks of the Academy be presented to Dr. Russell, for his kindness in permitting these interesting remains to be exhibited at this meeting, and for allowing them to remain so long in the museum of the Academy.

This motion was seconded by Dr. Todd, and passed unanimously.

MARCH 16, 1851.—(STATED MEETING.)

HUMPHREY LLOYD, D. D., PRESIDENT,
in the Chair.

THE Secretary of the Academy read the following Report from the Council:

The second part of the twenty-second volume of the Transactions of the Academy has been published, and the third part is in an advanced state.

The fourth volume of the Proceedings has also been completed, containing an account of the papers read and communications made to the Academy from November 8, 1847, to the 24th June last.

During the past year, as the Academy are already aware, considerable progress has been made in the meteorological and tidal observations, which have been for some time going on under the superintendence of the Committee of Science. The annexed Report, presented by that Committee to the Council, will give the Academy full information as to the progress and present state of this important undertaking.

The Academy are aware that there has been a great effort made during the past year to raise by subscription the amount necessary for completing the purchase of the Betham MSS. There remains now to be collected only the small sum of £38 12*s.*, in order to fulfil the engagement made with Sir William Betham by Mr. Graves, and to render that curious and valuable collection of MSS. the property of the Academy. The Council cannot but express the hope that the friends of Irish literature will soon enable Mr. Graves to report that this sum has been raised, in order that the full balance due to Sir William Betham may be at once handed over to him, and this transaction, so long pending, may finally be wound up.

The following articles of antiquity have been purchased by the Committee of Antiquities during the past year, from the small funds intrusted to them by the Academy:

October 16, 1850.—A bronze figure, curiously inlaid with gold, representing a bishop *in pontificalibus*, holding his crozier in both hands. This figure is supposed to have belonged to an ancient box or shrine; and from the style of art, and the form of the mitre and crozier, is probably a work of the twelfth century.

—— A gold bracelet, consisting of a solid cylindrical bar, weighing 3oz. 15dwts.: the extremities rudely ornamented by engraved lines.

The following articles having been purchased from different parties by Mr. Clibborn, were approved by the Committee, on the same day:

1. A brass pipe-stopper, with the head of King Charles I.

2. A wooden tray, with a very rudely carved head in wood, found in the bog of Allen. The ear is peculiar, resembling that of a satyr; and a fragment remains of one hand applied to the right cheek.

3. The seal of the clergy of Emly, in bronze, fourteenth century.

4. Ancient bronze chisel of a peculiar and rare form.

October 21st, 1850.—A gold lunette or collar, weighing 1oz. 10dwts. 12grs.

November 11, 1850.—A similar gold crescent (but with peculiar and very ancient ornaments) in three fragments, weighing 16dwts.

—— An ancient bronze vessel, with small feet of an unusual construction. Found near Dungiven, in the county Derry.

A large deep pan, of thin bronze. Found in the county Fermanagh.

December 2, 1850.—An ancient Irish crozier head, supposed to be the remains of the crozier of St. Blathmac, of Rath-Blathmac, near Corofin, in the county Clare; and two ancient bronze ecclesiastical bells from the same place.

December 18.—The shaft and upper boss of a very ancient crozier, supposed to be the crozier of St. Columba, formerly belonging to the abbey of Durrow, in the County Meath ; also eleven Anglo-Saxon coins, found at Durrow ; two bronze pins, one of them very ancient, found at Moate; with a silver bodkin, and a horn powder-flask of the reign of William III.

This crozier, although unfortunately much mutilated, is of peculiar historical interest: it still retains some traces of its original magnificence, and must have been a beautiful specimen of ancient Irish art. It was preserved, since the dissolution of monasteries, by the Macgeoghan family, lately represented by Sir Richard Nagle, Bart., at whose death it became the property of Mr. Nugent, who consented to part with it for the Museum, along with the other antiquities here mentioned.

Several valuable donations have also been made to the Museum, which have already been acknowledged by the thanks voted to the several donors by the Academy. A list of them will appear in the forthcoming volume of the Transactions.

The *Mias Tighernain*, an ancient relic which was deposited in the Museum, by its owner, at the instance of Dr. Wilde, and which was the subject of a valuable paper by that gentleman, published some time ago in the Transactions,* has recently been returned, through Dr. Wilde, to its proprietor, Mr. Knox, of Rappa Castle. The thanks of the Academy are due to Mr. Knox, and to the other possessors of remarkable antiquities, for the important service they have rendered to the science of archæology, by depositing such antiquities for a season in our Museum, and permitting the Academy to preserve correct drawings of them.

The Council regret very much that no steps appear to have been taken during the past year towards the preparation of the Catalogue of the Academy's Museum.

* Vol. xxi.

During the past year the following new Members have been elected:

Signor Basilio Angeli.
William H. Hardinge, Esq.
Robert Fowler, Esq.
Hugh Carlile, M. D.
R. Clayton Browne, Esq.
James Gibson, Esq.
Rev. Orlando T. Dobbin, LL.D.
Samuel Gordon, M. D.
Daniel Griffin, M. D.
Henry Hennessy, Esq.
Andrew John Maley, Esq.
Sir Francis Waskett Myers.
William Harvey Pim, Esq.
Ewing Whittle, Esq.
St. George Williams, M.D.
William Oliver Barker, M. D.

The following Honorary Members have been elected:

In the Department of Science.

Alexander D. Bache.

In the Department of Polite Literature.

Augustus Boeck.
Victor Cousin.
Washington Irving.
A. Thiers.

In the Department of Antiquities.

G. T. Grotefend.
L. C. F. Petit Radel.

The following Members have been removed by death during the past year:

1. Andrew Armstrong, Esq., A. M.; elected a member of the Academy, 30th November, 1833: died in Trinity College, on the 22nd of December last.

2. Abraham Abell, Esq., died at his house in Cork, on the 12th February, 1851, in the sixty-eighth year of his age. He was elected a member of the Academy 11th May, 1840. Mr. Abell was well known in his native city for his zeal and activity in promoting the welfare of the literary, scientific, and charitable societies of Cork. He was one of the founders of the Scientific and Literary Society, as well as of the Cuverian Society of that city. He was treasurer of the Cork Library, and a manager of the Cork Institu-

tion. To him we are indebted for having directed the attention of the public and the renewed zeal of Irish antiquaries to the subject of the Ogham inscriptions. He collected from various places a great number of stones inscribed with Ogham characters, and pointed out the importance of examining the inscriptions themselves, instead of depending upon hastily made copies of them, as had previously been the usual course adopted by those who attempted their interpretation. This valuable collection of Ogham stones is now in the museum of the Cork Institution. Mr. Abell was a member of the Society of Friends, and was remarkable for his enlightened philanthropy, and the variety of his literary tastes.

3. The Right Honourable Windham Henry Wyndham Quin, Earl of Dunraven and Mount Earl, &c., died at Adare Manor, in the County Limerick, August 6, 1850, in the sixty-eighth year of his age.

Lord Dunraven was elected a Member of the Academy on the 22nd May, 1843. He had been a Member of the Imperial Parliament for several years, having been first elected as representative of the County Limerick in 1806. He succeeded to the peerage on the death of his father in 1824, and was chosen a representative peer in 1839.

4. Richard Sharpe, Esq., elected a Member of the Academy, 13th January, 1845.

Mr. Sharpe had an hereditary claim to eminence in the noble department of practical science, to which his life was devoted. The chronometers made by his father are still highly prized by those who possess them, and the equatorial made by him for the Observatory of the University is probably more steady than any other instrument of equal dimensions in existence.

The son, however, with equal practical dexterity and zeal for his profession, exceeded the father in inventive powers. Many of his contrivances have been honoured with medals from the Royal Dublin Society and other scientific institutions. But those which have in this way become known to the public bear a very small proportion to the numerous inventions of which no record is preserved. Three of the more remarkable of these may be here noticed.

1. His method of figuring the acting surfaces of the dead beat,

a scapement which, after the experience of a century and a half, still holds the first place with astronomers;

2. The chronograph, in which he carried out the views of Mr. Bergin; and

3. The apparatus which he applied to the pendulum of the principal clocks of the Armagh Observatory.

In the first of these the pallats must combine extreme hardness with perfect truth, especially on the cylindric surfaces from which the scapement derives its peculiar properties. By a simple application of the revolving lap, which when seen is self-evident, he constructed them, even in hard steel or sapphire, with almost mathematical truth.

In the chronograph the task required was to trace on an uniformly revolving disc a spiral line, which could be dislocated during the continuance of any phenomenon, and thus preserve a graphic record of the time on a highly magnified scale.

A little before his death Mr. Sharpe was engaged by Mr. Cooper to combine this principle with the conical pendulum, and would probably have made an instrument capable of being applied with singular advantage to the electro-telegraphic mode of observation, recently invented in America.

The third was intended to obviate a defect which Dr. Robinson suspected to exist in the means of connecting a pendulum with the wheel-work which maintains its motions. This is done in general by a crutch connected by its arbor with the pallats, and at its extremity driving the pendulum rod; the axis of that arbor should be in the same line with the centre of the pendulum's rotation, but this condition can neither be certainly fulfilled nor verified. Mr. Sharpe joined the rod and crutch by a spring resembling a flattened figure of 8, which is of scarcely appreciable elasticity in the vertical direction, but so rigid in the horizontal that it transmits undiminished the full power of the train.

Mr. Sharpe died at his house in Dublin on the 13th of April, 1850, at the early age of thirty-one.

5. Rev. Nicholas John Halpin, elected a Member of the Academy, 10th February, 1845. He was born 18th of October, 1790, at Portarlington, in the Queen's County. He entered Trinity College, Dub-

lin, in the year 1810, and was early distinguished for talent in literary composition. While an undergraduate he gained several Vice-Chancellor's Prizes, and medals at the Historical Society, for English verse. He was ordained in 1816, and appointed soon after to the curacy of Oldcastle, in the diocese of Meath, which he held for nearly twenty years. He was struck with paralysis on the 4th of April, 1850; and, after a painful illness, expired on the 22nd of November, 1850, aged 60. Except a few sermons, and other professional tracts, Mr. Halpin published little; but he has read here from time to time some essays on subjects connected with the dramatic and poetical literature of the Elizabethan period. His principal publications were in connexion with the Shakspearian Society. "Oberon's Vision," a beautiful illustration of a remarkable passage in the "Midsummer Night's Dream," was published in 1843, and attracted considerable attention. "The Bridal Runaway," or an examination of a passage in "Romeo and Juliet," appeared in 1845. Both these tracts are among the Shakspearian Society's publications.

His last work was entitled "The dramatic Unities of Shakspeare." This was published in 1849, and is an ingenious examination of the way in which Shakspeare managed to preserve the illusion necessary for the purposes of the drama, and the artifices by which, in his works, he overcomes the difficulty of exhibiting, within the time which the performance of an hour or two occupies, the incidents of a story occupying, in their actual occurrence, a much longer period. The principle by which Mr. Halpin thinks that Shakspeare's management of time is governed, he illustrates by an examination of the story of the "Merchant of Venice." Mr. Halpin was a Member of the Council of the Academy, on the Committee of Polite Literature, for the last two years.

The following Honorary Members died during the past year:

1. The Right Hon. the Marquis of Northampton, died 16th January, 1851.

2. William Wordsworth, died 25th April, 1850.

3. Thomas Amyot, Esq., died 28th September, 1850.

THIRD REPORT OF THE COMMITTEE OF SCIENCE RELATIVE TO THE METEOROLOGICAL AND TIDAL OBSERVATIONS.

[Received by the Council, March 8, 1851.]

The Committee of Science, having been intrusted with the organization and superintendence of the Meteorological and Tidal Observations, believe it to be their duty to submit to the Council an account of the progress of that undertaking, from the period of their last Report on the subject to the present time.

At the period referred to, the plan of observation had been definitively arranged; the coast-guard stations had been selected, with the sanction of the Comptroller-General; and the necessary orders had been issued by that officer to the inspecting commanders of the several districts. The Committee, in consequence, placed themselves in communication with these officers, and the result of that communication has been a partial modification of the arrangement of the stations originally proposed. Portrush, in the county of Antrim, has been substituted for Ballycastle; and Killybegs, in the county of Donegal, for Mullaghmore. Old Head and Ardglass were subsequently abandoned as tidal stations, chiefly on account of difficulties connected with the erection of the tide-gauges; but the Committee deeming it important that their places should be supplied by new stations on the north-eastern and western coasts, an application was made by the Council to the Comptroller-General on the subject, in the month of October, the result of which has been the establishment of the tidal stations of Cushendall, in the county of Antrim, and Bunown, in the county of Galway. The coast-guard stations, twelve in number, are accordingly the following:—On the East Coast—Portrush, Cushendall, Donaghadee, Kingstown, Courtown, and Dunmore east; and on the West Coast—Buncrana, Killybegs, Bunown, Kilrush, Cahirciveen, and Castletownsend.

Upon the suggestion of the Committee, an application was made by the Council to the Ballast Board, requesting their co-operation. This application was favourably received, and orders were in consequence issued to the light-keepers at some of the principal light-houses round the coast, directing them to give the required aid in the meteorological observations. The situation of the light-houses being generally elevated and exposed, co-operation in the tidal observations was deemed impracticable. As the result of this negociation, meteorological observations are now carried on, on the plan laid down by the Council, at the light-houses of Killough, in the county of Down, Killybegs, in the county of Donegal, and Inishgort, in the county of Mayo.

Concurrently with these arrangements, the necessary instruments were ordered from Mr. Yeates and Mr. Dobbyn, the details of their form and construction having been previously considered by the Committee, and the estimates for their cost submitted to the Council and approved of. They were completed in the beginning of July last, and were soon after forwarded to the stations then agreed upon, all the thermometers having been previously compared with the standards belonging to the Dublin Magnetical Observatory. The tubes required for the tide-gauges being of considerable dimensions, and these dimensions being necessarily different in different localities, it was thought advisable that they should be constructed at the stations. Directions for their construction were, in consequence, prepared, and a printed copy forwarded to each station.

In the months of September and October all the stations then agreed on were visited, on the part of the Committee, by Dr. Lloyd, Mr. Haughton, and Dr. Apjohn, for the purpose of superintending the erection of the instruments, and of instructing the observers in their use. The visitors likewise conveyed, by hand, the barometer tubes (previously filled with care), to the several stations, measured the heights of the cisterns, and compared the instruments, when erected, with the standard barometer of the Dublin Magnetical Observatory, by means of good portable barometers. They also measured the differences of level between the zeros of the tide-gauges and the Ordnance bench-marks, where such existed in the locality.

In the end of December the recently added coast-guard stations of Cushendall and Bunown, and the light-houses of Killough and Inishgort, were, in like manner, visited by Dr. Lloyd, Mr. Haughton, and Mr. Galbraith, and were soon after in full operation. The expenses of these tours of inspection having been undertaken by the parties themselves, are thereby saved to the Academy.

The following is a memorandum of the principal facts connected with the several stations:

East Coast Stations.

PORTRUSH (Co. Antrim).—The tide-gauge is erected in an angle of the northern pier, close to the spot at which the tidal observations were made in 1842. It was found necessary, however, to deepen the spot by the removal of rubble, and to protect the dial, by cross beams of timber, from the hawsers of vessels approaching the quay. The zero of the tide-gauge is 12·33 feet below the bench-mark on the quay.

The barometer is put up in the guard-house, which is situated on an eminence facing the harbour; and the thermometers and the rain-gauge in a small attached garden. The height of the cistern of the barometer, above the bench-mark, is 23·4 feet. The diameter of the tube is 0·28 of an inch. The four thermometers at this, and at every other station, are inclosed in a shallow box with a sloping roof, open in front.

A vertical gnomon is fixed in the window sill of the guard-house, for the purpose of deducing the time of noon; and the observers are furnished at this, and at all the other stations, with a table of the equation of time computed for the present year, and for the mean longitude of Ireland.

CUSHENDALL (Co. Antrim).—The tide-gauge is erected on the landward side of the new pier in Red Bay. The pier not being completed, it was found necessary to place the gauge at some little distance, so as to stand clear of the sloping side. It is fixed in its place by a frame-work of wooden spars, bound together by ropes and chains; and is connected with the pier by a platform, on which a hurricane-house is erected for the shelter of the observer. The time of noon is obtained from a meridian line, marked by a picket driven into the ground, to the north of the coast-guard flag-staff.

No meteorological observations are taken at this station.

DONAGHADEE (Co. Down).—This is an excellent station for both meteorological and tidal observations. The tide-gauge is erected on the side of the pier, close to the Ordnance bench-mark, and near the guard-house; it is well sheltered, and in deep water. The zero of the tide-gauge is 19·80 feet below the Ordnance bench-mark.

The meteorological instruments are likewise favourably placed: the barometer in the guard-house, and the thermometers and rain-gauge in an inclosed yard connected with it. The meridian line is traced on the sill of a window in the guard-house. The height of the cistern of the barometer was not measured; it is between 3 and 4 feet above the bench-mark. The diameter of the tube is 0·30 of an inch.

Killough (Co. Down).—Lighthouse, St. John's Point.—This is a meteorological station only, and is well circumstanced for such observations. The barometer is put up in the hall of the light-keeper's dwelling; the other meteorological instruments are well placed in a garden attached to it. The meridian-line is traced on the flagging, at the south side of the house, the shadow being given by a vertical iron rail. The cistern of the barometer is 7·8 feet above the base of the light-house tower; the diameter of the tube is 0·28 inch.

Kingstown Harbour (Co. Dublin).—This is a station for tidal observations only. The tide-gauge is erected in the angle at the inner side of the new harbour. This locality is very favourable, as the water is deep, and the case is protected by the pier from the waves which enter the outer harbour from the north-east. The time at this station is taken from the clock of the Dublin and Kingstown Railway.

Courtown Harbour (Co. Wexford).—The tide-gauge at Courtown Harbour is erected beside the wooden pier, which is now used for the unlading of vessels, in consequence of the filling up of the harbour originally built. The situation of the gauge is very much exposed; but as the station was considered by the Committee to be important, it was determined to attempt making the observations with the gauge lashed to the pier. Hitherto the observations have been but seldom interrupted by the violence of the sea.

The barometer is erected in the guard-house belonging to the station; the thermometers and rain-gauge in the garden attached to it, and are in charge of the chief boatman. The diameter of the barometer tube is 0·28 of an inch. The time, at noon, is taken from a brass vertical gnomon, erected on the sill of the guard-house window, facing the south.

Dunmore East (Co. Waterford).—The tide-gauge at this station is erected in an angle of the pier, by which it is sheltered from the large waves which enter the mouth of Waterford Harbour from the south and south-west; it is also protected by a strong chain from the injuries which might be caused by the accidental rubbing of the large fishing-boats which frequent Dunmore Harbour. Although the water is not very deep, there is sufficient depth at spring tides to secure the accuracy of the observations recorded by the instrument. The zero of the tide-gauge is 17·34 feet below the bench-mark on the pier.

The meteorological instruments are erected at the guard-house of the station, which is at a higher elevation than the tide-gauge; the cistern of the barometer being 55·4 feet above the bench-mark. The diameter of the tube is 0·32 of an inch. The time at noon is found by means of a brass vertical gnomon erected in the window of the guard-house.

West Coast Stations.

Buncrana (Co. Donegal).—The tide-gauge was at first erected at Buncrana, attached to a rock near the mouth of the river, by means of iron stanchions; but, on inspection, the site was found to be wholly unsuitable. The instrument was, therefore, with the consent of the inspecting commander of the station, removed to Rathmullan, at the opposite side of Lough Swilly, where it is erected in a good situation, at the head of the pier. A hurricane house has been fixed on the pier, for the shelter of the observer. The meridian line is laid down to the north of the coast-guard flagstaff.

The meteorological instruments are put up at the guard-house at Buncrana, in charge of the chief boatman; the site is not as favourable as could be wished. The height of the cistern of the barometer above high water (spring tides) is forty feet. The diameter of the tube is 0·34 of an inch.

Killybegs (Co. Donegal).—Much difficulty was experienced in making the arrangements for the tidal observations at this station. There are three piers at the town, all well sheltered; but, unfortunately, all dry at low water spring tides. The tide-gauge was consequently abandoned, and two tide-poles employed in its stead. One of these is fixed to the pier in the immediate vicinity of the guard-house, and the other fastened to a rock at a short distance from the shore, the latter being used only when the base of the pier is dry at low water spring tides. The term observations alone are taken. The gnomon, for the time, is fixed to the sill of the window in the guard-house.

It was found advisable to separate the meteorological from the tidal observations at this station, and to intrust the former to the keeper of the light-house at St. John's Point, near Killybegs, the permission of the Ballast Board having been previously obtained. This light-house is admirably circumstanced for meteorological observations. The Academy's barometer was not put up, the barometer belonging to the light-house being found sufficiently good; it is favourably placed in the sitting room of the light-keeper's dwelling. The thermometers are in an angle of the yard at the back of the house; the rain-gauge is attached to an iron railing in the front yard. There is a sun-dial in the front yard, the position of which was examined, and found correct.

Inishgort Light-house, Clew Bay (Co. Mayo).—The whole of Clew Bay was examined with the intention of erecting a tide-gauge; but as there is no pier in the bay which is not left dry at low water, the Committee of Science were obliged reluctantly to give up tidal observations at this important locality. The meteorological instruments are erected at the light-house of Inishgort, and are in charge of the keeper. The barometer belonging to the light-house was found sufficiently good for the observations. It is placed, with a thermometer near it, in the sitting room of the light-keeper. The external thermometers and rain-gauge are erected in a favourable site in the small garden attached to the light-house.

Bunown Bay (Co. Galway).—The tide-gauge is erected at the inner side of the new pier erected in this bay for the accommodation of fishing boats. It is protected by the pier from west and south-west winds, and has the advantage of deep water at the lowest spring tides. So far as position is concerned, this is one of the most important stations on the west coast. The time at noon is found from a brass vertical gnomon, erected in the garden of the chief boatman's house.

No meteorological observations are taken at this station.

Kilrush (Co. Clare).—The importance of having as many tidal stations as possible on the west coast, induced the Committee of Science to undertake the erection of a tide-gauge at Kilrush, although, from its being so far up the Shannon, the station was not as valuable as could be wished. The only place in which the gauge could be erected was at the extremity of the stone pier, facing the river, and consequently exposed to violent gales from the south-west. During the first few weeks of its existence it was twice washed away by the violence of the waves. The zero of the tide-gauge is 20·59 feet below the bench-mark at the pier-head. The time at noon is found by a gnomon attached to the flag-staff near the guard-house.

The meteorological instruments are erected in the guard-house of the station, and are in charge of the chief boatman. The cistern of the barometer is 6·4 feet above the bench-mark. The diameter of the tube is 0·32 of an inch.

Cahirciveen (Co. Kerry).—The tide-gauge at this station is placed in an angle above the bridge, in a very sheltered situation, and having the advantage of deep water at the lowest tides. The only objection to its position is that it is not situated on the open sea, and the tide at Cahirciveen must be considered as a river tide. There is no Ordnance bench-mark at this station. A provisional mark was therefore placed on the corner coping-stone of the bridge; and the zero of the tide-gauge was found to be 23·51 feet below it.

The barometer is erected in the house of the officer of the station, in the town of Cahirciveen, and the thermometers and rain-gauge in the garden attached to it. Their site is not very favourable. The cistern of the barometer is 37·0 feet above the mark on the bridge. The diameter of tube is 0·38 of an inch. The brass vertical gnomon, for finding the time at noon, is placed on the sill of a window of the officer's house.

Castletownsend (Co. Cork).—The tide-gauge at this station is in an excellent position, although rather exposed. It is erected in the open sea, and is held in its place by guys and chains which are made fast to the solid rock. The zero of the tide-gauge is 31·88 feet below the bench-mark at the foot of the flag-staff.

The meteorological instruments are placed in the guard-house, close to the tide-gauge. The cistern of the barometer is 7·0 feet below the bench-mark. The diameter of the tube is 0·26 of an inch. The time at this station is found by means of a brass gnomon, placed on the sill of the guard-house window, and a dipleidoscope belonging to the officer in command of the station.

In addition to the foregoing stations organized by the Academy, meteorological observations are also taken, on the plan laid down by the Council, at the Magnetical Observatory, Trinity College, Dublin; at the Observatory of Armagh, under the direction of Dr. Robinson; at the Observatory of Markree, under the direction of Edward J. Cooper, Esq.; at the Queen's Colleges of Belfast and Galway; at Portarlington, by Dr. Hanlon; and at Athy, by Alfred Haughton, Esq. There are thus, in all, eighteen meteorological, and twelve tidal stations, co-operating in the plan of the Academy.

It remains to say a few words of the financial position of this important undertaking.

The sum of £225 has been voted by the Academy, in two separate grants, for the purchase and erection of the instruments. This sum has been expended; and a detailed account of the expenditure is herewith laid before the Council.* Other sources of expenditure, not originally contemplated, have, however, arisen. The duties of the men employed in the tidal observations being very onerous, the Committee deem it important that they should be enabled to offer a moderate pecuniary reward to those observers who shall discharge them faithfully. In addition to this, other contingent expenses have been incurred, arising from accidental injuries to the instruments, and other causes.

To defray these additional expenses, a further sum of about £200 will be required; and, as the financial resources of the Academy are not such as to afford so large an outlay, it is proposed to raise it by subscription. A circular has accordingly been prepared, and is now in course of circulation, inviting the friends of science in he Academy, and in the country generally, to contribute, and thus

* See Appendix, No. I.

to enable the Committee to carry out to a successful issue an undertaking of great national and scientific importance.

The Committee cannot close this Report without recording the large measure in which the success of the present undertaking is due to the effective co-operation of the Comptroller-General of Coast Guard; and they feel sure, that the Academy will avail themselves of the earliest opportunity to express their grateful acknowledgments to that enlightened officer. They desire also to suggest, that the thanks of the Academy are likewise due to the Ballast Board, and to the other public bodies and individuals who have taken part in the undertaking, for their valuable aid.

It was Resolved,—That the Report of the Council be adopted, and printed in the Proceedings.

It was Resolved,—That the special thanks of the Academy be given to the Comptroller-General of the Coast Guard, for the zeal with which he has seconded the efforts of the Academy in the meteorological and tidal observations; and also that the thanks of the Academy be given to the Ballast Board, and other public bodies and individuals who have aided this undertaking.

The Ballot for the annual election having closed, the Scrutineers reported that the following gentlemen were elected Officers and Council for the ensuing year:

President.—Rev. Thomas R. Robinson, D. D.

Treasurer.—Robert Ball, LL. D.

Secretary to the Academy.—Rev. James H. Todd, D.D.

Secretary to the Council.—Rev. Charles Graves, D. D.

Secretary of Foreign Correspondence.—Rev. Samuel Butcher, D. D.

Librarian.—Rev. William H. Drummond, D. D.

Clerk and Assistant Librarian.—Mr. Edward Clibborn.

Committee of Science.

Sir William R. Hamilton, LL. D.; Rev. Humphrey Lloyd, D. D.; James Apjohn, M. D.; Robert Ball, LL.D.; Sir Robert Kane, M. D.; George J. Allman, M. D.; Rev. Samuel Haughton, A. M.

Committee of Polite Literature.

Rev. William H. Drummond, D. D.; Rev. Charles W. Wall, D. D.; John Anster, LL. D.; Rev. Charles Graves, D. D.; Rev. Samuel Butcher, D. D.; Digby P. Starkey, Esq.; Rev. John H. Jellett, A. M.

Committee of Antiquities.

George Petrie, LL. D.; Rev. James H. Todd, D. D.; J. Huband Smith, Esq., A. M.; Frederick W. Burton, Esq.; Samuel Ferguson, Esq.; Aquilla Smith, M. D.; the Earl of Dunraven.

The Rev. Humphrey Lloyd, D. D., having left the Chair, and John Anster, LL. D., V. P., having been called thereto,

It was Resolved unanimously,—That the most sincere and affectionate thanks of the Royal Irish Academy be, and that they are hereby presented, to their late President, the Rev. Humphrey Lloyd, D. D., for the dignity, diligence, and zeal, with which he has filled their chair, and otherwise attended to the interests of their body, during the last five years.

Sir William R. Hamilton communicated to the Academy a generalization of Pascal's theorem, to which he had been led by the method of quaternions.

Equation of Homodeuterism: $\Sigma\,(\pm\,\mathrm{ABCDEF.GHIK}) = 0$;

ABCDEF = *aconic* function of a hexagon;

GHIK = volume of a pyramid.

Sir Wm. R. Hamilton proposes to give a more full explanation of the nature of this equation of *homodeuterism*, and of what he calls the *aconic* function of a hexagon, at a future meeting of the Academy. The equation itself was exhibited by him to some scientific friends so long ago as the August and September of 1849; and also at the Meeting of the British Association, at Edinburgh, in 1850.

April 14th, 1851.

THOMAS ROMNEY ROBINSON, D. D., President, in the Chair.

John Barker, M. B., and William Kelly, M. D., were elected Members of the Academy.

George Petrie, LL. D., presented a specimen of a vitrified font in the County of Derry.

The President delivered an inaugural Address.

It was Resolved unanimously,—That the President be requested to allow his Address to be printed in the Proceedings.

The President's Address was as follows:

Gentlemen,—It is my first duty to express my grateful acknowledgment of the honour which you have conferred on me; an honour high in the estimation of mankind, highest in mine. Other titles are attained most frequently by the accidents of position or birth; are even sometimes acquired by means which are positively degrading: they are occasionally the prizes of successful intrigue; sometimes even the reward of crime. They are, therefore, no accurate exponents of an individual's superiority in that which constitutes the real nobility of man; their value is conventional, rated highest by the meanest minds, and negative, an actual dishonour, unless they be accompanied by the more sterling decorations of wisdom and virtue. But it is far otherwise with this. In naming me your chief, you have given me the first rank in a Society where all are noble; a Society whose franchise is based on personal excellence, on moral worth, on intellectual superiority; whose guiding principles are the most exalted on which the human mind can rely, love of knowledge, sense of duty, reverence of truth! To be one of your number is itself a high distinction; how much higher to be chosen as your head! how much the highest to be so honoured in one's own country!

Yet I cannot but feel, that in proportion to the dignity of such an office so are also the weight of its duties and the burden of its responsibility; which become still heavier when I compare myself with those who have preceded me in this proud station. Not to speak of the illustrious men who, in the earlier years of the Academy, upheld it by their energy and prudence, and flung over its infant struggles the glory of their own fame, I cannot fail to remember that I follow in immediate succession two of that great triad, who, in this latter time, have especially contributed to win for you that lofty position which you now hold in the realm of science. I know how painfully all here feel, that the third would as surely have filled the place which I now hold, had he been spared to pursue his brilliant career.

But though I may not compare myself to those mighty ones in achievements or power, there are qualities in which I yield neither to them nor to any, and on which, with your aid, I rely to preserve untarnished the sceptre which you have committed to my hand. The first is, devoted attachment to this Academy, which I have cherished and prized above the other scientific societies with which I am connected, during a series of years equalling half the ordinary extent of human life. The second, love of Ireland; pride in all that reveals the value and exalts the renown of my country; intense interest in all that tends to develope the powers and dignify the character of my countrymen. To carry into active effect this sentiment, has been with me a guiding principle through life; and whenever I have had access to the ear of power, or in the ordinary intercourse of scientific and social life, to give it extension and enforcement has been a main motive of my exertion, the aim of my ambition. I love my countrymen, not merely because they are my countrymen, but because there is in them a rich endowment of noble qualities. Their faults are but too apparent; they lie on the surface, and so do the causes of them; but beneath we find an exhaustless treasure of kind and generous feelings; a deeply imaginative and poetic character, which elsewhere is fast disappearing under the influence of affected civilization and utilitarian philosophy, but without which nothing of transcendent excellence is ever accomplished; and lastly, an energy and acuteness of intellect not surpassed by any people in the world. Surely these are heavenly gifts, and ought to unfold into a glorious future! Whatever, therefore, tends that way, whatever trains and guides these noble powers in their legitimate direction, or counteracts the deceptive influences that would make them instruments of evil, is a national blessing.

And such a thing I hold our Academy to be; not merely as an example and encouragement at home, or an evidence abroad of what we can perform, but because the habits which it requires of united exertion, of calm and dispassionate judgment, of steady and unvarying application, are among the most important elements of national happiness and glory. Without them the brightest qualities are a curse instead of a blessing.

It may, perhaps, be expected that I should now make some reference to those rich contributions which this Society has given to the treasury of knowledge; some estimate of their brilliancy and worth. This, for the present, I must decline; first, because it has already been admirably done on many occasions by my immediate predecessor; and secondly, because the train of thought into which I have been led is so completely in unison with the anticipations by which the founders of the Academy seem to have been guided, that it may not be unprofitable to develope it more fully.

In the Preface to the first volume of our Transactions, all of which is well worthy of your attentive consideration, this passage occurs, among many others of similar import:—"Whatever tends by the cultivation of useful arts and sciences to improve and facilitate manufactures; whatever tends by the elegance of polite literature to civilize the manners and refine the taste of the people; whatever tends to awaken the spirit of literary ambition, by keeping alive the memory of its ancient reputation for learning, cannot but prove of the greatest national advantage. To a wish to promote in these important respects the advancement of knowledge in this kingdom, the Royal Irish Academy for Science, Polite Literature, and Antiquities, owes its establishment; and though the members who compose it are not entirely without hope that their efforts may become extensively useful, yet the original intent of the institution must be considered as confining their views, for the present, more immediately to Ireland. If their endeavours shall but serve to excite in their countrymen some sense of the dignity of mental exertion, if their exhortation and example shall be so far successful as to become the means of turning vacant thoughts to science and to utility, their labours are abundantly recompensed."

You see they designed the Society which they were organizing to be an instrument of moral as well as intellectual cultivation; and to this we owe our peculiar constitution, admirably suited to such a purpose, but having no exact counterpart in any scientific body with which I am acquainted. It stands almost alone in the extent of its objects. Others are limited in general to a single department of inquiry, or even a small section of one: we have *three*, connected by no closer union than what exists between demonstration, conjecture, and fancy. It might be thought, that they could scarcely be brought into any harmonious co-operation, and that there could be but little sympathy between those who cultivate them. It might be expected, that the archæologist could not take any very strong interest in scalars and vectors, or the transcendental geometrician in the half-obliterated legend of a battered coin, and that they would only agree in their contempt of Punic dialogue or Assyrian orthography. Our plan is also liable to these objections, that polychrest machines seldom work well; that an object is best attained by undivided effort; and that the energy which, when confined in a single channel would be irresistible, is lost if you divide it into many streams. This opinion has latterly prevailed so far, as to induce philosophers, in many instances, to split into secondary societies those previously existing: it, however, seems to me to grow from a narrow and imperfect view of the subject. It is true that, in some respects, though not in all, the cultivation of particular branches of science may be benefited by this system of isolation; but there is ample ground for doubting whether it be equally beneficial to the cultivators. The mind that is restricted to some engrossing pursuit, and shut out from a wide range of thought and activity, cannot but suffer; for it seems to me that a variety of objects and employments is as essential to a healthy development of man's intellectual powers, as a variety of food and exercise to those of his body. You may in the latter nourish particular muscles to enormous strength, if you confine yourself to the exclusive and unremitting practice of some one kind of exertion; but you do it at the expense of the rest; they waste away, and the individual who is deformed by such disproportion can never be considered a perfect specimen of the human figure. And so is it also with the mind: it may indeed, by a concentration of its activity on one object, acquire in respect of that an intensity of power; but on the whole it loses: the balance of its powers is disturbed; the decay of those faculties which are left inert more than compensates the partial vigour, and the result is far more than an average depreciation. But this narrowing of the mind has a danger much greater than mere loss of power, which Bacon saw clearly when in those words of weighty meaning, with which many of us are familiar, he warned us to beware of "the idols of the cave." The mind that retires from the broad expanse of its intellectual domain to some secluded nook, where it may devote itself undisturbed to the admiration of some favourite object, makes there for itself a den, where the little light that finds entrance is coloured and confused. It may from habit be able to find an easy path among the darkest windings of that abode, where one accustomed to the full daylight must grope his way with difficulty; but its vision is not the less imperfect. In that doubtful twilight all is distorted from its true form and magnitude; the things which it follows assume strange and fantastic shapes, become objects of visionary reverence, and are at last enthroned by it as idols to which it gives the worship due to that which should be its sole divinity, the spirit of truth. Well, too, if that wild dwelling become not also a lair of wilder influences! This oracle of the great hierophant needs no interpreter but experience: in every department of knowledge you find its fulfilment; errors glaring to all but their victim, while he thinks them axioms; blind and presumptuous exaggeration of the extent and power of his own acquirements, absurd and contemptuous disparagement of all with which he is unacquainted. Look at the mist with which sulphur and phlogiston so long darkened chemistry! Look at Boreel explaining vital actions by mechanical principles, or Cumberland demonstrating ethics by the sixth book of Euclid. Look at one man referring everything to electricity, another to magnetism; one declaring man to be a mere association of infusoria, another an assemblage of voltaic currents; this antiquarian correcting the history of Herodotus from the poem of Firdûsi, that discovering that the Hydra of Hercules was a native of Killarney! But you will say this is madness: no, it is only the end of a chain of aberrations, whose first link is the almost imperceptible predominance of some idea or system; and had these dreamers been dragged from their dens, had they been compelled to look at their idols in the broad daylight of wider and more varied knowledge, to scan them under the rough but just criticism of the votaries of other shrines, their delusions would have vanished. But yet worse remains: there is the far greater danger, that where a number of individuals are congregated with faculties intensely bent on one common object, the legitimate spirit of emulation may degenerate into envy and hatred, or self-esteem be exalted till it blots out all memory of our duty to man and God. It is known to most of us, how, towards the close of the last century, the naturalists of the Royal Society trampled on its physicists and mathematicians, and not long since (*fas sit audita loqui*) the ascendency of the latter became in its turn a cause of irritation and jealousy. The death of Lavoisier still throws a painful shadow over the memory of Fourcroy. Halley rejected Revelation, because he would not be satisfied with any evidence which had not the rigour of geometric proof; and a greater than Halley has argued from the theory of probabilities *against* Christianity and *for* mesmerism.

But even waving the consideration of its injurious influences on the mind, the advantage to be derived from the isolation of scientific pursuits is more apparent than real. In fact it is impracticable to any great extent; for there is no branch of science which does not inosculate with many others. Take, for example, the geologists, who were the first to act on this system of separation. None are more ready than they to press into their service the geometry of Hopkins, or the earthquake-dynamics of Mallet; and the deepest fountain of their power springs in zoology. The two greatest triumphs of human intellect, the Principia and Mecanique Celeste, owe their very existence to the data of the practical astronomer, and even take a little from the literature of Greece and China. The most exclusive antiquarian is glad to obtain light from chemical investigation, or borrow an eclipse from the astronomer; and must honour that science which formed those powers of keen analysis and severe induction which have torn the veil from the mysteries of Ogham. Accordingly philosophers are retracing their steps, and feel the necessity of recombining their societies into large and powerful unions; they have performed this in our own isles, among our transatlantic kinsmen, in Germany, France, and Italy; with results so successful as to give the highest guarantee for the wisdom of such a course. In these new bodies the essential condition is a separation of departments, bound together into harmony of action and unity of purpose by a common organization, and an equal participation of authority and power. In this, which exactly defines the system of the British Association, you find a correct description of our own constitution. Honoured, therefore, be the memory of our founders! who, anticipating this important result by more than fifty years, selected from the crowd of possible combinations that which not only secures the good and avoids the evil that I have indicated, but was, perhaps, the only one which, under the existing circumstances, contained in itself a principle of permanent vitality. Doubtless to it we owe not only our present prosperity but our actual existence. If you look at the early volumes of our Transactions, and examine the list of our original members, you will see how far the department of Literature predominated; and will be convinced that a society which had been organized on a base either purely scientific or archæological must have perished at once, and left scarcely a tradition of its existence. It is true that afterwards the chemistry of Kirwan, and the geometry and astronomy of Brinkley, gave powerful aid; but I remember well, and I see valued friends here who still remain to bear witness with me to the fact, that there were times when we were unable to muster even a quorum for ballot; and when the sole principle that saved us from dissolution was the habit of union, the feeling of personal attachment, and the interchange of kindness and courtesy, to which this Institution had trained its Members. But though those times have passed, and though we now stand at an elevation of which your founders never dreamed, yet let us not forget, in the season of triumph, the principle to which we owe it. That principle is equality of consideration and power in each of our departments. No doubt many will be ready to dispute its truth, and assert the supremacy of their favourite pursuits; but let such beware of "the Idols of the Cave." Each individual thinks that the noblest for which he feels himself most highly gifted; but for that very reason he is the worst possible judge as to the relative value of any other. We have already seen that this system affords the best means of general intellectual development; let us also consider how it bears on the elements of our power.

Our power depends on the place we hold in public estimation at home and abroad; these two react on each other. Abroad we can be known only by our publications; while they appear regularly, and maintain their present high standard of value, so long we shall command the suffrages of the world; the honour which we win is reflected on our country, and therefore we are upheld and cherished by our countrymen. But it would be unsafe to rest on this alone, or strain the chivalry of sentiment too far. We must also make our countrymen take a direct and personal interest in our proceedings; we must mark out for ourselves a range of exertion, which shall as far as possible conciliate the sympathy and co-operation of all. Now it is unquestionable that, with reference to the approbation of the world at large, the mathematical part of our Transactions holds the highest place. This is just; but let us never forget that, were our pursuits restricted to that one science, we should soon be unable to publish a single volume. Such investigations are not of general interest; the number of those who can read, much less appreciate them, is inversely as their value; and though there is probably in this room a larger per-centage of persons thus competent than could be found in any similar assembly in Europe, you would wonder, if I reckoned their names, to find so few. Yet on those few the rest of you rely; you accept with confidence their estimate of the value of such researches, and in that faith *you* supply the means of presenting them to the world. This is as it should be; but it is only just that your confidence be returned. You have a perfect right to demand from the geometrician a similar concession; you are entitled to expect that, for instance, if he be ignorant of the language or history of Ireland, he shall trust to the antiquarian on subjects where the acquirements of the latter are essential. The more firmly we are convinced of this (which is in truth the only true base of prosperity as a body) the safer we shall be. We can never forget it without lessening our usefulness and weakening our power: it is enforced by prudence as well as justice; for we must look to the departments of Literature and Antiquities as the main sources of our national influence. Those transcendental achievements to which I have referred act through a remote and exterior zone; the others bear more powerfully on one which, though of less extent, surrounds us in immediate contact, from which we draw the elements of our body, in whose movements our existence is involved. Whatever tends to interest our countrymen in our pursuits, strengthens our hands; and it is needless to show that in this respect the objects which are most popular must be most powerful. You have hitherto carried out this principle most effectually, and I now insist on it the more, as an application of it to the special action of one of your committees may not be unworthy of your consideration. Two of them have lately devoted themselves to work which will give us an additional claim on the gratitude of the Public. The Committee of Science is superintending a survey of the tides and meteorology of our island; both subjects of peculiar interest, the first from the remarkable facts which Mr. Airy's discussion of them has made known, and from variations of the mean sea-level round our shores, as yet inexplicable by theory, and therefore requiring most careful examination; the other from its striking contrast with continental climates, and its display of oceanic influence, whose working must be important on organic life, perhaps even on national character. The Committee of Antiquities, besides the service which it conferred on us and the world in establishing our Museum, that glorious fragment of the vanished past, is about to complete its tribute to the ancient renown of Ireland by describing and illustrating its treasures. This is no easy task; yet when the Council lay before you the arrangements for its execution which they recommend, you will, I think, be satisfied that it will be completed in a manner worthy of its subject and of you.

I must, however, regret that we cannot point to any similar exertion of the Committee of Polite Literature. It is true that times are much changed since its institution; the periodical press now opens a more appropriate course for much that would have belonged to its department; and, notwithstanding the practice of some Continental societies, there are (I think) few among us who would venture before such a meeting as this to recite their own verses. But a wide field remains. Ethnology in all its provinces; all that relates to history, or philosophy of language; the character, the rise and decline of the literature of nations:—in all these can nothing be found to interest our friends and increase our honour? One is so obvious that I cannot refrain from suggesting it for your consideration. We have added to our early store of Irish manuscripts the collection of Smith, and now that of Betham; both, I believe, of extreme rarity and value. It is certainly much that these precious relics have been saved from dispersion, perhaps destruction; but I cannot bring myself to feel that this is enough to compensate the generous bounty which has enabled us to acquire them, or to answer the claim which the literary world has a right to urge for a knowledge of their contents. To watch over their conservation, to arrange them in a manner worthy of their value, to give a catalogue of them,—not a dead, arid list of names, but one which shall exhibit the mind and manner of each author as well as his matter, such as shall be a clear and satisfactory guide to ulterior research,—this, as it would certainly repay the labour bestowed on it, and be in the truest harmony with our duty to our country, so it never can be executed under happier auspices, and if deferred for a few years may be totally impracticable.

I have thus endeavoured to lay before you the rules by which, in my opinion, our conduct should be guided; rules, at least, which have ever guided *me* in relation to the Academy, and ever shall guide. If we abide by them I see no reason to doubt the future. There still remain with us, in undiminished splendour, most of the commanding minds to whose power we owe our present pre-eminence; others are rising, worthy to co-operate with them, and in due time to succeed them; nor need we fear that genius and energy will ever fail among our people. Still less have I any dread of that greater calamity, that in the pursuit of knowledge we may make shipwreck of Faith; that Science, while like sunlight it reveals the wonders of earth, may obscure those of heaven. That temptation has over us but little hold; our temperament is too poetic, too reverential, too religious! If there be any cloud that throws a shadow over our prospect, it is the dread of DISUNION, that bane of Ireland, whose poison has tainted every page of her history from the beginning to the present time; whose baneful influence has made of no avail the valour of her heroes, the genius of her bards, the wisdom of her sages, and the piety of her saints! I say this, not from any belief that it has as yet found entrance among you; on the contrary, all my experience has shown that in this respect you are honourably distinguished above most other societies; and I hold the lesson which your example has thus given as one of the greatest blessings which you have conferred on your country. Yet be ever on your guard, and therefore let me conclude by giving you a charm against the serpent, which I received from one who seldom spoke in vain.*

"Look to the true ends of knowledge! Seek it not for amusement, for contention, or that you may look down on others! Seek it not for profit, or fame, or power, or mean things of the sort, but for its own dignity and the improvement of life! Make it perfect, and wield it in gentleness and love! For by desire of power angels fell; by desire of knowledge, men. But of love there can be no excess, and by it neither angel nor man was ever endangered."

It remains now to enter on the duties to which you have called me. May I justify your choice! I rely on the zealous co-operation of you all; I rely on the talents and prudence of the Council whom you have appointed to assist me; but I rely above all on the highest aid, Him, without whom all else is vain. May He bless our labours to our own improvement, happiness, and wisdom; to the advantage of our fellow-men, and a fuller manifestation, to ourselves and them, of His goodness, His glory, and His power!

* Preface to the Novum Organum.

The President, under his hand and seal, nominated the following Vice-Presidents for the current year:

Rev. C. W. Wall, D. D., Vice-Provost, T. C. D.
John Anster, LL. D.
James Apjohn, M. D.
Rev. Humphrey Lloyd, D. D.

Rev. Charles Graves read a communication from Edward J. Cooper, Esq., on comets.

Rev. Samuel Butcher read a paper by the Rev. Francis Crawford, on the connexion between certain terminations of words in the Hebrew and in different Indo-European languages.

The author has long been of opinion that a close connexion exists between Hebrew and the Indo-European family of languages; and that this connexion is not confined to the *radical* elements of these languages, but extends also to the *formative* elements. The object of the present paper is to exhibit some instances of the affinity which he has found to exist between the latter.

He first notices the class of stem-words formed by adding to the original root, or some other stem, the liquid *l* preceded by a vowel.

Thus, in *Latin*, we have

ag-il-is,	from	*ag-o.*
doc-il-is,	,,	*doc-eo.*
fac-il-is,	,,	*fac-io.*
fid-el-is,	,,	*fid-es.*
ann-al-is,	,,	*ann-us.*

In Latin the vowel which precedes *l* is *a*, *e*, or *i*. In *Greek* the same mode of formation is found, but the vowel is more generally *α*; thus:

ἄζ-αλ-έος,	from	*ἄζ-ω*.
δειμ-αλ-έος,	,,	*δεῖμ-α*.
θαρσ-αλ-έος,	,,	*θάρσ-ος*.
᾿νυ-άλ-ιος,	,,	*ἐνυ-ώ*.
εἴκ-ελ-ος,	,,	*εἰκ-ὸς*.

In *Welsh* again the favourite vowel seems to be *o*, though a diphthong also is frequently employed. Thus, we have

gwr-ol, manly,	from	*gwr*, a man.
gormes-ol, oppressive,	,,	*gormes*, oppression.
oes-ol, aged,	,,	*oes*, age.
tad-ol, fatherly,	,,	*tad*, a father.
mab-awl, filial,	,,	*mab*, a son.

The *Anglo-Saxon* also presents the same mode of formation; thus,

deag-el, coloured,	from	*deag*, colour.
fret-ol, greedy,	,,	*fret-an*, to devour.
gif-ol, liberal,	,,	*gif-an*, to give.

The true explanation of this formative suffix, which is found in so many different languages, the author believes to be furnished by the Irish, in which language there is a formative amail = *like*, which in pronunciation is usually shortened into a monosyllable, and might be written, according to dialectical varieties of pronunciation, *awl*, *ail*, or *eil*. Instances of this mode of formation in Irish are common; thus,

cailc-amail, chalky,	from	cailc, chalk.
dreach-amail, well-featured,	,,	dreach, form.
grim-e-amail, warlike,	,,	grim, war,

Whilst in Irish the full form amail is *written*, though not pronounced, the other languages exhibit the abbreviated form in their *orthography* also, under the forms *ol*, *el*, and *il*. Sometimes we find the lengthened form in the latter also; thus, in Latin, we have

am-*abil*-is, from am-o.

But the point which the author desires mainly to establish is, that a kindred mode of formation to that above described exists in Hebrew, and admits a similar explanation. Thus, we find in Hebrew a large class of proper names ending in ל preceded by a vowel; and these proper names are obviously expressive of some characteristic property belonging to the persons or places which they denote. Thus, we have

אורי־אל, fiery,	from	אור, light.
ארי־אל, lion-like,	,,	ארי, a lion.
חנב־אל, compassionate,	,,	חנן, to pity.
נתנ־אל, bountiful,	,,	נתן, to give.
רעו־אל, friendly,	,,	רעו, a friend.

In the above and similar examples, the author regards the final affix as belonging to the same mode of formation above indicated in the languages of the Indo-European family. According to the commonly received opinion, the suffix in all these cases is the name of God, אל.

But it is not only in the mode of formation just noticed that the author discovers an affinity between Hebrew and the Indo-European languages. He finds another resemblance in the case of the suffix *bar*, ־בר, *e. g.*

גד־בר, a treasurer,	from	גז, treasure.
דת־בר, a lawyer,	,,	דת, law.

Gesenius has already compared this suffix ־בר to the Persian ور (*war*), and German *bar*, in such words as *acht-bar*, *ehr-bar*, &c. Mr. Crawford detects it also in the Irish -ṁaṗ or

-ḃar, which is pronounced either *war* or *var*, and which is a very common formative suffix, *e. g.*

> aḋ-ṁar, fortunate, from aḋ, luck.
> raṫ-ṁar, prosperous, „ raṫ, prosperity.
> dul-ḃar, doleful, „ dul, = *dol-eo.*

He is also of opinion that the Hebrew termination ־מר־ is also sometimes referable to the same head. As an example he selects the word נמר, a leopard, properly *spotted*, which he compares, both in root and formative affix, to the Irish neiṁ-ṁar, spotted.

A third point of resemblance between Hebrew and the Celtic branch of Indo-European is found in the Hebrew termination ָה *ah*, which is nothing more than a softened form of the Irish adjective suffix -aċ = aṁail. Thus, אוריה denotes *fiery*, and so is identical in meaning with אוריאל, above noticed. The י in these formations would accordingly be merely a union-vowel. In this way a great number of proper names are disposed of which are commonly supposed to contain as their final element the name of God, יה. Thus, in the example selected, the ordinary interpretation of the name is "the flame of Jehovah."

A fourth point of resemblance is found between the Hebrew adjective termination ִי and the Irish -iḋe, in which the consonant is silent. Thus אורי, fiery, is equivalent to אוריה and אוריאל. To the same origin Mr. Crawford would refer the *-id* in cand-*id*-us, and similar words.

The Hebrew, fifthly, agrees with the Irish in its formative affix ־מן = aṁain, which is found in such words, *e. g.* as fanaṁain, from fan, to stay. As an illustration of this the author selects the Hebrew ארגמן, which denotes reddish-purple, and which he finds to be identical, both as to its root and affix, with the Irish earċ-aṁain. This formation he finds in Latin, *e. g. con-amen, cert-amen*, from *con-or, cer-to ;* and in Greek, *e. g.* Μελπ-ομεν-η, from *μέλπω* ; and in certain participles, as *τυπτ-ομεν-ος*, from *τύπτω*.

Lastly, the termination יון־ in Hebrew is identified with the Irish termination -ıon. Thus, in the former language, we find, *e. g.*,

דמ־יון, likeness, from דמת, to be like.
נק־יון, purity ,, נקה, to be pure.

And in the latter we have

leıᵹ-ıon, learning, from leıᵹ-ım, to read.
baın-ıon, female, ,, bean, a woman.

This formative element also appears in the inflection of some Latin words : *e. g.* nat-*ion*-is, leg-*ion*-is, reg-*ion*-is, from natio, regio, legio, respectively.

APRIL 28TH, 1851.

THOMAS ROMNEY ROBINSON, D. D., PRESIDENT, in the Chair.

ON the recommendation of the Council, it was

RESOLVED,—That the sum of £50 be placed at the disposal of the Council for the purchase of antiquities.

READ,—The following Report of the Council :

" We recommend that immediate steps be taken to prepare a Catalogue of the Museum. So long as we are without an accurate list of the articles contained in it, we have no guarantee for their safety beyond the vigilance and integrity of the Curator. It is also obvious, that the want of a proper descriptive Catalogue greatly diminishes the usefulness of the Museum.

"We propose that the Catalogue be prepared in the following manner.

"The entire work to form an octavo volume, not exceeding twenty sheets, or 320 pages, to be illustrated by woodcuts, not exceeding 160 in number.

"The work to be divided into Fasciculi, each complete in itself, and comprising the description of a class of objects, such as the Gold Ornaments, the Weapons, &c.

"That the complete manuscript of each Fasciculus be submitted to the Committee of Publication before it is put to press.

"That George Petrie, LL. D., be requested to undertake the preparation of the Catalogue, subject to the foregoing conditions; and that a sum of 100 guineas be paid him as a remuneration for his labour; with permission to the Treasurer to pay him by instalments, on the completion of each Fasciculus, at the rate of five guineas per sheet; the balance to be handed to him on the completion of the whole work, provided that the whole work does not fall short of fifteen sheets.

"That the Committee of Publication be charged with the execution of this design, and that they be requested to confer with Dr. Petrie respecting the details of it."

Resolved,—That the Report of the Council be sanctioned, and adopted by the Academy; and that the sum of £105 be placed at the disposal of the Council, for the purpose stated in the Report.

The Rev. Samuel Haughton, Fellow of Trinity College, and Professor of Geology in the University of Dublin, communicated a short account of Experiments made by the Rev. Joseph A. Galbraith, Fellow of Trinity College, Mr. S. Wilfred Haughton, Mechanical Engineer, Superintendent of the Locomotive Department of the Dublin and Kingstown Railway, and himself, to determine the Azimuthal Motion of the Plane of Vibration of a freely suspended Pendulum.

"The experiments, of which the following is a brief account, were made at the engine-factory of the Dublin and Kingstown Railway Company, with different modes of suspension, upon a pendulum 35 feet 5 inches in length, the bob of which was of iron made spherical in a lathe, with a point turned true, projecting from its lower surface: its weight being 30lbs., and the pendulum being set in motion in the plane of the meridian. After some unsuccessful trials of various modes of suspension, we adopted one, which appears liable to less theoretical objection than any other we could undertake at a short notice. It consisted simply of a number of parallel fibres of hemp or cocoon silk, drawn tightly through a small hole in a thick metallic plate, at the upper surface of which the fibres were secured. This plate was then screwed down upon a metal surface, accurately planed and levelled, with a large circular aperture to allow the string of the pendulum to play freely. The silk or hemp fibres were continued for about ten inches below the under surface of the plate, and the remainder of the string of the pendulum was composed of copper or pianoforte steel wire. Underneath the point of suspension we placed a horizontal table furnished with graduated circles, round the common centre of which travelled a moveable arm, divided into tenths of an inch by parallel lines. We were enabled by this simple contrivance to read off the azimuth of the plane of vibration from the opposite sides of the circle, and at the same time to measure with precision the magnitude of the minor axis of the small elliptic vibration which accompanies the movement.

"In order to try the mode of suspension used by M. Foucault himself, we replaced the hemp fibres by a pianoforte wire drawn tightly through a hole carefully drilled in a thick steel plate, this being mounted as in the preceding experiments. Our observations were taken, during the earlier experiments, at intervals of five minutes, which we afterwards changed to ten minutes; and having thus determined the important points, we watched these continuously, using an interval of twenty minutes for the other portions of the motion.

"The two experiments with hemp fibres occupied a time exceeding sixteen hours each. The experiments with the wire suspension occupied periods of twenty hours each, and the experiments with the silk fibre suspension occupied fifteen and nineteen hours respectively. At the close of these periods the motion was distinctly visible, and being almost rectilinear, the direction of vibration could be determined with considerable accuracy.

"The results of these and subsequent experiments will shortly be offered to the Academy in detail; at present we shall confine ourselves to an abstract of those results, and to a brief comparison of the theory of M. Foucault with observation.

"The facts which we observed, without making any allowance for instrumental error, apsidal motion due to the difference between the arc of vibration and its sine, or disturbances produced by the air, may be expressed by the following statements, the initial motion being in the meridian:

"I. The azimuthal velocity diminished from the commencement of the motion, attaining a minimum in the position between E. 30° N. and E.

"II. The azimuthal velocity increased after it had passed the east, and attained a maximum, which appeared to lie between S. 40° E. and S.

"III. The motion of the azimuthal plane near the south and south-west appeared very unsteady, as if greatly affected by disturbing causes; but indicated a general tendency to increase its rate from S. to S.W.

"The azimuthal velocity derived from M. Foucault's theory is expressed by the following equation:

$$\frac{dA}{dt} = k \sin \lambda, \tag{1}$$

in which A denotes the azimuth measured from the north towards the east; k the angular velocity of the earth, *i. e.* 15° per hour; and λ the latitude of the place of observation. This expression indicates a uniform angular velocity, and a time of revolution equal $24^h \times$ cosec. of latitude, which for Dublin would be about $29^h\ 50^m$.

"The following Table, No. I., contains the mean results of the six experiments, giving the azimuth measured from N. to E., and the mean hourly motion, during the successive hours of observation:

TABLE I.

Hour.	Hourly Motion.	Azimuth.	No. of Experiments.
I.	12·86°	12·86°	6
II.	11·90	24·76	6
III.	11·61	36·37	6
IV.	11·50	47·87	5
V.	11·72	59·69	5
VI.	10·82	70·41	4
VII.	9·85	79·46	4
VIII.	10·77	90·23	4
IX.	13·00	103·30	6
X.	11·47	114·77	6
XI.	13·94	128·71	4
XII.	15·99	144·70	4
XIII.	14·32	159·02	4
XIV.	12·42	171·44	5
XV.	6·96	178·40	5
XVI.	16·97	195·37	4
XVII.	10·40	205·77	3
XVIII.	12·38	218·15	3
XIX.	11·01	229·16	3
XX.	12·15	241·31	2

" The next Table, No. II., contains the mean hourly motion and azimuth, calculated from the theory of M. Foucault.

Table II.

Hour.	M. Foucault.	
	Hourly Motion.	Azimuth.
I.	12°	12°
II.	"	24
III.	"	36
IV.	"	48
V.	"	60
VI.	"	72
VII.	"	84
VIII.	"	96
IX.	"	108
X.	"	120
XI.	"	132
XII.	"	144
XIII.	"	156
XIV.	"	168
XV.	"	180

" A comparison of Tables I. and II. shows that M. Foucault's azimuth appeared to fall short of observation during the first, second, and third hours; that it agreed with observation during the fourth and fifth hours; afterwards exceeded the observations, until, at a period occurring during the twelfth hour, it again coincided with the observed azimuth; became deficient again during the thirteenth, fourteenth, and fifteenth hours; and coincided with observation in the early portion of the sixteenth hour.

" If M. Foucault's azimuths be compared with the observed azimuths at the end of every three hours, the agreement will appear more close.

TABLE III.

Hour.	Calculated Azimuth.	Observed Azimuth.
III.	36·0°	36·37°
VI.	72·0	70·41
IX.	108·0	103·30
XII.	144·0	144·70
XV.	180·0	178·40
XVIII.	216·0	218·15

" A comparison of Table III. with Tables I. and II. would appear to indicate, that the variable part of the hourly motion is due to instrumental error.

" I may mention, in concluding this abstract, that in our sixth experiment, with silk fibre suspension, we obtained a complete revolution in azimuth of 360°. The time occupied in the revolution being 28^h 26^m."

[*Note added in the Press, May* 16, 1851.—" Before we commenced our experiments, and at the tine when the foregoing communication was made to the Academy, we had obtained a theoretical solution of the pendulum problem, founded on the supposition, as a first approximation, that the tension of the string of the pendulum was constant. The complete integrals obtained on this hypothesis, gave a value for the azimuth, which indicated a variable angular velocity of the plane of vibration. This solution of the problem we have since found to be erroneous, and therefore believe, that the variation in velocity which we have observed is due to instrumental error. The differential equations which we made use of, and which contain the complete solution of the problem are the following:

$$\frac{d^2x}{dt^2} = -\frac{gx'}{r+l} + N\frac{(x'-x)}{l};$$
$$\frac{d^2y}{dt^2} = -\frac{gy'}{r+l} + N\frac{(y'-y)}{l}; \qquad (2)$$
$$\frac{d^2z}{dt^2} = -\frac{gz'}{r+l} + N\frac{(z'-z)}{l}.$$

"In these equations the origin is the centre of the earth, the positive axis of z is the axis of rotation of the earth directed upwards; the positive axis of y is directed towards the spectator, and the positive axis of x to the right hand; x, y, z denote the co-ordinates of the centre of oscillation of the pendulum; x', y', z' the co-ordinates of the point of suspension; g is the attraction of the earth; l the length of the pendulum, and N is the tension of the string.

"If equations (2) be transformed to the point of suspension as origin, the positive axis of z being vertically downwards, the positive axes of x and y being in the horizon, and directed towards the east and north respectively, we shall obtain the following:

$$\frac{d^2x}{dt^2} + \frac{Nx}{l} = 2k\sin\lambda\frac{dy}{dt} + 2k\cos\lambda\frac{dz}{dt} + k^2x; \qquad (3)$$
$$\frac{d^2y}{dt^2} + \frac{Ny}{l} = -k^2r\cos\lambda\sin\lambda - 2k\sin\lambda\frac{dx}{dt} + k^2\sin\lambda(y\sin\lambda + z\cos\lambda);$$
$$\frac{d^2z}{dt^2} + \frac{Nz}{l} = g - k^2r\cos^2\lambda - 2k\cos\lambda\frac{dx}{dt} + k^2\cos\lambda(y\sin\lambda + z\cos\lambda).$$

"Or supposing the axes of co-ordinates transformed to the vertical and horizon of the actual spheroid, and supposing g to denote gravity, we find

$$\frac{d^2x}{dt^2} + N\frac{x}{l} = 2k\sin\lambda\frac{dy}{dt} + 2k\cos\lambda\frac{dz}{dt} + k^2x;$$
$$\frac{d^2y}{dt^2} + N\frac{y}{l} = -2k\sin\lambda\frac{dx}{dt} + k^2\sin\lambda(y\sin\lambda + z\cos\lambda); \qquad (4)$$
$$\frac{d^2z}{dt^2} + N\frac{z}{l} = g - 2k\cos\lambda\frac{dx}{dt} + k^2\cos\lambda(y\sin\lambda + z\cos\lambda).$$

" If the terms depending on k^2 be neglected in equations (4), we obtain

$$\begin{aligned} &\frac{d^2x}{dt^2} + N\frac{x}{l} = 2k \sin\lambda \frac{dy}{dt} + 2k\cos\lambda \frac{dz}{dt}; \\ &\frac{d^2y}{dt^2} + N\frac{y}{l} = -\ 2k\sin\lambda \frac{dx}{dt}; \qquad (5) \\ &\frac{d^2z}{dt^2} + N\frac{z}{l} = g - 2k\cos\lambda \frac{dx}{dt}. \end{aligned}$$

Eliminating N between the first two equations, we find

$$y\frac{d^2x}{dt^2} - x\frac{d^2y}{dt^2} = 2k\sin\lambda\left(y\frac{dy}{dt} + x\frac{dx}{dt}\right) + 2k\cos\lambda\, y\frac{dz}{dt}.$$

Integrating this equation, we obtain the following:

$$y\frac{dx}{dt} - x\frac{dy}{dt} = k\sin\lambda\,(x^2+y^2) + 2k\cos\lambda\int y dz. \qquad (6)$$

Transforming (6) to polar co-ordinates, by the formulæ

$$\begin{aligned} x &= l\sin\phi\sin\theta, \\ y &= l\cos\phi\sin\theta, \\ z &= l\cos\theta, \end{aligned}$$

in which ϕ denotes the azimuth measured from the north, and θ the deviation of the pendulum from the vertical, we find

$$\frac{d\phi}{dt} = k\sin\lambda - \frac{2k\cos\lambda}{\sin^2\theta}\int\cos\phi\sin^2\theta d\theta. \qquad (7)$$

This equation proves, that the azimuthal velocity consists of two parts; one uniform, and equal $k\sin\lambda$, directed from the north to the east; the other periodic, and passing through all its changes in the time of an oscillation of the pendulum, and depending on the amplitude of the vibration. As the azimuth ϕ may be considered constant during the time of an oscillation, the second term in equation (7) may be integrated. Hence we obtain,

$$\frac{d\phi}{dt} = k\sin\lambda - \tfrac{2}{3}k\cos\lambda\cos\phi\,.\,\theta; \qquad (8)$$

θ being a small arc, the powers of which above the third may be neglected, and vanishing twice during each oscillation.

"From equation (8) it is easy to see, that the plane of oscillation undergoes a periodic variation in azimuth; in consequence of which the projection of the centre of oscillation of the pendulum on the horizon will describe a curve resembling a figure of eight, in which, if the pendulum be in the meridian, the motion in the northern loop is retrograde; and in the southern loop progressive.

"The variation in azimuth produced by the second term of equation (7) will be insensible, unless θ become nearly equal to π, in which case the change in azimuth will become indefinitely great; for, integrating (7), we find, the initial motion being in the meridian,

$$\frac{d\phi}{dt} = k \sin \lambda - k \cos \lambda \frac{\theta - \sin \theta \cos \theta}{\sin^2 \theta}. \qquad (9)$$

If in this equation θ be equal to π, the second term will be infinite and negative, denoting that the plane of vibration swings round suddenly to the west. This result is evident without analysis; for if the pendulum be started in the meridian, so as to pass the lowest point with a velocity due to twice its length, it will reach the top of the circle without velocity, and fall suddenly to the west, in the prime vertical.

"If the pendulum were to perform a complete revolution with a high velocity, the time of revolution in azimuth of the plane of its motion would tend to the limit $23^h\ 56^m$; but when the motion is oscillatory, the theoretical time of revolution in azimuth will $23^h\ 56^m \times \operatorname{cosec} \lambda$, as has been proved for small arcs of vibration by M. Binet. *Comptes Rendus de l'Acad. des Sciences*, Feb. 17, 1851)."]

Professor Allman read a notice of the emission of light by *Anurophorus fimetareus* Nicholi (*Leptura fimetarea*, Linn.) During a walk over the Hill of Howth, near Dublin, on a dark night in February last, he was struck with a luminous appearance in the earth, when disturbed to the depth of three or four inches; the light proceeded from numerous distinct points, and lasted for more than a minute after its first appearance. On carrying home some of the phosphorescent earth, Dr. Allman was enabled to trace the phenomenon in question to the presence of numerous living individuals of *Anurophorus fimetareus*, from each of which there proceeded in the dark a faint but very evident emanation of light. Specimens of the insect preserved alive in a glass phial continued for many nights to exhibit this beautiful phenomenon, which was also witnessed by Dr. Stokes and Mr. Haliday, as well as by numerous other friends, whose attention was directed to it by Dr. Allman. The light could not be traced to any definite point in the insect. The Anurophorus was very abundant on the hill, and subsequent observations proved, that the dark peaty soil which abounds in some places on Howth was almost the only part of this district from which it could be affirmed to be absent.

May 12th, 1851.

JOHN ANSTER, LL. D., Vice-President, in the Chair.

Francis Codd, Esq.; Rev. Johnston Brydges Sayers; Vincent Scully, Esq.; and Robert D. Lyons, Esq., M. B.; were elected Members of the Academy.

The special thanks of the Academy were given to Pierce Morton, Esq., for his donation of an old manuscript copy of the Domesday Book, in seven volumes folio, formerly the property of Dr. Charles Morton.

A stone ball, found in the Lower Castle Yard, was presented to the Museum by Captain Williams; and the episcopal seals of Dr. Elrington, successively Bishop of Limerick, and

Leighlin and Ferns, were presented by Joseph Faviere Elrington, Esq.

The Rev. Samuel Haughton read a paper entitled "Theoretical Considerations respecting the original Fluidity of the Earth and some other Planets, deduced from their observed Figures."

Dr. Kennedy Baillie, being called upon by the President to read his Memoir on two ancient sculptures* preserved in the Manuscript Room of the Library of the University, commenced with dividing his subject into the Philological and Archæological; the first including notices respecting the epigraphs; the second, relative to the type of ancient art, according to which the anaglyphs were elaborated.

Beginning with the former, he explained, in the first place, the use of the lineole over the letters ΚΛ in the bust of Thelymítres: secondly, the true meaning of "Thelymítres," assigning his reasons for considering it in a quite different sense from that entertained by Smith: thirdly, the signification of the epithet *φίλανδρος*, which he proved to have been, in the present case, one of honour.

His fourth subject of investigation were the interesting details suggested by *ὁ θρέψας* in the second line, as to the relations which subsisted between the *Θρεπτῆρες* and the *Θρεπτοί*, as also the full meaning of the offices termed *Θρεπτήρια*. This inquiry was extended to the relations which obtained between the tutelary deities, *Προστατήριοι*, and individuals respectively under their guardianship, their *Θρεπτοί*, the acknowledgment of which, in the ritual of the ancient Greeks, was the offering of the *Πλόκαμος θρεπτήριος*. The universal observance of

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* The reader is referred to the "Proceedings of the Academy," of the 25th January, 1841, for important notices respecting these Anaglyphs, submitted by the Rev. J. H. Todd, D. D., now S. F. T. C. D., as preliminary to those now presented.

this rite amongst the ethnic peoples was then proved, in the course of which argument a view respecting the origin of the Nazaritic rite amongst the Hebrews, adverse to the theory of Spencer on the same subject, was proposed.

All these details were accompanied with references to standard authorities, and particularly to epigraphic records, as the undoubted exponents of the customs and sentiments of the Greeks.

His next subject of consideration was the mutilated inscription, with a view to its probable restoration.

His first step was to prove that it must have been a Χαριστήριον, that is, "an offering of gratitude for benefits which had been conferred." His second was to define the meaning of 'Αττικός, whether it should be received as a Proper name or an Ethnic: in the course of which discussion he took occasion to disprove the views of Smith, offering at the same time his reasons for adopting the first of these meanings, namely, that 'Αττικός was the actual name of the donor, and that he was a Greek of unmixed descent. These several positions were established by references to inscriptions; and by pursuing the same course, it was demonstrated, that Smith's proposed identification of this Αττικός with either of the individuals of the same name who flourished in the times of Trajan, Hadrian, and the Antonini, cannot hold good.

The third subject of inquiry consisted in an endeavour to determine the Original of the anaglyph. In order to this, four possible objects of representation were proposed: a Mythical, in the person of the foundress of the Myesian city: an Allegorical, as impersonating the community: a Religious, in the person of a tutelary: an Historical, in the person of an individual, who was enabled by her position to influence the state's weal.

These were considered in the following order: the Tutelary; the Foundress; the Impersonation of the community; the Historical personage.

The first of these was found to be admissible on the ground of an extensive numismatical research: the second, on the contrary, inadmissible, on the ground of the absence from the anaglyph of her constant symbolical accessaries: the third was found to be admissible, but on a lower ground of probability, as compared with the first. This reduced the discussion to a comparison of the first and fourth; in order to estimate the respective claims of which to be received, the author next proceeded to identify the site termed in the epigraph ἡ Νέα Μυησίων Πόλις.

A comparison of two passages, one in Stéphanos of Byzántion, the other in Strabo, enabled him to draw a definite conclusion, viz., that this site could have been none other than the Ionian Neápolis; which inference was further corroborated by showing, that a very general mode of expressing Νεάπολις amongst Greek writers was, to disjoin the components of the word, Νέα and Πόλις, and then allow them their separate inflexions.

It was next proved, on the testimony of Strabo, that Héra, the tutelary of Sámos, was either that of Neápolis, or entitled therein to the consideration of such; on which ground a conclusion was formed, that Héra was in some form or another represented in the anaglyph.

This led to a discussion of the claim of the Historical personage, and an endeavour to fix on some particular one who might be considered as entitled to a paramount consideration.

In order to this, the probable age of the epigraph was discussed, on the evidence afforded by two of its characters, Σ and W, and this was tested by the coiffure represented in the anaglyph. The independent evidences of both these suppositions supplied a limit of age commencing with the epoch of Antoninus Pius, and terminating with that of Septimius Severus.

The next step was to review the claims of the Augustæ comprised within this interval; in prosecuting which, a marked coincidence was ascertained in the person of one of them with the fact which had been elicited from Strabo respecting the subordination of Neápolis to Sámos, and, therefore, the claim of the tutelary of the latter to worship in the former.

It was ascertained on the authority of a Phrygian inscription, as well as of a coin of Karía, that the Augusta here referred to, namely, Fulvia Plautilla, the consort of Caracalla, had been deified during her life by the Greeks, under the name of *Νέα Ἥρα*, and that in an especial manner, she having been mentioned as such without the accompaniments of either her family name or her imperial title.

It was next proved, concurrently with an explanation of the cause, that the members of the family of Septimius Severus had been honoured in an especial degree by the Grecian communities.

From all these premises a twofold conclusion was deduced; firstly, that Plautilla, in her Heræan impersonation, was the subject of the anaglyph: secondly, that the offering made by Attikós was of the Charisterial class.

This furnished sufficient grounds for the restoration of the lost members of the epigraphs: viz., of the first line, by the introduction of the Heræan title; of the second, by its confirmation of a former conclusion, deduced from more general considerations, as to the Charisterial import.

The evidence of coins which had been struck in the early part of Plautilla's career was next interrogated, and found to be corroborative of this inference, as well from the general contour of the features, as the special type of the coiffure.

From a combination of all these evidences, the following restoration of the titulus was proposed:

ΤΗΝΝΕΑΝΗΡΑΝΕΙΣΤΗΝΝΕΑΝΜΥΗΣΙΩΝΠΟΛΙΝ
ΥΠΟΜΝΗΜΑΤΗΣΕΥΧΑΡΙΣΤΙΑΣ . ΑΤΤΙΚΟΣ

MAY 26TH, 1851.

JOHN ANSTER, LL. D., VICE-PRESIDENT, in the Chair.

ON the recommendation of the Council,

IT WAS RESOLVED,—That in the event of M. De la Ponce being elected a Member of the Academy, his collection of manuscripts relating to the Irish Brigade, now in the custody of the Assistant Secretary, be accepted as equivalent to the sum of twenty guineas, his entrance fee and life composition.

The Maps of the Geological Surveys of the Counties of Dublin and Wexford, were presented by J. B. Jukes, Esq., on the part of Her Majesty's Government.

The small cinerary urn, noticed and figured in the Proceedings, vol. iv. pp. 35, 36, was presented to the Museum by Charles F. Johnson, Esq., on the part of Mrs. Beauchamp Newton, Bagnalstown. In addition to the original notice of its discovery already printed in the Proceedings, Mr. Johnson, in his note, explained, "that this urn or cup was found in a rude stone coffin composed of six pieces of freestone granite, during the formation of the Irish South-eastern Railway, at Knocknecoura, near Bagnalstown, in the county of Carlow. There was another piece of earthenware, of a much larger size, in this coffin, but it was unfortunately broken to pieces by the labourers, in their struggles to ascertain its contents, which were nothing but dust and charcoal."

A highly ornamented carved oak chest, with an inscription in English on it, and the date 1616, was presented to the Museum, by Barclay Clibborn, Esq., of Hall, County Westmeath.

Five volumes of manuscripts, comprising the original returns collected from all parts of Ireland, during the recent agricultural distress, by the Irish Relief Association. Presented by the Rev. C. H. Minchin, on the part of himself and the other Honorary Secretaries.

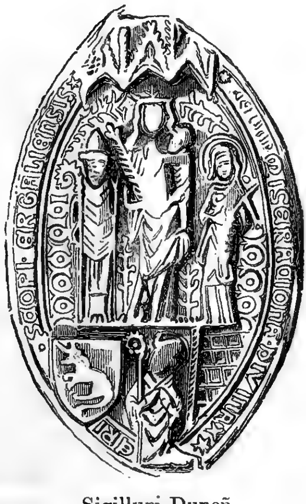
The Secretary, on the part of the Rev. William Reeves, D. D., read a notice of a record preserved in the Chapter-house, Westminster: the original of which is written on a piece of parchment, five inches seven-eighths long and nineteen inches and a half wide, the names of the seals being written on the straps to which the seals are attached.

"To the kyng oure souverain lord.

"Meekly Beseecheth your mooste Noble Hieghnesse and pre-excellent grace youre humble Subiectes and servantes whose Seales vnto this presentes beth affixed with all the faithfull and trwe liege peaple of Therldome of Vlster whiche some tyme was named the third moost Rialle Erldome in Christiante and nowe in defaute of lordiship and peaple with youre enmyes daly destroied and under tribute constitute and thraldom ȝe graciousely to considre the said thraldome and tribute with the importable werres vpon youre said liege peaple daly continued both by see and land by see with Bretones and with Scottes of the oute Iles whiche beth w[t] Irishmen enmyes of the land confedered that is to say w[t] Oneyll bwy Okane m[c]gwylyn henry Oneylle Con Oneylle m[c]gyunusse m[c]cartan and the Offlynnes whiche with in shorte tyme fynally and vtterly woll destroye youre said Erldome and peaple withoute that it be by youre mooste gracious hieghnesse provided to send vnto theym a certain of peaple to inhabite and to defende youre said grounde othir to send vnto youre faithfull servant and trwe liege man Janico Savage youre Senescall of Vlster whiche hath kept and defende youre said cuntray w[t] grete aventure daly in drede he and his men withe grete Care hunger thurste watching blodeshed and mannys slaghtie ayens youre said Enmyes mortell and yeven many grete slaghties and Scomfettes in the whiche his frendes that was to hym mooste socoure beth slayne and passed vnrewarded as yett: suche fees outhir suche rewarde wher with he may wage Sawdiours to resiste and to defende your said Enmyes and kepe youre said cuntray to be sped within shorte tyme othir ellys youre said peaple woll fynally be destroied and youre said cuntray w^{t} youre Enmyes conquered wating daly and nyghtly whanne the said Scottes of the oute Iles of Scotland with the said Irishmen confedered shal vtterly distroie theym. Thiez premissez to be remembred and remedied by youre said preexcellent grace. We mekely at the Reuerence of almighty Jesu which by his prophete moises delyuered the childeren of Israel oute of the thraldome and bondage of Kyng pharoo besecheth in way of charite And we daly to pray for the preseruyng of youre maieste roiall Beseching mekely more ovir youre preexcellent grace that it might please youre hieghnesse to geve vnto the berers herof Thomas lambert and dauid Callan in the circumstaunce of the premissez faith and credence."

The following are the signatures annexed to this document, with fac-similes of the remaining seals:

No. 1.

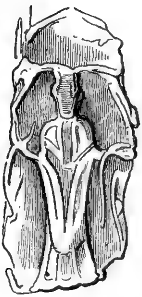


Sigillum Duneñ
ꝛ Conneren Epĩ.

No. 2.

Prioris de
Duno.

No. 3.



Archid̄
Duneñ.

No. 4.

Ab̄b̄tis de
Bangore.

No. 5.

Ab̄b̄tis de
Saballo.

No. 6.

Ab̄b̄tis de
Ines.

No. 7.

Ab̄b̄tis de
Iugo Dei.

No. 8.

[No Seal.]

Magr̃ Sc̄i
Ioh̄is Bapt̃e.

No. 9.

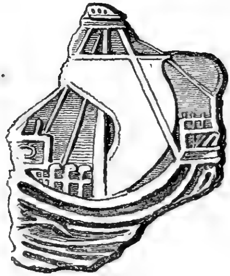
[No Seal.]

S. Coīe ciuitat̃
de Duno.

No. 10.
[No Seal.]
Georgi Russhel
Baronis.

No. 11.
[No Seal.]
Ville de
Ardglasse.

No. 12.



Ville de
Kilcleth.

Dr. Kennedy Baillie, having been called upon to read the conclusion of his memoir on the University sculptures, commenced the Archæological division of his subject by an examination of the meanings attached by the Greeks to the terms Ἄγαλμα, Ἀνδριάς, Εἰκών, and Πίναξ.

He then proceeded to details respecting the imports of the expressions *Εἰκὼν γραπτή*, *Εἰκὼν γραπτὴ ἔνοπλος*, *Εἰκὼν γραπτὴ ἐν ὅπλοις ἐπιχρύσοις*, *Εἰκὼν γραπτὴ τελεία*.

His next step was to discuss the analogy between the *εἰκόνες ἔνοπλοι* and the "Clypei," "Clupea," or "Clypeatæ Imagines" of the Romans.

His conclusion from the passages of Pliny, Macrobius, Suetonius, and other writers, in which distinct mention has been made of these, was, that the Greek and Roman denominations were synonymous; and that the opinion of Professor Böckh, which would limit the sense of *Εἰκόνες ἔνοπλοι* to pictorial forms, is not entitled to reception.

This was followed by a consideration of the title "Medallion Busts," assigned to the anaglyphs; which terminated in its approval, as a sufficiently intelligible form of expression, but not accurately designative of the artistic type according to which they had been elaborated. This type was regarded as holding a middle place between the ancient "imagines clypeatæ" and the "medallions," thus marking a transition in the progress of the glyptic art.

The next subject which he submitted to the notice of the Academy were two inedited Patmian inscriptions, which constitute part of his collection of tituli formed during his travels in Greece. The first of these contained fourteen lines composed in the elegiac metre, the last six of which had suffered very much from injuries inflicted by time and perhaps barbarism.

The task which he undertook was, to effect a restoration of the whole to a consistent form, by a comparison of the poem with similar compositions of Greek authors. He then proceeded to read a literal translation of the verses so restored, the general subject of which were notices respecting the Artemisiac worship established in Pátmos, and, subordinately to these, the praise of the island, as having been the scene of the liberation of Oréstes from the vengeful persecution of the Erinyes, consequent upon the murder of Klytaimnéstra.

The second titulus was a fragment of a decree on the part of the *Κοινόν*, or "General Convention" of the Icarian *Παράκτιοι*, in favour of a benefactor of the community named Chrysóstomos. A literal translation of this monument also was given, on the basis of restorations which had been effected by adopting the municipal phraseology of certain inscriptions forming part of the author's collection.

June 9th, 1851.

GEORGE PETRIE, LL.D., in the Chair.

Ven. M. G. Beresford, Archdeacon of Ardagh; Christopher Fleming, M. D.; Thomas Hone, Esq.; John Edward Pigot, Esq.; Monsieur Amadie De la Ponce; Robert Ross, Esq.; and Catterson Smith, Esq.; were elected Members of the Academy.

Mr. M. Donovan read a paper on Concert Pitch, and the means of determining its vibrations.

Mr. Donovan commenced his communication by requesting indulgence while he made a few observations which might at first appear to have but little connexion with the objects of the Academy, but without which the utility or necessity of the communication itself would not be apparent. He then proceeded with an account of concert pitch during the last 160 years, its fluctuations, uncertainty, and ill-effects on the voice of public singers. Musicians have, however, at length come to an understanding on the subject, and have to congratulate themselves on the cessation of the confusion under which they have so long suffered. The pitch having fluctuated through all the shades of an interval of three semitones, each has had its trials: experiments have been made on the adaptation of the powers of musical instruments to the capabilities of voices, with this important result, that the Philharmonic and Opera pitches are now identical with each other, and with that of the French Conservatoire. We may consider that concert pitch is now permanently fixed: this, therefore, is the proper time for ascertaining and strictly defining it, so that, should it be ever lost or disputed, it may be recovered and identified in all countries and in all times, independently of pitch-pipes, pitch-forks, or the caprice of musicians. The precise meaning in which concert pitch ought to be understood was then explained, as also the means by which instruments ought to be tuned to it.

Concert pitch is determined by the number of double vibrations which any string or pipe makes in a given time. The apparatus used by the author for ascertaining the number was then described: he described the means by which he attained a standard pitch. Some experiments were detailed, the calculations founded on them were entered into, and the results stated. The present concert pitch was shown to be at all times attainable and recoverable by throwing a steel wire of a certain length, diameter, and tension, into vibration, so that it shall quit and return to the point of inflection a certain number of times, within a given period.

Calculations and processes were then entered into, for obtaining the proper wire at all times, in case of its being no longer manufactured or sold. Means of proving or testing its qualities, and examples, were given. Necessity of great precision in these processes was proved by the instance of wires differing in diameter by the one-thousandth part of an inch, sounding notes which differed by very nearly a semitone. The errors of Mersenne in attributing the pitch of bells to their composition, and in estimating the effect of the component metals, were noticed. Similar mistaken notions were shown to have been acted on by the makers of piano-fortes.

The Rev. Professor Dixon exhibited a model intended to illustrate the azimuthal motion of a freely suspended pendulum, of which he gave the following account:

" This model is constructed on the principle, that we may consider the parallel of latitude, along which the point of suspension of the pendulum is carried by the diurnal rotation, to be made up of a number of elements, each of which coincides with the corresponding element of a great circle tangent to the parallel, and consequently that the vertical passing through the point of suspension and centre of the earth may be conceived to move through a succession of small angles in a series of planes perpendicular to the axes of the great circles above referred to. These, which may be called *directive axes*, lie on the surface of a cone whose axis coincides with that of the earth, and whose angle equals twice the latitude. In the model, a graduated circle fixed on the vertical shows the deviation of the meridian from the plane of oscillation, after a period of time indicated by an hour circle attached in the usual way to the axis of rotation. If the successive positions of the directive axis were taken indefinitely near to one another, the expression for the azimuthal motion would be

$$A = H \sin \lambda,$$

where A is the angle made by the plane of oscillation with the meridian, after the earth has described the angle H round its axis, and λ is the latitude of the place of observation. The model is so constructed as to enable the directive axis to be placed in the positions it occupies at the termination of periods of half hours, and the error in the value of A produced by this approximation is so small as to be almost insensible on a model of the size of the present one, and much less than that necessarily arising from defects of construction."

The Rev. Charles Graves, D. D., communicated a formula containing a symbol which denotes rotation through a given angle, and round a given axis, by means of rectangular coordinates and differential coefficients.

"Sir William Hamilton, by his calculus of quaternions, has arrived at a simple mode of denoting rotation round an axis.

"Using Q to denote the quaternion whose amplitude is θ, and whose axis has given directive cosines, he finds that

$$QQ'Q^{-1},$$

represents the quaternion Q' after its axis has been turned through the angle 2θ round the axis of Q.

"In other words,

$$Q(\ )\,Q^{-1}$$

is the *symbol of rotation* round the axis of Q through an angle equal to the double of its amplitude.

"I am not aware that any symbol, expressed in the terms of our previously existing calculus, has been assigned to the same operation. It is not difficult to prove by geometrical considerations, that the symbol

$$e^{\theta\psi},$$

where

$$\psi = \cos\alpha\left(z\frac{d}{dy} - y\frac{d}{dz}\right) + \cos\beta\left(x\frac{d}{dz} - z\frac{d}{dx}\right) + \cos\gamma\left(y\frac{d}{dx} - x\frac{d}{dy}\right),$$

denotes rotation through the angle θ round the axis which passes through the origin of rectangular co-ordinates, and makes with the axes the angles α, β, γ.

"So that if

$$F(x, y, z) = 0$$

be the equation of a surface,

$$e^{\theta\psi}\,F(x, y, z) = 0,$$

will be the equation of the same surface after it has undergone the rotation already described.

"By means of this symbol, and purely in virtue of the laws of the received analysis, I have succeeded in demonstrating the known theorems concerning finite rotations and their composition. I freely admit, however, that my proofs are less simple than those which the calculus of quaternions has furnished; just as my fundamental symbol of rotation is less simple than that which Sir William Hamilton has made known to us."

June 23rd, 1851.

THOMAS ROMNEY ROBINSON, D. D., President, in the Chair.

Joseph Napier Higgins, Esq., was elected a Member of the Academy.

Lord Talbot de Malahide, on the part of the subscribers, presented the collection of Irish manuscripts purchased by them from Sir William Betham.

The following letter, from the Rev. R. V. Dixon, was read by the Secretary:

"*West Chapel-Buildings, Trinity College,*
"*June* 23, 1851.

"Sir,—As I am about to make an attempt to realize a project which I have had in contemplation for some time, and in which I must look for success, mainly, to the co-operation of persons interested in scientific pursuits, I am anxious to bring the subject under the notice of the Members of the Royal Irish Academy, with the hope that they will kindly assist me in carrying it out. The project to which I refer is the establishment of a cabinet or museum for the reception of philosophical instruments and apparatus fallen into disuse, and discarded in consequence of subsequent improvements.

"I need not dwell upon the importance of such a collection. It would serve admirably to illustrate the progress of science in any department in which it could be rendered tolerably complete; and I am disposed to think, that this could be effected in several to a greater extent than might at first sight appear possible. For, notwithstanding the loss of many interesting articles which has already taken place, and is daily occurring, owing chiefly to the want of such a cabinet as that which I propose establishing, I have reason to believe that there still exists a considerable number of old philosophical instruments, both in the possession of private individuals and also in public collections and museums, where they are generally looked upon as mere curiosities, and where, from their isolated position, they scarcely deserve to be regarded in any other light. Such articles, however, if they were collected together, and arranged in historic series, would acquire a real value and importance; and I am sure that, in many instances, their present possessors would be glad to have an opportunity of transferring them to a collection where their true value would be thus recognised and appreciated.

"It has occurred to me, that such a museum would be most advantageously established in connexion with the School of Natural and Experimental Philosophy in our University, where the nucleus for its formation already exists, and where its permanence and security would be insured. I have accordingly solicited and obtained permission from the Board to undertake its formation in connexion with that School, and will feel much indebted to the Members of the Royal Irish Academy, if they will kindly give me their assistance in carrying out the project, both by making it known as extensively as possible, and also by using their interest to procure donations of such articles as will add to the interest and value of the collection.

"I have the honour to remain, Sir,

"Your obedient Servant,

"ROBERT V. DIXON,

"*Erasmus Smith's Professor of Nat. and Exp. Philosophy.*

"*To the Secretary of the Royal Irish Academy.*"

Mr. Robert Mallet read a paper giving an account of his experimental determination of the limits of the transit rate of propagation of waves or pulses, analogous to those of earthquakes, through solid materials.

The experiments, of which this was a record, were conducted during three years past, at Killiney Bay and on Dalkey Island, off the Irish coast, and had for their object to determine the rate at which a pulse produced by the explosion of gunpowder, both in the discontinuous medium of the sand of Killiney Bay, and in the nearly continuous one of the granite of Dalkey Island, was propagated through these respective solids for given distances. In the case of the sand, the rate of transit might be presumed the slowest possible, in that of the granite the fastest, due to any media forming considerable portions of the earth's crust. Hence determinations in these would give the limits of earthquake wave motion, supposing such waves to be quite analogous to those experimentally produced.

The range chosen in the sand at Killiney Bay was a measured half mile, and the powder used in each mine was twenty-five pounds; in the granite at Dalkey Island, the range was about half this distance, and the charge for each mine, sunk in a jumper-hole of twelve feet in depth, was from twelve to fifteen pounds. The precautions taken for measuring both bases, the peculiar arrangements for firing the mines by galvanic battery, and for simultaneously releasing and stopping the chronographs, or instruments by which the interval of time of the explosion from the moment of ignition, and that of the pulse from its setting out to its arrival at the observer, were determined and registered, were minutely described; as also the new instrument devised by the author, and called by him the seismoscope, by which those minute and rapidly travelling pulses were made visible to the eye, and capable of being distinctly observed. The transit rates, as thus determined, were given, and compared with the recorded speed of earthquake waves in some great earthquakes in India and elsewhere;

and the instruments employed in these experiments were exhibited in action before the Academy.

The author made some remarks as to the unexpected slowness of transit of these pulses, and ascribed deficiency of velocity as predictable from the theory of elastic moduli, as probably due to the imperfect homogeneity and continuity of the media operated on. The relation that his results bore to those recently obtained as to the rate of sound in wrought iron, as determined in France, suggested that the hitherto received theory of sounds in solids would probably require to undergo revision.

Sir William Betham read a paper on the account of Thomas de Chaddisworth, Custodee of the Temporalities of the Archbishop of Dublin, from 1221 to 1256, from the Great Roll of the Pipe.

"The Academy require no evidence to satisfy them, that in historic importance the records of the country are the surest and safest guides to the historian. No histories of Ireland, yet published, synchronize with the records, but for the most part are delusive and erroneous.

"Nearly half of the last decade of the first moiety of a century has passed since I commenced an investigation into the ancient records of Ireland; and my accumulation of volumes of manuscripts on the subject surprise even myself. Much was done by the Record Commission, appointed in 1810, and the ponderous volumes published by it demonstrate the value of the muniments of the country, although they have not accomplished an object at all commensurate with the expenditure.

"Little was done by that Commission to preserve them, or make the records available. The subject has been brought under the consideration of the Government of many administrations; about four years since commissioners were appointed to investigate the present state of the Irish records; their report has been made, and a bill was prepared to provide for their safe custody, which has been long in the hands of the

Treasury, but nothing farther has been done. Many of the records may be said to be in not responsible *custody;* others in unpaid custody, without even an allowance for keeping them clean; and have been so for thirty years, and, but for the *con amore* zeal of the keepers, might have been altogether unavailable to the Public.

"I mention this as a preface to the paper I am about to bring under notice, because the Academy may justly be considered, and have shown themselves, the anxious protectors and guardians of all documents which tend to illustrate the history and antiquities of Ireland.

"Long since, I considered the document I am about to read would be acceptable; it is but one of many, and I found it difficult to decide which I should first bring forward, and various causes have conspired to prevent my reading any. I may mention one that I purpose laying before the Academy on a future occasion; it is *A Tabular View of the Customs received at the various Seaports of Ireland, from about the Middle of the Thirteenth to the Fifteenth Century;* during which period New Ross was the port at which the largest public revenue was received.

"The archbishopric of Dublin, before the coming of the English, possessed lands and immunities which were very little, if at all, affected by the Conquest: the conquerors touched *not holy Church.* The jurisdiction as to the administration of laws within the archbishop's possessions I do not at present take into consideration; the evidence I have been able to collect not being sufficiently clear to enable me to draw satisfactory conclusions.

"Shortly after the Conquest, John, *Earl,* or *Count, of Moreton* (for the dignity was Norman, and not English) in the reign of his father, King Henry the Second, was created and invested with the *Lordship of Ireland,* with all regal rights and authority, about the year 1184, after which all public documents were issued in his name, and continued so until he became, on the death of his brother Richard I., *Cœur de Lion*, King of England. Richard never was King or Lord of Ireland, or exercised any regal authority in that country. The first charter of John to the Archbishop of Dublin is to the following effect:

" 'John, Earl (Comes) of Moreton and Lord of Ireland, to all his men, French, English, and Irish, greeting. Know ye that we, in regard of and for the salvation of our souls, and the souls of our ancestors and successors, have given, granted, and confirmed, &c. &c., to the venerable father John, Archbishop of Dublin, all liberties and free customs granted by our predecessors to his church, for him and his men, throughout the whole of Ireland,' &c. &c.

" Shortly after, by another charter, commencing, '*John, Son of the King, Lord of Ireland*,' he granted the bishopric of Glendaloch, with its appurtenances and free customs, to be united to the archbishopric of Dublin, &c.

" Henry the Third confirmed his father's grants, by a charter, with the addition of free warren in all his lands. Richard the Second, by his charter, confirmed all the previous charters, and recites that Robert, Archbishop of Dublin, Primate of Ireland, and Dean of our chapel of Penckrich in England, claimed to have within all his lordships and manors the following liberties, viz., soc and sac, thol and them, infangethef and outfangethef, hamsoke, greede breche, blodewite, flethwite, and fordwite, and hangwite, and bethwite, flemings frethe, murdro, and latrocinio, and ordell, and crest, duels of Englishmen, and all others within these lordships and manors, and abjuration of fugitives and felons flying for sanctuary to the holy church, and also to take in their courts fines and redemptions for felonies committed on their lands; and in like manner to grant peace to felons for felonies committed within their lordships and manors; and also to condemn and outlaw felons in their courts; to make coroners independent of the king's coroners, who was forbidden to intermeddle in the Archbishop's liberties; also for the justification, correction, and punishment of artificers and labourers within their lordships and manors; and also all pleas of the Crown, except four pleas, *forestalling*, *rape*, *treasure trouve*, *and arson;* and to have all the aforesaid liberties in the courts, and also the return of all writs and royal precepts, &c. &c., *within their lordships, manors, and crosses*, view of frankpledge, and the assize of wine, bread, and ale; of standards of all weights and measure; and that the royal clerk of the market should not intermeddle with their officer within their lordships, manors, and crosses; but only once a year to inspect that their standard weights, &c., were correct; and to hold all courts of *vetita namio*, and all other pleas of a court baron; and also to have one boat on the Liffey to catch salmon, a market and fair at Swords, wrecks of the sea, pillories, tumbrels, and stocks, &c. &c. &c.

"These extensive liberties and free customs were equal to those of a palatine county or honour, and constituted the Archbishop's lordships, manors, and crosses into a feudal dignity or principality, similar to a county palatine. They are indeed nearly *identical* to those granted to the Earl of Ulster. The only grant of more extensive liberties was made to Hugh de Lacy, of the lordship of Meath, in which the king reserved only homage and fealty.

"The Archbishop's seneschal was made the supreme judge, *within his lordships, manors, and crosses*, in all cases, as well criminal as civil. The Archbishop could, however, appoint a seneschal for each of his manors, or one for the whole.

"These manors were denominated the crosses of the archbishopric of Dublin, and in process of time became what are now called the baronies of *Upper Cross* and *Nether Cross*, and accounts for these baronies being composed of detached portions of the county of Dublin. Over every part of these baronies the jurisdiction of the seneschal of the Archbishop's court still extends.

"On the death of Fulk de Sandford, Archbishop of Dublin, 6th May, 1271, 55 Henry III., the see was vacant for seven years, and Master Thomas de Chaddisworth was appointed custodee of the temporalities. His account of the receipts and discharge, from the 55th Henry III. to the 5th of Edward I., from 1251 to 1257, now on record on the great Roll of the Pipe in the Record Tower, supplies great light on the state of Ireland at that period, and explains many facts involved in mystery and doubt. It has reference to the three manors of the bishopric of Glendaloch, as well as those of the archbishopric of Dublin.

" The revenues of the archbishopric from these manors, at this period, amounted, on the average of the period of the five years, to £1222 11*s.* 10*d.* per annum (a sum of no inconsiderable amount at that time), in absolute value of silver by weight to £3667 15*s.* 6*d.* of the present money, in weight of silver.

" ' MANOR OF SWORDES.

	£	*s.*	*d.*
The said Master T. de C. rendered account of the rents of the freeholders, farmers, and betagii (villains or serfs), and cottagers of the manor of Swords, from the feast of St. James, 55 Henry III., to the feast of St. Michael, 5 Ed. I., as is contained in the extant roll of particulars, which the said Master Thos. delivered into the Exchequer, ...	1530	5	0
Of the demesnes of the aforesaid manor of Swords, Lusk, and Werne, members of the said manor, for the aforesaid time, as is contained in the same roll, ...	467	6	4
Of the meadows there for the said time, ...	129	13	6
Of the pasture there for the said time, with the grain of Swords and pasturage of Lambeye, as is contained in said roll, ...	91	1	5
Of the farm of the Rabbit Warren of Portrahelyn, and the issues of the rabbit warren of Lambeye, as is contained in the said roll, ...	107	15	3

	£	s.	d.
Of the gardens there for said time, ...	14	12	0
Of the fishing and boll beer of Portrahelyn, put to farm for the said time, ...	18	3	4
Of the bolls of beer for the same time, ...	25	3	2
Of the prizage of beer for same time, ...	3	0	0
Of the stallage of the Irish for the same time, . .	0	18	8
Of the toll for the same time, ...	1	10	0
Of the 12 customary cows for the said time, . . .	2	11	3
Of the work and services of the betagii (serfs) for the same time, ...	104	13	6
Of the rent of lands which were Hugh de Cowloks, which escheated, from the Vigil of St. Michael, 1 Ed. I., to the same vigil, 4 Edw. I., viz., 17*s.* 6*d.* per annum, before the said Hugh recovered his said lands by the King's writ, ...	3	12	0
Of the rent of hens for said time, ...	1	4	7
Of the issues of the wardship of the heir of Geoffrey de Scherdel, 1 Edw. I., before the said ward was delivered to Robert Bagod by the King's writ, .	3	10	6¾
Of the rent of the houses at a place at Werne, . .	0	18	0
Of straw and hay sold there, ...	1	19	8
Of wheat sold there, ...	5	15	4
Of persons imprisoned, ...	0	19	10½
Of the goods of William the fisherman, slain, . . .	0	5	0
Of one acre of meadow escheated there, ...	0	3	0
Of four acres of land destroyed there, ...	0	10	4
Of the wardship of the heir of Henry Barbedor, . .	1	15	3½
Of divers reliefs there for the same time, ...	0	19	9½
Of meadow held by Hugh de Belings for life, . .	0	9	0
Of sallies sold there, ...	0	4	0
Of the perquisites (or fees) of court there for the same time, as is contained in the roll of the extent of particulars, which the said Master Thomas delivered into the Exchequer, ...			
Summa, ...	£2518	10	10¼

"'The Manor of Balymor.

	£	s.	d.
The said Master Thomas render account of the rents assessed on the freeholders, farmers, betagii, and cottagers of the manor of Balymor, for the whole time aforesaid, as is contained in the roll, &c. &c.,	788	4	9
Of the demesnes of the said manor and its members for same time, &c., ...	154	12	0
Of the meadows thereof for same time, ...	25	0	0
Of the pastures thereof for same time, ...	42	8	0
Of the issues of the mills for same time, ...	215	2	9
Of the wax rents of Tobyr for same time, ...	1	16	0
Of the rent capons for same time, ...	1	8	0
Of the 6 muttons rents for same time, ...	0	4	0
Of the rent of 6lbs. of frankincense for same time, .	0	3	0
Of the garen rents of Holywood for same time, . .	1	16	8
Of the rent of David Heye there for same time, . .	1	0	0
Of the wardship of John, son of Adam de Balyrothegan, for same time, ...	0	12	0
Do. of do. of Henry de Weynill, for same time, . .	1	4	0
Do. of do. Richard fitz Geoffrey, for part of same time,	0	8	0
Do. of do. the heirs of Reymond de Fynglas, for part of, &c., ...	1	4	0
Of the wardship and marriage of the heir of Richard Gressy, sold, ...	2	0	0
Of the relief of Nicholas de Vale, ...	1	6	8
Of the relief of David, son of Robert de Holywood, .	0	4	4¼
Of the wardship and marriage of the heir of William Ririth, sold, ...	1	4	0
Of various others, for part of same time, ...	4	9	1
Of the wardship and marriage of the heir of Simon Manning, sold, ...	3	0	0
Of the wardship of the heir of Ely (Walsh or) the Welshman, a 4th part of which was held by Master Thomas by extent, ...	9	4	8
Of divers services due to our lord the King, . . .	4	13	4
Of the work and services of the serfs (betagii) and cottagers there, ...	62	13	8
Of a fine made by Will. Dodyng to the King, . . .	10	0	0

	£	s.	d.
Of dead wood, charcoal, turbary, and parmoge there, for same time, ...	2	5	1
Of five cows coming *de waniatur*, four horses skins, 16 cows skins, and 11 of goats, ...	10	0	0
Of 56 crannocs of wheat,* . . . . 63 crannocs 6 bushels of oats, ... 4 crannocs of barley, ... 1 bowl of wheat flour and 3 of oatmeal, sold, . .	44	13	10
Of hay sold, ...	0	19	6
Of rent of a messuage of *Reymond of the Water*, .	0	1	0
Of a tenement of Roger Bovun, ...	0	18	0
Of houses there, ...	0	3	0
Of the land which was Richard the Carter (Cissor), .	0	4	8
Of the profits or perquisites of the fairs there, for same time, ...	0	18	3
Of the profits or perquisites of the courts there, for the same time, ...	155	18	8¼
Summa, ...	£1550	0	11¾

" ' Manor of Clondolcan.

	£	s.	d.
The said Master Thomas rendered an account of the receipts of this manor, for the same period, as follows :			
Of the rents of the freeholders (betagiorum), serfs, and cottagers, for the whole time aforesaid, . .	279	3	9
Of the demesnes of Ballymacnegh, member of the same manor, for the same period, ...	116	9	6
Of the meadows there, &c., ...	28	10	6
Of the pasture, wood, turbary, and underwood there, sold, ...	50	17	7
Of the profits of the mill there, ...	20	12	9
Of the meat of the seneschall and bailiffs there, &c., .	2	4	0
Of the boll beer there, &c., ...	7	5	4

* The crannoc was an Irish measure of sixteen bushels, Winchester measure, or two quarters. There are many accounts of corn on the Pipe Rolls kept in crannocs.

	£	s.	d.
Of the profits of the garden there, ...	0	19	2
Of the work and services of the serfs (betagii) and cottagers, ...	27	12	1½
Of straw sold, ...	0	10	11
Of eleven skins of oxen, 20 of lambs sold, ...	0	6	11¾
Of the heriot of Maidonethed, ...	0	13	4
Of one horse coming to the Weighmaster, and imprisonments and fines, ...	0	11	0
Of the perquisites and profits of the court there, . .	76	6	11¾
Summa, ...	£611	3	11

" ' Manor of Finglas.

The said Master Thomas rendered an account of the receipts of this manor as follows :

	£	s.	d.
Of the rents of the freeholders, serfs, and cottagers of the manor of Finglas for the same period, . . .	241	10	11
Of produce of 7 acres at Kildonan, ...	2	10	0
Of the produce of 24 acres in Kilsawan, ...	7	4	0
Of the produce of 13 acres at Glasnevin, ...	0	13	0
Of the rents of Derneskill, ...	21	0	0
Of the demesnes there, ...	112	7	0
Of the meadows there, ...	32	7	6
Of the pasture there, ...	32	5	3
Of the turbary and red bog, ...	43	3	4
Of the boll beer there, ...	2	1	6
Of the issues of the gardens there, ...	2	3	8
Of the underwood sold there, ...	1	16	0
Of the services and work of the serfs and cottagers,	73	3	7
Of the profits of the mill, ...	32	0	0
Of the *Vigil Boum*, ...	2	0	0
Of the rent hens there, ...	0	10	6
Of the rent honour there, ...	0	1	6
Of the houses and hay sold, ...	0	8	6
Of straw or stubble (stipula) sold, ...	0	12	1
Of the profits of the court, ...	19	19	9¾
Summa, ...	£627	18	1¾

"'Manor of Rathoul, or Rathcool.

	£	s.	d.
The said Master Thomas rendered an account of the manor of Rathoul, for the same period, as follows:			
Of the rent of the freeholders (betaghs), serfs, and cottagers of the manor for said time, ...	70	8	3
Of the demesnes of the same, ...	46	10	$10\frac{3}{4}$
Of the meadows of the same, ...	60	18	0
Of the pastures there, ...	9	16	0
Of the wardship of Meldiric, and 40 acres of land which were Joseph Aubyn's there, from Easter, the 1st of Edw. I., to Michaelmas, 5 Edw. I., 1272 to 1276, ...	15	0	0
Of the boll beer there, ...	2	15	0
Of the hay sold there, ...	1	3	0
Summa, ...	£206	11	$1\frac{3}{4}$

"'Manor of Newton.

	£	s.	d.
The said Master Thomas rendered an account of the manor of Newton as follows:			
Of the rents of the freeholders, betaghs, and cottagers of this manor for same time, ...	24	9	6
Of the demesnes of the same, ...	24	6	$1\frac{3}{4}$
Of the meadows of the same, ...	5	12	0
Of the pastures of the same, ...	11	0	6
Of the work and services of the betaghs and cottagers there, ...	1	8	$9\frac{1}{2}$
Of the food of the seneschal, ...	1	5	$4\frac{1}{2}$
Of the boll beer there, ...	0	1	9
Of heriots of certain defuncts, ...	0	1	0
Summa, ...	£68	5	$0\frac{1}{4}$

"'THE MANOR OF TAMLATH (TALLAGHT).

	£	s.	d.
The same Master Thomas rendered an account of the manor of Tamlaght, for the same period, as follows:			
Of the rents of the freeholders, betaghs, and cottagers of the same manor, for the same period, . . .	253	0	0
Of the demesnes of the same, for same, ...	53	6	0
Of the meadows of the same, do., ...	14	3	6
Of the pastures of the same, do., ...	6	16	6
Of the boll beer of the same, ...	2	18	11
Of the service and work of the betaghs and cottagers there, ...	27	0	3¾
Of the rent hens, ...	0	10	11
Of the rent of the lands of Thomas de Monte Alto, .	0	6	8½
Of the houses there, ...	0	1	0
Summa, ...	£358	3	10¼

"'MANOR OF COLOYNE.

	£	s.	d.
The said Master Thomas rendered an account of the manor of Coloyne for the same period, as follows:			
Of the rents of the freeholders, betaghs, and cottagers of the said manor, ...	195	18	0
Of the demesnes there located and set to farm, . .	110	3	1
Of the meadows there, ...	19	18	0
Of the pastures there, ...	26	15	6
Of the rent of three mills there, ...	51	0	0
Of the gardens there, ...	12	12	0
Of the boll beer and alewyte, ...	16	4	9
Of the rents of horse shoeing, ...	0	6	6
Of the portion of salmon fishery, ...	6	0	0
Of the service and work of the betagh and cottagers,	9	6	4
Of underwood sold, ...	4	1	5
Of one seldar newly levied, ...	1	0	0
Of chimney rent, ...	0	2	0

	£	s.	d.
Of the rent of Close of Weymill, ...	2	3	6
Of stubble sold, ...	0	2	0
Of perquisites of the fairs on the day of the Invention of Holy Cross, ...	8	0	10
Of the perquisites of the court there, ...	22	19	8¼
Of the issue of the mill which was Robert de Weymill's, ...	1	2	11½
Summa, ...	£487	16	6¾

" 'MANOR OF SENCKILL (SHANKHILL).

The aforesaid Master Thomas rendered an account of the manor of Senckil for the same period, as follows:

Of the rents of the freeholders, betaghs, and cottagers of the manors of Senckill, Killmacberne, and Dalkey, members of the same manor for the same period, ...	169	19	0
Of the issues of the mills therein, ...	21	0	0
Of the demesnes of the same, ...	127	19	0
Of the meadows of the same, ...	7	17	6
Of the pasturage there and the Island of Dalkeye, .	63	11	6
Of the boll beer there, ...	4	6	8
Of the service and work of the betaghs and cottagers,	19	17	7
Of a customary cow there, ...	1	6	0
Of the rent of a cottage near the gate of Senckill, .	0	2	8½
Of the prize of fish at Dalkey, ...	1	4	0
Of stubble sold, ...	0	10	0
Of the goods of Donethad slain, ...	0	5	0
Of a garden there, ...	0	7	0
Of wood sold there, ...	0	4	4
Of the perquisites of the court there, ...	5	19	0
Summa, ...	£424	9	3½

"'MANOR OF CASTLE KEVYN.

	£	s.	d.
The aforesaid Master Thomas rendered an account of the manor of Castle Kevyn and Glendel, and other members, for the same period.			
Of the rents of the freeholders, betaghs, and cottagers of the said manors, for said time, ...	412	13	0
Of the demesnes thereof, ...	120	0	0
Of the meadows thereof, ...	7	16	0
Of the pasturage thereof, ...	53	16	0½
Of the ponnage there, ...	0	15	0
Of the rents of houses in Wykynglo, ...	2	14	0
Of the advowsons there, ...	3	3	6
Of the there, ...	5	12	0
Of the boll beer there, ...	3	0	0
	£609	9	1½

"'MANOR OF KILMASANTAN.

	£	s.	d.
The aforesaid Master Thomas rendered an account of the manor of Kilmasantan, for the same period, as follows:			
Of the rents of the freeholders, betaghs, and cottagers of the manor, for the same, ...	59	13	9
Of the demesnes there, ...	33	2	9
Of the work and services of the betaghs and cottagers there, ...	5	15	3½
Of the advowsons there, ...	0	6	0
Of the customary cow there, ...	1	10	0
	£100	7	9½

"'MANOR OF BRETACH.

The aforesaid Master Thomas rendered an account of the manor of Bretach, for the same period, as follows:

	£	s.	d.
Of the rents of the freeholders, betaghs, and cottagers of the same,	105	9	6
Of the demesnes of the same,	28	6	6
Of the meadows there,	2	16	0
Of the mill there,	18	0	0
Of the boll beer there,	0	6	0
Of the advowsons there,	0	2	0
Of the works and services of the betaghs and cottagers there,	7	8	9
Of meat sold, &c., there,	3	0	0
Summa,	£165	8	9
The Total for the period,	£7728	5	10½
Per annum for the 5 years,	£1545	13	2½

"The pound, of that day, was three times the value of our present pound, being twelve ounces of silver. The silver penny was the 240th part of the pound of silver; the silver threepence, of our present money, is the same. This calculation would make the revenue of the Archbishop at that time to be, per annum, £3336 15*s.* 6*d.* in silver by weight in pounds Troy.

"It appears that courts were then held in the manors of Swords, Balymore, Clondalkin, Finglas, and Shankil; but not in those of Rathcool, Newtown, Tallaght, Cullen, in the archbishopric of Dublin; nor were courts held in the manors of Castlekevin, Glendel, or Glendelagh, Kilmasantan, or Bretach, which were the manors of the bishopric of Glendalagh.

"The manors of Balymore, Clondalkin, Shankhill, Rathcool, Newtown, Cullen, and Kilmasantan formed, afterwards, the barony of Uppercross; those of Swords and its members, Lusk and Werne (or Warren), the barony of Nethercross.

" 'Discharge.

	£	s.	d.
Paid into the Treasury, ...	721	6	8
To Maurice Fitzgerald, Chief Justiciary of the King in Ireland, for a certain important business, by the King's writ allowed, ...	10	0	0
To Milo de Dywe, by precept of Geffery de Geneville, Chief Justiciary of Ireland, for the custody and garrison of Balymor, and the parts adjacent, from the day of the Circumcision of our Lord, 3 Edw. I., to the Vigil of the Conversion of St. Paul, the same year, by another writ allowed, ...	23	0	0
To Oliver le Gras, for the same, by the same, for the custody of Balymore, &c., from Monday of the morrow of St. Nerius and Achilles, to the morrow of St. Barnaby the Apostle next following, by similar writ, ...	14	9	0
To Walter l'Enfant, for same custody, from the Feast of St. Ciril and Julite to the Feast of St. Giles following, by similar writ, ...	50	1	10½
To Robert, Baron of the Naas, for the same custody, by similar precept, from the day of the Nativity of the B. Virgin Mary to the Feast of St. Michael following, ...	13	6	8
To Philip de Staunton, by precept as aforesaid, for custody and garrison of Dunlavan and the parts adjacent, from the Feast of the Nativity of the Virgin to the Feast of St. Michael following, . .	6	13	4
To Robert, Baron of the Naas, for custody and garrison of Balymore and parts adjacent, from the Feast of St. Michael to the Feast of St. Simon and Jude, and from thence to the Feast of St. Denis, 20 marks, ...	13	6	8
To Hugh fitz Thomas, for custody, &c., of Dunlavan, from Michaelmas to the Feast of St. Denis, . . .	9	6	8

	£	s.	d.
To Mathew le Porter, serjeant to Geffrey de Geneville, Justiciary of Ireland, for doing a certain business of our Lord the King's at Dublin, by precept of said Justiciary, by writ allowed, . . .	2	0	0
To Geffrey de Geneville, Chief Justiciary of Ireland, for certain arduous business of our Lord the King's, allowed by the King's writ, ...	909	2	3
To same for 60 cows delivered to Maurice Fitz Maurice and Master John de Saumpford, Escheator of Ireland, by precept of our lord the King, for the supply of the expedition led to Glyndalore against the King's enemies there, by writ allowed, ...	13	19	0
To Mathew le Porter, for three tons of wine bought for Geffrey de Geneville, Justiciary of Ireland, allowed by writ, ...	6	0	0
To Stephen de Munteney, for hay bought for said Justiciary, ...	0	18	0
To Walter Gamage, for a horse bought for the King's service, ...	1	0	0
To Geffrey de Geneville, &c., for the expenses of his houshold, &c., by writ allowed, ...	122	4	6
To same for various expenses in divers places on the King's business, ...	8	9	6½
To same for his expenses at Balymore, ...	44	1	8¾
To Percival of Lucca and his fellows, merchants of Lucca, for doing certain business for the King in England, allowed by the King's writ of England,	306	13	4
To Lucas de Lucca, and his fellows, merchants, for similar business, by the same writ allowed, . .	510	8	8
To the monks of our Lady of Hogges, for six years' rent due to them by the archbishoprick, . . .	3	12	0
To robes for the constables of Balymore, Swords, Clondalkin, and St. Sepulchre, for the time aforesaid, viz., a winter robe and summer tunick for each, at 20*s.* per annum, and for a robe for John de Burges, one mark, ...	1	13	4

	£	s.	d.
To the same, for their losses in horses, arms, and other things, for saaid time, ...	40	3	4
To Master John de Saumpford, for the sustaining the castles of Ireland, ...	200	0	0
To the same for his salary, viz., £40 a year, for the same period,.	140	0	0
To the same for parchment bought for the same time, ...	2	0	0
To the same for various messengers sent to England,	5	0	0
For the expenses in passage to England by the King's command, ...	30	0	0
To same for the support of the heir of William de Aveny, from the day of the Conversion of St. Paul, anno 6to regis, to the day of St. Lindicius the Abbot, ...	7	0	0
To the same for the archbishop's vicars, for celebrating divine service in St. Patrick's cathedral, viz., 40*s.* per annum, for same time (six years), .	12	0	0
To the same for robes, 40*s.* per annum, ...	12	0	0
To the same, for the fees of the bailiffs and the repairs of the houses, mills, and other expenses of the manor of Swordes for the said time, . . .	100	17	6½
To same for same, of the manor of Fynglas, . . .	34	12	7¼
To same for same, for the manor of Clondalken, . .	31	6	0
To same for same, for the manor of Senckill, . . .	56	0	4
To same for same, for St. Sepulchre and Coloyn, . .	37	12	0
To same for same, for the manor of Tamlath, . .	6	5	11¼
To same for same, for the manor of Balymor, . .	259	11	9¼
To said Master Thos. de Saumpford, for same, for the manor of Rathcool, ...	4	10	7
To the same for the decrease of rents of the demesnes, meadows, pastures, mills, works, and services, &c., of the manor of Swordes for said time, ...	863	3	5¾
To same for same, for Fynglas, ...	261	7	6½
To same for same, for Clondalken, ...	206	3	7¼
To same for same, for Coloyne, ...	174	14	9¾

	£	s.	d.
To same for same, for Senckill, ...	344	0	5
To same for same, for Tamlath, ...	141	0	8¼
To same for same, for Rathcoul, ...	75	9	9¾
To same for same, for Newtown, ...	37	10	10¼
To same for same, for Balymor, ...	452	4	0½
To same for same, for Castlekevyn, on account of the continuance of war nothing was received, . .	8	13	10
To same for same, for Kilmasanten, for same cause,	100	7	9½
To same for same, for Bretach, for same cause, . .	165	8	9
Summa, . . .	£6193	18	11½
He owes, . . .	£908	16	7¼

The said Master Thomas rendered account of said debt:

Into the Treasury, ...	£190	6	8
	293	13	4

And owes £234 16*s.* 7¼*d.*, which was after accounted for in the account of Robert de Ufford, in the roll of same year.' "

Dr. Todd gave a short account of his visit to the Bodleian Library, in company with Mr. Eugene Curry, in July, 1849, for the purpose of examining the Irish MSS. there preserved. He stated that, with the very efficient assistance afforded him by Mr. Curry, he was enabled to settle two important questions which had previously been a source of error to Irish historians. He had ascertained that the Psalter na Rann, by Aengus Ceile De, or the Culdee, was, in fact, a metrical version of the history of the Old and New Testaments, and not a collection of tracts on Irish Hagiology, as some had supposed. The MS. of this work, preserved in the Bodleian Library, is of high antiquity, and in beautiful preservation; and the work itself, if published, would be of the highest value to the lexicographer and philologist.

He had ascertained, secondly, that the original of O'Donnell's Life of St. Columba was, beyond all doubt, preserved in the Bodleian.

He then handed in to the President, for insertion in the Proceedings, the following list of the Irish MSS. examined by him and by Mr. Curry, during their visit to Oxford.

Rawlinson, 406.—Contains a curious ancient poem on the clans and tribes buried at Clonmacnois. As many inscriptions, from the sixth to the eleventh century, are still extant on the tombstones at Clonmacnois, it would be very desirable to procure a correct copy of this poem.

Rawl. 486.—A book of historical poems and pedigrees.

Rawl. 487.—A very valuable collection of historical documents on vellum. This volume contains an ancient tract entitled Caṫ Ḟinntraġa, the Battle of Ventry Harbour, in Kerry.

The Library of the Academy, and Trinity College Library, contain several modern corrupted copies of this work, which are so bad that Irish scholars have hitherto considered it a modern production. But this copy in the Bodleian proves it to have been older than the fifteenth century, as the MS. in which it occurs is of that date. Its antiquity, however, was suspected from the fact, that "the Battle of Ventry" is quoted in the Book of Lismore, a MS. of the fifteenth century, in a tract which has been transcribed into that collection. This tract is a dialogue, in which the speakers are St. Patrick, Oisin, the son of Finn Mac Cumhall, and Cailte, Finn's cousin and counsellor. The two latter personages are represented as relating to St. Patrick the most remarkable of Finn's exploits, and amongst the rest, a short sketch of the Battle of Ventry is given, with a reference to the ancient historical tale so entitled, of which the only authentic copy as yet known is that preserved in the Bodleian MS. under consideration.

"The Battle of Ventry" throws considerable and very valuable light on the ancient topography of Munster, especially of the counties of Limerick and Kerry.

There is also in this MS. a good copy of the Dialogue already alluded to as preserved in the Book of Lismore, between Patrick, Oisin, and Cailte.

Then follows a Brehon Law Tract.

On the lower margin of fol. 11 is the following memorandum, in the same handwriting as the rest of the MS. :

"Ar na scribaḋ ḋ' Ḟinnlaeċ o Caṫasaiḋ
ḋo Saiḋḃ ingen Taiḋġ ui Maille."

"Written by Finnlaech O Cathasaidh [Finlay O'Casey], for Saidhbh [Sabia], daughter of Taidhg Ua Maille [Teague O'Malley]."

Dr. Todd was unable to say with certainty whether the existing pedigrees of the O'Malley families were sufficiently perfect to enable us to tell the period at which this lady lived.* But the memorandum is interesting, as proving that our ancient Irish ladies were patrons of literature and learning, and employed scribes to write books of this kind for them.

Rawl. 488.—The Annals of Tighernach. This is the MS. from which these Annals were partly printed by Dr. O'Conor.

Rawl. 489.—The Annals of Ulster. This is the MS. from which Dr. O'Conor printed the first part of these Annals.

Rawl. 502.—This is a most important volume. It is on vellum and in fine preservation.

It begins by a chronology of the ancient Eastern empires; then follows a tract beginning with an account of the six ages of the world, probably the same which has been copied into the Speckled Book and other collections.

At fol. 19 commences a beautiful and very ancient copy

* The Four Masters, at the year 1123, mention a Tadhg Ua Maille who was "drowned with his ship" at the Arran Islands, in that year.

of the tract so often referred to, but so little known, called *Psaltar na Rann*, or "The Psalter of the Poems," or, as Colgan thinks, "Psalter of the Divisions," i. e., "Psalterium multipartitum."—Acta SS. p. 582. It is entitled, in the original handwriting of the MS.,

"Psaltar na rann inso sis, do rigni Oengus celi de."

"The Psalter of the Poems begins here, which was made by Oengus Cele De," or Oengus the Culdee.

This establishes the authorship of this work beyond any reasonable doubt, for this MS. is certainly not later than the twelfth century, and Oengus flourished in the ninth. He was for some time a monk of the celebrated Abbey of Tamhlacht, or Tallaght, near Dublin, and was surnamed *Cele De* (or servant of God) from his great devotion and sanctity. Some suppose that he had this title from his having been one of the founders and early members of the order of ecclesiastics called Cele De or Culdees, of whom so much has been written.

Oengus was the author of many other works, particularly of the Martyrologies which bear his name, and other tracts relating to the history of the saints of Ireland, all of which are still extant, but, to the disgrace of this country, extant only in MSS., which, in another generation, will probably become illegible, or at least the ample means we now possess for illustrating and translating them will be seriously diminished, if not wholly lost.

Colgan thinks that Aengus was the author of two works, both of which, although very different in their subject, bore, nevertheless, the same name of Psaltar na Rann.

One of these he supposes to have had its name in the sense of *Psalterium multipartitum*, or the Manifold Psalter, from the fact that it consisted of the five following works, all of which are still extant in the Library of the Royal Irish Academy.

1. A list of the Saints of Ireland, according to their ecclesiastical dignity; of whom the author enumerates 345 bishops, 299 priests and abbots, and 78 deacons.

2. A list of Saints who had the same name; which is divided into two books, one containing the homonomous male Saints, the other female Saints.

3. A list of the Saints according to their parentage; that is to say, Saints who were the sons of the same father; Saints who were the only sons of their fathers; and female Saints, classified in the same way.

4. A book on the mothers of the Saints, in which the maternal genealogy of about 210 Saints, male and female, is preserved.

5. The Book of Litanies, addressed to the Saints.

Colgan gives to these five tracts the collective title of Psaltar na Rann, on the authority of an ancient MS., in which a copy of the treatise on homonymous Saints is thus entitled: *Homonymi Hiberniæ Sancti, ex Saltuir na rann, quod composuit Ængussius Keledeus.*

But the work called Psaltar na Rann, preserved in the Bodleian Library, is of a totally different character; it is in fact an abridgment of the history of the Old Testament in Irish verse, consisting of a number of *ranns* or short poems, each poem relating to some remarkable event or period of sacred history. It is well described by Colgan in the following words (Acta SS. p. 582): "Præter jam memorata scripsit hic vir devotissimus metrico et eleganti stylo hystoriam Veteris Testamenti: quam omnia Dei opera in Creatoris laudem finaliter referendo, mentemque legentis et recitantis in ejus laudem, et amorem incendendo, ita in formam orationis efformavit, et in partes distribuit, ut aptissime in utroque sensu Saltuir na rann, i.e., Psalterium metricum, vel Psalterium multipartitum, vocari posset; uti et de facto in alterutro vel utroque sensu nuncupari et intitulari consuevit." It does not appear that Colgan had ever seen this work, and as many mistakes have been made respecting it, it is desirable to put on record a somewhat full account of its contents.

It consists of 162 poems, of which 150 (corresponding to the number of the Psalms) contain the history of the Old Testament, and constitute probably the original work, which was hence called the *Psalter* of Poems. Then follow two poems of a penitential character, and ten on the Resurrection and history of the New Testament.

The first poem consists of eighty quatrains, or stanzas of four lines each. It describes the omnipotence, eternity, omniscience, and omnipresence of God; the creation of the world from chaos; the elements; the firmament; the planets, stars, and signs of the zodiac; the course of the sun, and the whole system of ancient astronomy. It begins:

"Mo Ríri Riġ niṁe náir"

"My King is the triumphant King of heaven!"

The second poem begins thus:

"Ri do rigne Riċech reil"

"The King who made the heavenly city."

It consists of seventy-eight quatrains, and describes "the heavenly city;" the throne of God; the hosts of angels; and all that is revealed in Scripture of the order and inhabitants of heaven.

The third poem describes the creation of angels and archangels, with the names of the chief angels.

The third poem consists of nine stanzas only, and describes the fall of Lucifer, with his sentence and condemnation.

The fourth poem describes the horrors and torments of hell. It consists of twenty-three quatrains.

The fifth consists of twenty-nine quatrains, and contains a description of Paradise, the creation of Adam and Eve, and the placing of Paradise at their command.

The sixth poem consists but of six quatrains, and relates the history of the prohibition given to Adam and Eve against touching the forbidden fruit. The poet says that he heard it as a tradition that Adam had been one thousand years and six hours in Paradise, before his transgression.

The seventh poem describes the tempting of Eve and the fall of man.

This must suffice as a specimen of the work, for time did not permit a complete perusal of it. All that could be done was to make a list of the first lines of each poem, for the purpose of identifying them if they should chance to turn up in any collection here or elsewhere, or if any fragment of the work should by chance be met with in this country.

A fragment in the possession of Mr. Curry, was written in the county Leitrim in 1727; and as the Oxford copy was deposited in the Bodleian by Archbishop Laud, it follows that there must have been another copy in Ireland in the beginning of the eighteenth century. It would be very desirable to ascertain where this copy now is; and the fact is here noticed in the hope that some member of the Academy may have it in his power to make it known, if not to secure it for our library.

Amongst the Egerton MSS. in the British Museum is a small manuscript volume, described in the printed catalogue as a copy of Psaltar na Rann, and stated to be in the handwriting of the learned Irish scholar, Peter O'Connell, of the county Clare, who died in 1824.

Both these statements are mistakes. Mr. Curry found on examining the MS. that it is not a copy of the Psaltar na Rann, nor in the handwriting of Peter O'Connell. It turns out to be an Irish Martyrology, in verse, of much more recent date than the Psaltar na Rann, and in the handwriting of the celebrated Duald Mac Firbis, who was murdered in 1666.

It is time, however, to return to the Bodleian MS.

The Psaltar na Rann occupies thirty-nine folios.

At fol. 40 we have a curious poem, very much of the same character, and probably of about the same age as the Psaltar na Rann. It is introduced by the following note:

"Pantscte incipit .i. tintuḋ duiḃlitirsch hui huaṫġaile for sin Pandect Cirine tria Ġoedeilġ inso sís. Do ardġabalaiḃ in doṁuin, acus do chroeḃaiḃ coiḃniusa in doṁain, acus dia hilchenelaiḃ; acus do nuiṁir a mberla, acus do aissiḃ a nair-ech, acus dia nanmannaiḃ; acus do aessaiḃ in doṁain, acus do nuiṁir cacha aesse. Do réir in tSeptin inso."

"Pantecte incipit, viz., a translation made by Dubhlitir* O Huathghaile, of the Pandect of Cirine [St. Jerome], into Gaedhlic, here follows. Of the great conquests of the world, and of the genealogical branchings of the world, and of its various races; and of the number of their languages; and of the ages of their chiefs and their names; and of the ages of the world, and of the duration of each age. This is according to the Septuagint."

This poem begins

"Cetna aimsir beṫaḋ binn."

"The first age of the noble world."

The work here alluded to under the name of "Pandect of St. Jerome," is certainly his "Bibliotheca," or Latin version of the Bible. It is so called by Alcuin, in the well-known epigram which he annexed to his own copy of the Scriptures:

"Nomine *Pandecten* proprio vocitare memento
Hoc corpus sacrum, Lector, in ore tuo;
Quod nunc a multis constat *Bibliotheca* dicta
Nomine non proprio, ut lingua Pelasga sonat."†

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* Dubhlitir, i. e., Black Letter. There were several abbots of this name living between the years 780 and 930. See note, next page.

† Quoted by Vallarsius, in his Preface to the Bibliotheca of St. Jerome. Opp. S. Hieron., tom. ix. p. xi. (*Venet.* 1770). The erroneous quantity given to the penultimate syllable of *Bibliotheca*, in these lines, is by no means uncommon amongst mediæval writers. The entire epigram of Alcuin may be seen in Baronius, ad an. 778, n. 23.

This poem was, therefore, probably intended to be prefixed to the *Pandect* or *Bibliotheca* of St. Jerome, according to a custom very prevalent in the middle ages, of prefixing (or postfixing) to copies of the Bible, verses laudatory of the holy Scriptures, or containing brief summaries of their contents.

It is followed by the tract entitled "Sex ætates mundi," translated chiefly from Bede, of which we have copies in the Leabhar Breac, and in other MSS.

Then follows Dubhlitir O'Huathghaile's* poem on the "Pantecte," on the branchings of the race of Adam, at fol. 44.

This is followed by a poem by Mac Coisse of Ross, county Cork, on the geography of the old world.

[There are fine copies of these two poems preserved in the ancient MS. known as the Book of Leinster, in the library of Trinity College, Dublin.]

These are followed, at fol. 46, by a poem on the kings of Jerusalem (twenty in number).

This is followed by a poem on the collecting, the arrangement, the mode of singing, and the number of the singers of the Psalms of David in the Temple.

Then follows a poem on the Exodus.

This is followed by an account of the chaining of Eochaidh, the son of Enna Cinselach, King of Leinster (fifth century), to the celebrated Hole-stone, near Tullow, in the county Carlow.†

Then follow a number of short and very ancient poems and scraps of prose, on the men of Leinster, some of them containing curious historical information.

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* In a copy of this poem transcribed into the Book of Lecan (fol. 36, b. col. i. line 22), the author's name is given in the last quatrain as Donnchuach Uu Fuathgaile, of Glenn Uishen, a celebrated church in Ossory. But here the name of the author is made Dubhlitre, which was possibly not a name, but an appellative of Donnchuadh, as it signifies *the Black-lettered,* and seems to have denoted his high literary reputation or learning. If so, he was Abbot of Glen Uishen, and flourished in the ninth century.

† Book of Ballymoate, fol. 77, b. [Reign of Niall of the Nine Hostages.]

Then an ancient poem by Flann Mac Maelmaedhog, on the triumphs of the men of Leinster. No other mention of this ancient writer has been discovered, nor is any other copy of his poem known to exist.

Then another poem on the Leinstermen, by Orthanach O'Caellama, of the Curragh of Kildare; of which, however, only four quatrains remain, owing to the loss of some leaves in the volume. Of this writer no other mention occurs in any known document.

Then follows an account of the great meeting of Drom-Ceat, in the county Derry, at which Saint Columb Cille attended.

Then follows what is commonly called "The Dialogue of the Two Sages."

Then follows a curious and very ancient tract entitled "The False Judgments of Caratniad," who was Chief Justice to Conn of the Hundred Battles. His legal decisions were worded so as to be apparently false, but on examination were always found consistent with justice and law.

Then a short tract on Irish Grammar, which, from its antiquity, is extremely curious and valuable.

Then "Incipiunt pauca de nominibus Lageniensium," with genealogies.

Then an ancient poem on the pedigree of Laeghaire Lorc, ancestor of the Leinster noble families, by the royal poet, Finn Mac Rossa Roe, king of Leinster. This poem was made for the kings of Leinster; and contains their pedigrees, from Nuada Necht to Adam. It is the only specimen known of the works of this royal bard, who is so much spoken of by our old Gaedhlic writers. Nuada Necht was monarch of Ireland for half a year, A. M. 3949, and the poet Finn, who was his great grandson, may therefore have flourished at the beginning of the Christian era.

Then an ancient poem on the pedigree of Enna Cinselach, King of Leinster, about A. D. 400, carrying him up to

Adam. This poem was written by Laidcenn mac Bareda, who was a Druid, and one of the chief poets to Niall of the Nine Hostages; and whose house in the east of Bregia was subsequently burned, and his son, with all his household, killed, by Eochaidh, the son of Enna, which event led to the latter being chained to the *Hole-stone* in Carlow. This is the only piece of this celebrated bard's works which is known to exist.

Then "The Destruction of Dinn Righ," a royal mansion in Carlow, and the murder of Laeghaire, by his nephew, Lobhradh Loingseach.*

Then a curious tract on the murder of the princesses at Tara, by Dunlaing, a Leinster prince, in the time of Cormac mac Art, in revenge for Cormac having levied on him the Boromean tribute. The names of all the princesses and of their fathers are given. The court in which the fearful deed was committed at Tara was ever since called *Claenferta-naninghean,* or the "inclined house of the virgins," because, as it is said of the other Claenferta at Tara, the house inclined to one side as a perpetual memorial of so atrocious and unjust a deed.† No other account is known to exist of the details of this murder of the princesses, nor of its cause.

Then follows the succession of the monarchs of Erinn.

Then an ancient poem on Tara.

Then pedigrees of the Heremonians.

Then pedigrees of the Hebereans.

Then ancient poems on the kings of Cashel; on the kings of Uisneach, or Meath; on the kings of Dal Araidhe, &c., &c., &c.

The volume, which is magnificently written, ends with folio 87, making 174 pages; and there can be little doubt

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* See the Tale of Maon, in Reliques of Irish Poetry, by Miss Charlotte Brook.

† *Vide* Petrie's Antiquities of Tara, p. 118, for the "Two Claenferts."

that it was transcribed about the year 1100. It was, doubtless, compiled in Leinster.

Rawl. 505. Vellum.—The Felire Aenghais, or Festology of Aengus Celi De, and some Latin lives of Irish Saints.

Rawl. 506. Vellum.—Contains ancient pedigrees.

A part of the Dinnscanchus, or tract on the etymology of the names of remarkable places in Erinn; of which we have good copies in the libraries of the Royal Irish Academy and of the University.

Forty-six folios of Brehon Laws.

An imperfect copy of Cennfaeladh's ancient Irish grammar.

Rawl. 514. Vellum.—A magnificent copy, in all probability the original, of the life of Saint Colum Cille, by Magnus O'Donnell.

The following extract from the preface to this work, so valuable for its curious legends and its topographical references, will be found of some interest.

"Acus bídh a ḟis ag luċt léġṫa na beṫaso go ndechaidh sí a mbáṫadh o ċéin máir, acus náċ raibe ar fáġail di aċt bloidh don lebar do ḋeċt Adhaṁnán naeṁṫa a Laidin, acus becan eli a-nGaidheilg, ar na dechtadh go ró ċruaidh d'filedhaib na nGaidhel. Acus fós an ċuid eli ina scélaib a fad ó ċéli ar fud tren-lebar Erind. Acus as dóiġ lemsa gurub é do b'ádhbar dó so. In uair táncatar danair allṁaraidh do ḋénaṁ gabáltais ar tús a nEirinn, do ṁilledar acus do loiscetar áird-ċella Erind uili, acus dó ṁilletar a scríne acus a screptra, acus rugatar mórán do ṫaisib na naeṁ leó dá tírṫib féin; aṁail ṁebraiġid sen-lebair oirir Erend, acus go háiriġe aṁail ṁebraiġes an lebar dára hainm Cogadh Gall re Gaidhelaib. Acus do loiscetar acus do ṁilledar áird-ċellaib Choluim Chille go sunnradhaċ. Acus as deiṁin lim gorab í an uair sin do ṁilletar acus do loiscetar a lebair, acus do ċuaidh a beṫa a mbáṫadh, áct an begán fríṫ re na scríb annso.

"Bídh a ḟis ag luċt léġṫa na beṫasa gorab é Maġnas mac Aedha, ṁic Aedha ruaidh, ṁic Néill ġairb, ṁic Toirrdhelbaiġ an ḟíona hí Domnaill, do ḟuráil an ċuid do bí a laidin don beṫaidh ꞅı ꝺo ċuꞃ a nᵹaıḋılc, acuꞅ ꝺo ḟuꞃáıl an ċuıꝺ ꝺo ḃí ᵹo cꞃuaıḋ a nᵹaıḋılᵹ ꝺı ꝺo ċoꞃ a mbuᵹa ınnuꞅ ᵹo mbeıṫ ꞅí ꞅoluꞅ, ꞅoṫuıcꞅena ꝺo ċaċ uıle; acuꞅ ꝺo ṫımꞅaıᵹ acuꞅ ꝺo ṫınól an ċuıꝺ ꝺo ḃí ꞅꞅꞃeıꞇe aꞃ ꝼeḋ ꞅenleḃoꞃ Eꞃenn ꝺı, acuꞅ ꝺo ḋeċꞇ aꞃ a ḃél ꝼéın hí aꞃ ꝼáġaıl ꞇꞃaſṫaıꞃ ꞃó ṁóıꞃ; acuꞅ aꞃ caıꞇheaṁ aımꞅıꞃı ꝼaıꝺe ꞃıa, oġá ꞅꞇuıꝺéꞃ cınꝺuꞅ ꝺo ċuıꞃꝼeaḋ ꞅé ᵹaċ én ċuıꝺ ꝺı ına hınaꝺ ımċuḃaıḋ ꝼén, aṁaıl aꞇá ꞅcꞃíḃṫa annꞅo ꞅíꞅ.

"Acuꞅ aꞃ nᵹaḃáıl báıꝺe acuꞅ bꞃáṫaıꞃꞃı ḋó ꞃe na áꞃꝺ-naeṁ acuꞅ ꞃe na ṗáꞇꞃún ᵹꞃáḋach ꝼén ꝺá ꞃaıḃe ꞃe ꞃo ḋúṫꞃaċꞇaċ.

"A Caıꞃlén Phuıꞃꞇ na ꞇꞃí naṁaꞇ, umoꞃꞃo, ꝺo ꝺeċꞇaıᵹ ın ḃeṫa ꞅo, an ꞇan buḋ ꞅlán ꝺá ḃlıaḋaın ꝺéc aꞃ ḟıċıꞇ aꞃ ċúıc ċéꞇ aꞃ míle blıaḋaın ꝺen Tıġeꞃna."—Folio 1, b.

"And be it known to the Readers of this Life, that it was extinguished for a long time, and that there was not be found but a fragment of the Book, which holy Adamnan compiled of it in Latin, and another small portion in Irish, compiled by the Irish poets in a very difficult dialect; and the remainder in legends scattered throughout the Old Books of Erinn. And it is my opinion that the following was the cause of this.

"When foreign Danes came at first to make a conquest in Erinn, they destroyed and burned all the chief churches of Erinn, and they destroyed their shrines and libraries (writings), and they carried off quantities of the Relics of her Saints to their own country, as it is recorded in the old historical Books of Erinn, and particularly as it is recorded in the Old Book which is named 'The War of the Danes with the Gaedhil.'* And they burned and destroyed the chief churches of Collum Cille in particular. And I am certain that it was at that time they destroyed and burned his books, and that his Life was lost, excepting the little of it that has been collected to be written here.

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* An imperfect copy of this ancient account of the wars of the Danes in Ireland, was found by Mr. Curry in the Library of Trinity College, Dublin. It was afterwards perfected by Dr. Todd, who collated it with a MS. in the Burgundian Library, Brussels.

"Be it known to the readers of this Life, that it was Manus, the son of Hugh, son of Hugh Roe, son of Niall Garve, son of Torlogh of the Wine, O'Donnell, that ordered the part of this Life which was in Latin to be put into Gaedhlic; and who ordered the part that was in difficult Gaedhlic to be modified, so that it might be clear and comprehensible to every one; and who gathered and collected the parts of it that were scattered through the old Books of Erinn; and who dictated it out of his own mouth (in his own words) with great labour, and a great expense of time in studying how he should place all the parts of it in their proper places, as they are written here after us; and in love and friendship for his illustrious Saint, relative, and Patron, to whom he was devoutly attached.

"It was in the Castle of Port-na-tri-Namad (now Lifford Castle, county Donegal) this Life was indited, when were fulfilled twelve years and twenty and five hundred and a thousand of the age of the Lord" [A.D. 1532].*

This distinguished chieftain and historian died in the same year that he finished the compilation of this work.

The Life of Colum-Cille is followed, in this volume, by valuable poems on the O'Donnells and other northern chiefs, by Flann Mac Lonan, a Munster poet, who was killed about the year 920, and Flann the Professor, of Monaster Boice, who died in 1050.

Laud, 610.—This volume is already described in the Proceedings of the Royal Irish Academy for the year 1842. Vol. II. p. 336.

Laud, 615. Vellum.—From folio 5 to folio 139, this volume contains about 160 religious poems, ascribed chiefly to Saint Colum-Cille. There are a few of them ascribed to Saint Patrick, and a few to other early Irish Saints. This is a most curious collection of ancient Irish poems, exhibiting various shades of theology and doctrine. They are evidently not in

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* Colgan says 1520. Trias, p. 446.

all cases the genuine productions of Patrick and Columba; but they are not, on that account, the less valuable as historical documents, because they are certainly of great antiquity, and express the opinions which the writers of these poems entertained themselves, or believed the personages to whom they ascribed them to have entertained.

Lord Talbot de Malahide exhibited a small flint knife, with a handle formed of moss, found in the bed of the river Bann, at Toome bridge.

"The knife was found, in the course of the present year, in the bed of the river Bann, near the bridge of Toome, between the counties of Antrim and Derry. It is of grey flint, and was accompanied by others without handles. It was, however, enveloped in a kind of handle made of moss, and, I believe, is the only one of that description ever discovered. The moss has been submitted to the examination of Mr. Wilson, of Warrington, who pronounces it to be the *Hypnum brevirostre*, a variety common in the neighbourhood of Killarney and other parts of Ireland. This is what one would have been led to expect by *à priori* reasoning, as it is not likely that the *stone-period* of the northern archæologists reached beyond the existing flora and fauna.

"I have seen no account of a similar application of moss. Some of the stone knives found in Denmark, described by Professor Worsaäe, have elaborately ornamented handles of the same material, but I believe none of these have been found in Ireland. The generality are of a very rude description, very few of them are ground down to an even surface, like so many beautiful flint axes and other implements found elsewhere. These probably had wooden handles attached to them, in the manner of the South Sea islanders' axes, lances, arrows, &c.

"It is supposed that flint knives were used, for sacred purposes, long after the introduction of the hard metals, as the Jews still use them in some countries for the purpose of circumcision. This might account for the rude mode of construction; it may be conventional and archaic, perhaps prescribed by the ritual of Druidism. However, in this instance, the number found would appear to negative the supposition. They were probably intended for daily use, and the moss would serve to steady the hand and prevent its slipping."

Rev. Joseph A. Galbraith read a communication on the Apsidal Motion of a freely suspended Pendulum.

Sir William Rowan Hamilton entered into some explanatory details respecting the nature and properties of that Aconic Function of six vectors, of which he had spoken in a recent communication with reference to a certain generalization or extension of Pascal's theorem, conducting to a relation between ten points on a surface of the second order.

In the Proceedings of the Royal Irish Academy for July 20, 1846, it was remarked by Sir W. Rowan Hamilton, that the theorem of Pascal might, in the calculus of quaternions, be expressed by the following general equation of cones of the second degree:

$$S\,.\,\beta\beta'\beta''=0,$$

where

$$\beta=V\,(V\,.\,\alpha\alpha^{\mathrm{I}}\,.\,V\,.\,\alpha^{\mathrm{III}}\alpha^{\mathrm{IV}}),$$
$$\beta'=V\,(V\,.\,\alpha^{\mathrm{I}}\alpha^{\mathrm{II}}\,.\,V\,.\,\alpha^{\mathrm{IV}}\alpha^{\mathrm{V}}),$$
$$\beta''=V\,(V\,.\,\alpha^{\mathrm{II}}\alpha^{\mathrm{III}}\,.\,V\,.\,\alpha^{\mathrm{V}}\alpha);$$

$\alpha, \alpha^{\mathrm{I}}, \alpha^{\mathrm{II}}, \alpha^{\mathrm{III}}, \alpha^{\mathrm{IV}}, \alpha^{\mathrm{V}}$ being any six homoconic vectors, and the letters S and V being the characteristics of the operations of taking respectively the scalar and vector parts of a quaternion. Now it is precisely *that function* of six vectors $\alpha\,.\,.\,\alpha^{\mathrm{V}}$, which was thus denoted in that communication of 1846, by $S\,.\,\beta\beta'\beta''$, to which it has since appeared to Sir W. Rowan Hamilton convenient to give the name of the Aconic (or *heteroconic*) *function* of those six vectors; because in the more general case, when they are *not* sides of any common cone of the second degree, this function no longer *vanishes*, but acquires some positive or negative value.

One of the most important properties of this *aconic* function is, that it *changes its sign without otherwise changing its value*, when *any two* of the *six* vectors on which it depends *change places* among themselves. Admitting this property, which there are many ways of easily proving by the general rules of quaternions, and observing that the following function of *four* vectors, a^{VI}, a^{VII}, a^{VIII}, a^{IX}, namely

$$S . (a^{\text{VI}} - a^{\text{VII}}) (a^{\text{VII}} - a^{\text{VIII}}) (a^{\text{VIII}} - a^{\text{IX}}),$$

can be shewn to change sign in like manner, for any binary interchange among the vectors on which it depends, and to vanish when any two of them are equal; denoting also, for conciseness, the former function by 012345, the latter by 6789, and their product by

$$012345 . 6789;$$

Sir W. Rowan Hamilton proceeds to form, by binary transpositions of these figures, or of the vectors which they denote, from one factor of each product to the other, accompanied with a change of the algebraic sign prefixed to each such product as a term, for every such binary interchange, a system of 210 terms, namely,

$$\begin{gathered}
+ 012345 . 6789 - 012346 . 5789 \\
+ 012347 . 5689 - 012348 . 5679 \\
+ 012349 . 5678 - 012359 . 4678 \\
+ 012358 . 4679 - 012357 . 4689 \\
+ 012356 . 4789 - 012376 . 4589 \\
+ (\text{a hundred other products}) - (\text{another hundred products});
\end{gathered}$$

these remaining terms being easily formed in succession, according to the lately mentioned law. And to the algebraic sum of all these 210 terms, of which each separately is a positive or negative number,—its positive or negative character depending of course not alone on the prefixed sign + or −, but also on the positive or negative characters of the *factors* of the product, which enters with that sign prefixed into the term,—Sir W. Rowan Hamilton proposes to give the name of the *heterodeuteric*, or (more shortly) the ADEUTERIC FUNCTION of the ten vectors $a \,..\, a^{\text{IX}}$, for a reason which will presently appear.

To make the formation of this function of *ten* vectors more completely clear, it may be observed, that the function of *four* vectors, which has been above denoted by the symbol 6789, is easily found to represent the sextupled volume of the *pyramid*, whose corners are the terminations of the four vectors (all drawn from one common origin); this volume being regarded as positive or negative, according to the character (as right handed or left handed) of a certain *rotation;* which character or direction is *reversed* when *any two* of the four vectors, and, therefore, also, their terminations, are made to change places with each other. On this account the lately mentioned function of four vectors may be called their PYRAMIDAL FUNCTION; and then the foregoing *rule* for the composition of the *adeuteric function* may be expressed in words as follows:—Starting with *any one set* of *four* vectors, form *their* pyramidal function, and multiply it by the aconic function of the remaining *six*, out of the proposed *ten* vectors, arranging the vectors of each set in any one selected *order*. Choose any vector of the four, and any other of the six, and interchange these *two* vectors, without altering the arrangement of the rest, so as to form a new group of four vectors, and another new group of six; and multiply the pyramidal function of the former group by the aconic function of the latter. Proceeding thus, we can gradually and successively form all the 210 possible groups or sets of four vectors, accompanied each with another set of six; and the four or the six vectors in each set will have an arrangement among themselves, determined by the foregoing process; so that the 210 pyramidal and the 210 aconic functions have each a determined value, *including* a known positive or negative sign or character. Each of the 210 *products*, thus obtained, is therefore itself also *determinate*, as being equal to some one positive or negative number, of which the *sign* as well as the absolute *value* can be definitely found, and may be considered as being *known*, *before* we introduce or employ any rule for *combining* or incorporating these various products among themselves, by any *additions* or *subtractions*. But if we *now* employ, for such incorporation, the rule that all those products which have been formed by any *even* number of binary interchanges, from the product first assumed, which we may still suppose to be

$$012345 \,.\, 6789,$$

are to be *algebraically added* thereto; while, on the contrary, all which are formed from that original product by any *odd* number of binary interchanges are to be *algebraically subtracted* from it: we shall complete (as was before more briefly stated) the determination of that *function of* TEN *vectors*, 0 to 9, which was lately called the ADEUTERIC.

Indeed, it may for a moment still appear that this function is in some degree *indeterminate*, because there may be many different ways of passing, by successive binary interchanges, from one given set of six, and a companion set of four vectors, to a second given set of six, with its own companion set of four. For example, we passed from the first to the tenth of the products already written, by a succession of *nine* binary interchanges, which may be indicated thus:

$$56,\ 67,\ 78,\ 89,\ 45,\ 98,\ 87,\ 76,\ 57.$$

But we might also have passed from the same first product,

$$+\,012345 \,.\, 6789,$$

by the *two* binary interchanges 47,56, to this other product and sign,

$$+\ 012376\,.\,5489,$$

where the sign + is prefixed, on account of there being now an *even* number (two) of such changes. On the other hand, the *odd* number (nine), of binary interchanges above described, had given the term

$$-\ 012376\,.\,4589.$$

But because, by the properties of the pyramidal function of four vectors above referred to, we have

$$+\ 5489 = -\ 4589,$$

the two terms thus obtained differ only in appearance from each other. And similar reductions will in every other case hold good, in virtue of the properties of the pyramidal and aconic functions, combined with a principle respecting transpositions of symbols (which probably is well known): namely, that if a set of n symbols (as here the ten figures from 0 to 9) be brought in any two different ways, by any two numbers l and m of binary interchanges, to any one other arrangement, the *difference* $m - l$ of these two *numbers* is *even*.

The VALUE (including sign) of the foregoing *adeuteric* function, of any ten determined vectors, is therefore itself completely *determined*, if we fix (as before) the *arrangement* of the ten vectors in the *first* of the 210 terms from which the others are to be derived: because the *value* of *each* separate term becomes then fixed, although the *forms* of these various terms may undergo considerable variations, by interchanges conducted as above. If then we choose *any two* of the ten vectors, suppose those numbered 4 and 7, we may *prepare* the expression of the *adeuteric* function as follows. We may first collect into one group the 70 terms in which these two vectors both enter into one common aconic function; and may call the sum of all these terms, Polynome I. We may next collect into a second group all those other terms, in number 28, for each of which the two selected vectors both enter into the composition of one common pyramidal function; and may call the sum of these 28 terms, Polynome II. And finally, we may arrange (after certain permitted transpositions) the remaining 112 terms into 56 pairs, such as

$$+ 012345 \,.\, 6789 - 012375 \,.\, 6489,$$

and

$$- 012346 \,.\, 5789 + 012376 \,.\, 5489,$$

and may call the sum of these 56 pairs of terms, Polynome III.; the rule of pairing being here, that the two selected vectors (in the present case 4 and 7) shall be interchanged in passing from one term of the pair to the other, with a change of sign as before. But when the expression of the *adeuteric* has been thus prepared, it becomes clear that *each* of its *three* partial polynomes is changed to its own *negative*, when the two selected vectors are interchanged. In fact, *each term* of the first polynome changes sign, by this interchange, in virtue of the properties of the *aconic* function of six vectors. Again, *each* term of the *second* polynome in like manner changes sign, on account of the properties of the *pyramidal* function of four vectors. And finally, *each pair* of terms in the third polynome changes sign, from the manner in which that pair is composed. On the whole then we must infer, that the sum of these three polynomes, or the function above called the ADEUTERIC, CHANGES SIGN, *without otherwise changing value, when* ANY TWO *of the* TEN *vectors on which it depends are made to* CHANGE PLACES *with each other:* whence it is very easy to infer, that *this adeuteric function* VANISHES, *when any two of its ten vectors become* EQUAL.

Now the aconic function is of the *second* degree, with respect to each of the six vectors on which it depends; while the pyramidal function is easily shewn to be only of the *first* degree, with respect to each of the four other vectors which enter into its composition. Hence each of the 210 terms of the adeuteric rises no higher than the *second degree;* and *if we equate* *this adeuteric function to zero, we thereby oblige any one of the ten vectors to terminate on a given surface of the second order, if the other nine vectors be given.* But it has been seen, that the adeuteric vanishes, when *any two* of its ten vectors are made equal to each other; the surface which is thus the *locus* of the extremity of the *tenth* vector, must, therefore, pass *through the nine points* in which the *nine other* vectors respectively terminate. On this account the ten vectors, or their extremities, may be said to be, under this condition, HOMODEUTERIC, as belonging all to *one common surface of the second order*. And thus we at once justify, by contrast, the foregoing appellation of the ADEUTERIC function, and also see that to equate (as above) this adeuteric to zero, is to establish what may be called the EQUATION OF HOMODEUTERISM, as in fact it was so called in a recent communication to the Academy; while, as an abbreviation of the recent notation, we may now write that equation as follows:

$$\Sigma\,(\pm\,012345\,.\,6789) = 0\,;$$

where the sum in the left hand member represents the adeuteric function.

What has been shewn respecting the composition of this *adeuteric*, may naturally produce a wish to possess some *geometrical rule for constructing the aconic function* (012345), of any *six* given vectors; and the *quaternion expression* for that function enables us easily to assign such a *rule*. For this purpose, let A, B, C, D, E, F be the six points at which the six vectors lately numbered as 0, 1, 2, 3, 4, 5 terminate, being supposed to be all drawn from some assumed and common *origin* O; while G, H, I, K may denote the four other points, through which the surface of the second order passes, when the equation of homodeuterism is satisfied, and which are the terminations of the four other vectors above numbered as 6, 7, 8, 9. The aconic function, above denoted as 012345, of the six vectors, OA, OB, OC, OD, OE, OF, which terminate generally at the six corners of a gauche hexagon ABCDEF, may now be concisely expressed by the symbol

O . ABCDEF ;

or even simply by ABCDEF, the reference to an origin being understood. To construct it, Sir W. Rowan Hamilton constructs first the six vectors

$$\mathrm{V}.\alpha\alpha^{\mathrm{I}},\ \mathrm{V}.\alpha^{\mathrm{I}}\alpha^{\mathrm{II}},\ \mathrm{V}.\alpha^{\mathrm{II}}\alpha^{\mathrm{III}},\ \mathrm{V}.\alpha^{\mathrm{III}}\alpha^{\mathrm{IV}},\ \mathrm{V}.\alpha^{\mathrm{IV}}\alpha^{\mathrm{V}},\ \mathrm{V}.\alpha^{\mathrm{V}}\alpha,$$

and then the three other vectors β, β', β'', which depend on these, in order to form thence that scalar $\mathrm{S}.\beta\beta'\beta''$, which, by what was stated near the commencement of the present Abstract, is the *aconic* function required. It will be seen that all the steps of the following construction of that function are in this way obvious consequences from the quaternion expression above given. The construction itself was communicated to a few scientific friends of his about the end of August and beginning of September, 1849, and has since been publicly stated at the Edinburgh Meeting of the British Association in 1850, although it has not hitherto been printed.

Regarding the given and gauche hexagon, ABCDEF, as a sort of *base* of a *hexahedral angle*, of which the *vertex* is the assumed point O, Sir W. Rowan Hamilton *represents* the *doubled areas* of the six plane and triangular faces of this angle, namely,

AOB, BOC, COD, DOE, EOF, FOA,

by *six right lines* from the vertex,

OL, OM, ON, OL′, OM′, ON′,

which are respectively *normals* to the six faces, and are distinguished from their own opposites by a simple and uniform rule of *rotation:* for example, the line OL contains as many linear units as the doubled area of the triangle AOB (to the plane of which it is perpendicular) contains units of area; and the rotation round OL from OA to OB is right handed. The doubled areas of the three new triangles,

LOL′, MOM′, NON′,

are next to be *represented*, on the same general plan, by *three new lines* from the vertex,

OL″, OM″, ON″;

which three lines will thus be the intersections of the three pairs of opposite faces of the hexahedral angle, and consequently will, by Pascal's theorem, be situated in one common plane, if the given hexagon ABCDEF can be inscribed in a cone of the second degree, with the point O for its vertex. But in the more *general* case, when the given hexagon *cannot* be so inscribed, in any such cone with that assumed point for vertex, we can construct a parallelepipedon with the three last lines, OL″, OM″, ON″, for three adjacent edges: and the *volume of this solid* is the geometrical representation which Sir W. Rowan Hamilton's method assigns for what he calls (as above) the *aconic function* of the six given vectors, or of the six given points A, B, C, D, E, F, in which those vectors terminate, or of the (generally gauche) hexagon of which those points are corners. And with respect to the *sign* of this function, it is to be regarded as being positive or negative, according as the rotation round ON″, from OM″ towards OL″, is to the right hand or to the left.

Such then is the construction of the *aconic* function, 012345, or ABCDEF; and it is still more easy to construct the *pyramidal* function 6789, which may also be denoted by the symbol GHIK; since the absolute value of this function is constructed (as above remarked) by the *sextupled volume of the pyramid*, which has the four points G, H, I, K for corners, or by the volume of the *parallelepipedon* which has GH, GI, GK for edges; while the quaternion expression assigned near the commencement of this Abstract, admits of being thus written,

$$S\,.\,(a^{\text{IX}}-a^{\text{VI}})\,(a^{\text{VIII}}-a^{\text{VI}})\,(a^{\text{VII}}-a^{\text{VI}}),$$

and conducts to the regarding this volume, or the function 6789, or GHIK, as being positive when the rotation round GH from GI towards GK is right handed, but negative in the contrary case. And the aconic and pyramidal functions having thus been *separately* constructed, they have only to be *combined* with each other, according to the law already stated, in order to assign a *geometrical signification* to each term of the *adeuteric function*, namely, the sum,

$$\Sigma\,(\pm\,\text{ABCDEF . GHIK})\,;$$

and also to the *equation of homodeuterism*, which may now be written thus (as in a recent communication to the Academy),

$$\Sigma\,(\pm\,\text{ABCDEF . GHIK}) = 0,$$

and which expresses that the *ten points*, A, B, . . . K, are situated *upon one common surface of the second order*. And if we place the arbitrary origin O at one of the ten points, the *number of terms* in the adeuteric function, or in the equation of homodeuterism, is easily seen to *reduce* itself, then, from 210 to 84.

If the thirty *co-ordinates* of the ten points were substituted in the function above called the *adeuteric*, the resulting expression could doubtless only differ by some numerical coefficient from that *determinant* which might otherwise be found, as the result of the elimination of the nine coefficients A, B, C, D, E, F, G, H, I, between the equations,

$$Ax^2{}_0+By^2{}_0+Cz^2{}_0+Dy_0z_0+Ez_0x_0+Fx_0y_0+Gx_0+Hy_0+Iz_0+1=0,$$

$$\cdots\cdots\cdots$$

$$Ax^2{}_9+By^2{}_9+Cz^2{}_9+Dy_9z_9+Ez_9x_9+Fx_9y_9+Gx_9+Hy_9+Iz_9+1=0.$$

And Sir W. Rowan Hamilton has much pleasure in referring to a paper by Mr. Cayley, printed near the commencement of the Fourth Volume of the Cambridge Mathematical Journal, on Pascal's Theorem considered in connexion with determinants, which paper had not been noticed by the present writer, till his attention was called to it by a friend to whom he had communicated the above-stated construction. But while gladly acknowledging the great mathematical learning and originality exhibited in that and every paper by Mr. Cayley, Sir W. Rowan Hamilton thinks it right to state, that he was led to his own results, respecting the *relation* (above assigned) between *ten points on the surface of the second order*, not by any system of *co-ordinates*, but by considerations of *vectors*, and by seeking to extend to *ellipsoids* the results respecting *cones*, which he had submitted to the Academy in July, 1846, and had also published in the Philosophical Magazine for the following month, as derived from the Calculus of Quaternions.

Mr. M. Donovan handed in a paper on a new and singular acoustic phenomenon produced by tuning-forks.

Mr. David Moore, Curator of the Royal Dublin Society's Botanic Gardens, communicated the following details of the results of physiological experiments on the formation of wood in plants, made in the Royal Dublin Society's Botanic Gardens, Glasnevin, between the years 1839 and 1851:—

"It may appear remarkable in vegetable physiology, that what has long been considered an axiom should now be gravely disputed by one of the best physiologists of the present time. Dr. Schleiden, of Jena, in his admirable work, 'Principles of Scientific Botany,' flatly denies that a downward current of elaborated bark-sap either does or can take place in plants, which opinion gives to the experiments I propose to describe much additional interest. At the time my experiments were commenced, and for several years afterwards, the descent of the sap in vegetables does not appear to have been doubted, the whole theory of wood-formation resting on the fact of such being the case. It was, therefore, more with a view of eliciting information on the latter subject, than to prove or disprove that sap circulates, as it has generally been considered to do, they were undertaken.

"Before entering into details, I shall take the liberty of very briefly stating to the Academy the views held on this important subject by Drs. Lindley and Schleiden, which are entirely antagonistic. The former author, in his 'Theory of Horticulture,' at p. 28, makes the following statement:—'When sap leaves the earth and passes into the stem, it ascends by the woody matter of the finest fibres of the root; having left them, it flows into the new wood from which those fibres emanated, and passes along this until it reaches the leaves; on its return from them it descends through the liber, in part passing off horizontally through the medullary rays. Wherever it passes it deposits a portion of its solid parts,' &c. Dr. Schleiden, on the other hand, denies that wood is formed by a descending bark-sap. In his chapter on the 'Reproduction of Plants,' in 'Principles of Scientific Botany,' p. 535, when treating on grafting, we have the following statement:—'Yet the stock must always exert a greater or less influence on the eye or graft, as the sap brought to it must pass through the cells of the stock, and become changed there. In this case the relations are too complicated to enable us to offer an explanation. All that is known on the subject is detailed in manuals of horticulture. I will mention one case. If the branch of a quick-growing plant is grafted upon a very slow-growing one, as, for instance, the branch of a plum upon a sloe-stock, the graft will grow rapidly, but not so the stock, which retains its slow-growing character; a striking example of the permanency of the specific life of the stock, and, as it appears to me, affording a fatal argument against the pretended descent of the sap. If a descending bark-sap existed, the sloe-stock would be naturally covered with annual rings of plum wood from the graft, and it would grow in proportion to the growth of the graft, but this is by no means the case, for the new annual rings are formed, not out of a descending bark-sap, but out of a cell-development of the cambium already existing in the stock, and having essentially the same characters. The formation of new wood of the nature of the graft has always been taken for granted, in order to prove the descent of the bark-sap; but we find that this wood does not partake of the nature of the graft, and that it must, therefore, be formed independently of any descending juices.' These being the views held by the best authorities on the matter at present, I shall now detail my experiments, and show how far they bear on either.

"My predecessor, Mr. Niven, had been conducting some physiological experiments before he left the Botanic Gardens, the results of which are already before the Public. I consider, however, it only just on my part towards him, that I shall here state my principal experiment to be founded on one he had commenced, though we do not appear to have been aiming to attain similar objects. He had cut several trees more or less through their boles in various ways, one of them a large horse-chesnut tree, then four feet in circumference, and now four feet nine inches. At three feet from the surface of the ground, two deep incisions had been made through the stem, crossing each other at right angles, and reaching the circumference on each side (Fig. 1). The tree was thus left growing on four separate pillars of wood, alburnum and bark, but no results, that I am aware of, were deducible from this experiment when I commenced the following. Seeing that it afforded an excellent example for observing the growth of woody matter, as it would form to fill up the perforations through the stem, I examined the portion of the tree where it was cut, and found that the heart wood was completely dead, and beginning to decay, at both the upper and lower lips of the cut. It, therefore, could render no assistance whatever for the phenomena of life being carried on through its medium. The ascent of the sap and formation of wood must then have depended altogether on the functions of the alburnum and cambium, which rested on the four pillars of dead wood, now simply acting as supports. During the

Fig. 1.

Fig. 2.

spring of 1839, I had one of the pillars laid bare (Fig. 1, A), thus confining the life-supporting action to the remaining three. In a short time afterwards, granulated masses of cellular tissue began to form on the upper lip of the incision made, and continued to extend down the surface of the bare pillar throughout the summer, whilst the lower lip of the incision remained free from wood-formation. The woody matter continued to increase rapidly through the summer of 1840, extending itself both in perpendicular and lateral directions from the upper lip. On the lower lip two leaf-buds were formed (Fig. 2, C), which produced young shoots, when woody matter began to form at the bases of these shoots; but on their being removed, the farther increase of tissue at once stopped. In May, 1841, the masses of cellular tissue and wood had extended from the upper lip so as to touch the lower, and to spread along its surface.

"When the junction took place, a second of the pillars was laid bare, as the first had been, and the results were similar. The only difference observable was, that the woody matter did not form so rapidly as it did in the first instance. At the expiration of three more years, a second junction had taken place on the pillar last laid bare. A third was now subjected to the same experiment, the principal difference of results in this case being, that no leaf-bud was formed on the lower lip. As soon as the third junction occurred, the fourth pillar was treated as the others had been, the growths of young wood becoming gradually weaker on each succeeding one being the only difference.

"Having now detailed the way this experiment was conducted, the facts elicited enable me to deduce:

"1st. That every organ in an exogenous tree may be thoroughly destroyed, without causing the death of the plant, provided they are gradually destroyed.

"2nd. Exogenous plants, through their vital processes, have the power of again restoring the organs so destroyed.

"3rd. The formative energy takes place principally above the wounded portion of the stem, and the newly formed tissues increase, for the most part, in a downward direction.

"Though these results may, at first sight, appear to be little more than confirmations of the old theory of wood-formation, and even the experiment itself in some degree similar to others which have already been made, the latter differs materially from any I know of, in the following particulars. Here the main stem of the tree was operated on, and not the branches only. All the organs were destroyed, including pith, medullary rays, and wood. In the course of twelve years the stem of a large exogenous tree, measuring four feet nine inches in circumference, has been completely killed in a circular ring seven inches wide, and the organs of vitality again restored, without apparently affecting the health of the tree, which is now, while I write (June, 1851), in full bloom. The results, I conceive, rather than adding confirmation to the established theory, bear out Dr. Schleiden's views in a remarkable manner. It is true the newly-formed tissue extended from the upper lip of the cut chiefly in the downward direction, and that very little appeared on the lower lip. But the train of reasoning I adopt from these circumstances is that of Dr. Schleiden. The flow of sap by endosmotic process from cell to cell, was interrupted by the alburnum and cambium being cut across on the pillar which was laid bare. It therefore diverged laterally, and followed its natural upward course, on the three pillars where no laceration had been made, which accounts for no growth taking place on the lower lip. On the portion of stem above the cut, a greater degree of formative energy accrued, in consequence of the interruption the endosmotic process met with below. The tissue thus formed would rather extend itself on the vacant space under, i. e., the bare pillar, than upwards, where endosmosis was less vigorous, in consequence of many of the cells being filled with sap of greater density. In this manner it continued to grow until it reached the lower lip of the cut, where its downward course was obstructed, when it spread in a lateral direction over the surface of the lip, as well as upwards, until the bare surface became covered over. During the whole process it did not occur to me, that the young wood was formed by a returning bark-sap. The growth seemed gradual and not periodical. The young tissue taking a lateral and upward direction when it met the lower lip, shows that, although the tendency be downwards, it will alter.

"A remarkable example of the permeability of the tissues of plants has farther been proved through this experiment. From knowing the heart-wood was dead at the part of the stem which was operated on, I was desirous to ascertain whether it continued so to the apex of the tree, which I had some reason to suppose it did, from having about four years ago observed a small portion of the top shoot dead. I, however, found the heart-wood full of sap, and apparently very healthy, in a piece of the top shoot which I had lately cut from below the dead part.

"With similar objects in view, a second series of experiments have been made, at various times within the last twelve years, by planting cuttings of free-growing plants with their tops downwards. Placed in this way, adventitious roots were protruded, and the plants grew. Cellular granulations at first appeared on the end which was now uppermost, and out of the ground, a circumstance which militates against the inference drawn by some, namely, that the physical law of gravitation operates in causing the sap to descend.

"In conducting this experiment I have invariably found, that no cellular callus formed at the lower extremity, as would have been the case had I planted the cutting in the regular way. The young roots were protruded laterally from the bases of leaf-buds under ground; when one or more of these elongated, the axis made a sharp curve upwards, until it regained its natural position. The growth and woody formation went on then in the usual way. In some cases the portion of the cutting above ground remained alive during a considerable period, though no leaf-buds grew on it. It, however, soon died after the ascending shoot gained strength.

"This experiment, in my opinion, also tends to prove, that no regular return of assimilated bark-sap takes place in the formation of wood; because, if such were the fact, the position of the cutting above ground would have lived, and continued to receive the annual deposits, which was not the case.

"The beautiful example I have laid before the Academy, of the junction of stock and graft, proves, beyond any manner of doubt, that the two increase by separate growths of their own wood, as thoroughly as if they still grew on separate roots. I cannot, therefore, see how this fact can be got over by those who hold that exogenous plants increase by annual deposits of bark-sap. It will not, however, do to draw final conclusions from isolated cases on a subject which, if Dr. Schleiden's reasoning be correct, so great a change must necessarily follow in our views of this part of the science of vegetable physiology.

" The present communication may, perhaps, have a tendency to direct more marked attention to the matter, by some of the Members of the Royal Irish Academy."

PROCEEDINGS

OF

THE ROYAL IRISH ACADEMY.

MONDAY, NOVEMBER 10TH, 1851.

THOMAS ROMNEY ROBINSON, D. D., PRESIDENT, in the Chair.

THE following antiquities were presented to the Museum of the Academy:

An ornament of annular shape, a stone celt, and a weapon made of flint, found near Ballinderry, King's County; presented by W. F. Barton, Esq.

A stone mould for casting bronze arrow-heads; presented by Patrick Brophy, Esq.

A bronze celt, a brass plate, and a bronze spear, found near Tullahogue; presented by the Rev. Thomas H. Porter, D. D.

An antique wooden dish, found near Magherafelt, County Armagh; presented by the Rev. Dr. King Irwin.

A wooden cup or mether, which bore the name and date of Dermot Tully, 1590; presented by William Allen, Esq.

An antique iron key, with a handle curiously wrought, and bearing traces of having been overlaid with gold, found in the vicinity of the Little Monastery, at Bonamargy, near Ballycastle, County Antrim; presented by John Francis Waller, Esq., M. R. I. A., from Caleb Powell, Esq., Clonshaboy, County Limerick.

The Secretary read an extract from a letter of Edward J. Cooper, Esq., M. R. I. A., addressed to the Rev. Dr. Lloyd, on a Thunder-shower at Markree Castle on June 30th, 1851:

"The forenoon of June 30th was fine, but overcast. There were a few drops of rain about noon; atmosphere electrically charged, but not unusually so for the period of the year. At 4, P. M., very distant thunder; and the clouds showing symptoms of an approaching storm, I returned to the house from my garden. The heat at this time was considerable, yet not such as to indicate very near high electric action. At 10 minutes past 6, P. M., I first perceived a flash of lightning; I then took my watch out to ascertain its distance. One thunder-clap was remarkably loud for the distance, which was six miles. Moving to the window, facing N. W., under which some people were playing at quoits, and perceiving that there was scarcely any wind, I told them that they need not be afraid of the storm, as the lightning was so distant; the nearest was not within four miles. At about half-past, and in an instant of time, a strong breeze arose, followed almost immediately and as instantaneously by a most extraordinary shower of rain, with hail. In five minutes the road under the window was a sheet of water; the quantity was so great that it penetrated through the ceilings of two stories of the house. It lasted for fifteen minutes; and during this time there fell one and a half inch *depth* of rain!! This singular phenomenon moved in a direction nearly at right angles to the magnetic meridian, from S.W. towards N.E. A lady who was in a room with a southern aspect, saw the rain approaching, and described it as appearing like a dark sheet. After this had passed away, there was no heavy rain again until a quarter before 8. The heaviest shower previously noted here fell on the 6th of August, 1846. On this occasion the amount of rain which fell in fourteen minutes = 0.409 in. This gives at the rate of forty-two inches for one day; but it was quite eclipsed on the 30th ult., which was at the rate of twelve feet per diem!! I think that this last shower may have enabled us to form some idea of the Deluge, for, had it lasted forty days and nights, the depth of water would have been 480 feet! without the breaking-up of the waters of the great deep."

The President observed that the amount of rain mentioned was very unusual. The heaviest fall that ever he himself observed in a part of Ireland almost in the same latitude as Markree, but differently circumstanced in respect of moisture, was 8–10ths of an inch in 45 minutes, when there was also a thunder-storm. The observatory of Mr. Cooper was situated in the rainiest part of Ireland, which received currents from the Atlantic, charged with moisture, and was surrounded with hills, from which a great deal of moisture descended. The annual average fall of rain at Markree, he thought, was 42 inches, while at Armagh, a distance of 70 miles eastward, it was only 23 inches. Two ranges of mountains intervening between those places accounted for the difference. But these falls of rain were insignificant in comparison with those of tropical climates. Perhaps the most remarkable on record was one mentioned in the meteorological journal which was kept at his request some years ago by an officer who was stationed at the mouth of the river Irawaddy, in the Birman Empire. The quantity noted in this record was 120 inches in one day. In tropical climates, however, the rushes of rain at certain seasons only compensated for the extreme aridity of the climates during the remaining portions of the year. There were more rainy days in Ireland than in the sister country, but a smaller quantity fell at a time in the former. In no part of Ireland had they falls of rain equal to those which occurred at Whitehaven and amongst the Cumberland mountains. There were falls of 100, and sometimes of 120 inches in the year at Whitehaven, and of 70 inches at Keswick. Detailed notices of remarkable showers of rain were useful and instructive.

The President gave a short account of his visit to Norway, to observe the Eclipse, in August last; and explained the object of the recent Rules made by the Council for expediting the publication of Communications made to the Academy.

The Secretary read a communication from Digby Pilot Starkey, Esq., M. R. I. A., on a Meteoric Phenomenon, similar to an Aurora Borealis, seen at Kingstown June 22nd, 1851:

"At about half-past 10, P. M., it crossed the magnetic north, from W. to E., nearly horizontally, and disappeared, like the bursting of a rocket, at about 25° or 30° above the horizon. It was of the colour of flame, and left a tail of white light, probably 40° in length, or more, ending where the meteor disappeared, and assuming the appearance of a comet, with a distinct head and long, ribbon-shaped tail. After five minutes, or thereabouts, it began to become wavy, as if blown by the wind; and before a quarter of an hour had elapsed it assumed a form resembling three arches, with rays diverging downwards from three points of contact, the head becoming diffused, but occasionally returned in portions, for some time. The downward rays at the *nodes* were not constant, but remitted and *recurred* more than once. There was the crepuscular haze in the north at the time; sky cloudless; light wind, nearly north; air cold."

The President said that important and useful information might be preserved for scientific men if those who chanced to observe meteors would be careful to endeavour to mark accurately any particular star near which they appeared, any striking phenomena accompanying them, and the time of their appearance or disappearance as given by a common watch. Should the meteor disappear behind any object, such as a tree, the observer would do well to note also his position at the time, together with the point of disappearance as afforded by the intervening object. Circumstances such as these were almost the only means of determining whether those bodies belonged to our atmosphere, or existed beyond its range.

SATURDAY, NOVEMBER 29TH, 1851.

THOMAS ROMNEY ROBINSON, D.D., PRESIDENT, in the Chair.

THE Secretary exhibited an ancient brass seal of Thomas, Bishop of Elphin, obtained in England, through the kindness of Albert Way, Esq., in exchange for the ivory seal of "St. John's Hospital, outside the Barrier, Litchfield," found some time since in the county of Wexford, and originally presented to the Museum of the Academy by the Rev. Nicholas Codd, of Carrick, County Wexford, who gave permission, at the time of its presentation, to exchange it for an Irish seal, should one be found in England.

The following antiquities were presented to the Museum of the Academy:

Four Roman coins; presented by J. B. Godfrey, M.D., of London.

Dr. Petrie observed, that hitherto sufficient attention had not been paid to the ancient coins found in this country, simply because they were not Irish. This was much to be regretted, for such coins ought to possess the greatest interest for the Irish antiquarian. Upon his own chimney-piece there was a coin of the Byzantine empire, found at Rathfarnham; how it came there he could not explain; but the fact was, that Roman coins had been so constantly found in that locality, that whenever he saw any of them in a shop-window and inquired where they were found, he was almost invariably told that they were found in the neighbourhood of Rathfarnham. He wished that when Roman or other ancient coins were found in this country it would not be supposed that Irish antiquarians took no interest in them; the very contrary was the case.

The Earl of Enniskillen said he was not aware whether Roman coins had been often found in this country; but he might mention that a friend of his own, Captain Graves, had shown him a considerable number of them which were discovered at the Giant's Causeway, in the County of Antrim.

Dr. Petrie had seen several hundred Roman coins in the possession of a gentleman who had resided in that county; and he had also seen many Carthaginian coins which had been found in Ireland.

The President—That is a remarkable fact, and one which ought to be placed on record.

A silver signet seal of the fourteenth century, with an Agnus Dei in cornelian, and the legend "Ecce Agnus Dei;" presented by Catterson Smith, Esq.

A silver bell, found in the County of Roscommon; presented by R. K. Gardiner, Esq.

Two vessels made of pewter, and supposed to be a ciborium and a chrismatorium, found in a lake, near the river Brosna, King's County; presented by Sir William Betham.

A large stone celt, a peculiarly fine specimen, found in Monmunny bog, parish of Ahavea, County Fermanagh; presented by Rev. G. S. Smith, D.D.

An iron collar and chain, a bronze pin, an iron spear, and a human skull, all found near Strokestown, County Roscommon, were presented by Dennis H. Kelly, Esq., on the part of Richard Kelly, Esq.

The President addressed the Academy, on presenting the Cunningham Medal to the Rev. John H. Jellett, as follows:

Gentlemen,—Before we proceed to our ordinary business, it is my duty to present the Cunningham Medal to the gentleman to whom the Academy has awarded this, its highest gift of honour. Probably you are all of you aware that we owe our power of recognising distinguished talent to the enlightened bounty of one of our earliest benefactors, who left to the Academy a sum of money, signifying his wish that its interest should be applied to the advancement of physical and zoological science, but leaving us a wide permission to extend it to any of the objects connected with our pursuits. For a long time it was supposed that we were restricted to the necessity of awarding this Medal annually to the best of the essays that might be presented to the Academy on a question proposed by it; a course open to the disadvantage of making it a test of comparative rather than intrinsic excellence, and of placing it in a lower degree of estimation than that which ought to attach to the decisions of a Society like this. Impressed by a conviction of this kind, and by other equivalent motives, the Academy came, a few years since, to the—as I think—wise resolution of construing the intention of the donor in a far wider and more liberal manner; not restricting it, as before, to one communication, or one year, but spreading its limits still more widely, so as to include even communications which were not published in our Transactions. In fact, if a man brings light into any dark recess of the intellectual world, we are disposed to honour him, even though he has not thought fit to name us its dispensers. We acted on this principle in its fullest extent when, on a former occasion, we conferred this Medal on Mr. O'Donovan for works not given by us to the world, and one of which could not have been published in its Transactions; but I believe we acted both well and wisely on that occasion, for that gentleman has, by his works, afforded to all who take an interest in the study of the ancient language, history, and antiquities of our island, aid such as none other could have afforded; and, in fact, in this particular department of literature, he shines out conspicuously among his predecessors. At the same time, it must ever be borne in mind, that this case is an extreme one; and, although the Council acted wisely, and in accordance with the legal construction of Mr. Cunningham's bequest, and, as I think, in full accordance with its spirit and his intention, still I need not point out to you that such a case must always be regarded as exceptional, and must never be established as a precedent, except on grounds which are able to meet the fullest examination, and stand triumphant when they pass through the ordeal of public opinion. These grounds, I feel bound to say, exist very forcibly in the present instance. I have not yet seen the work which the Council has this year recommended to the Academy as deserving of this honour; but I know, and have satisfied myself by the inquiries I have made of one well acquainted with this work, and one than whom there is no person more competent to give a weighty opinion —I have, I say, satisfied myself, and, if I named my authority, you would all of you, I think, be equally satisfied, that in this instance also, the Academy will do honour to itself by honouring the author of this valuable work. On a subject like that of which he treats—the Calculus of Variations—parts of which have, for a century and a half, employed the noblest mathematical intellects in the world, it is not to be supposed that any one individual, however highly gifted he may be, can add much to the existing stock of our knowledge; yet, even in that respect, this work contains improvements of previously existing methods and other advantages, which, if their author had given them to us in a separate manner, would themselves have formed no ordinary title to fame. But this would have been a very contracted mode of considering the question. A far greater service has been rendered by the manner in which this task has been executed, to the advancement of geometry, than could possibly have been done by the author, if he had had in view merely the extension of his fame in this branch of high analysis. By devoting himself to a task far less attractive, and less remunerative to the exertions bestowed upon it than many other pursuits, and by descending from the more desirable position of an inventor to the humbler but more useful one of enabling others to place themselves on a level with himself, by compiling, for their use, an excellent elementary treatise, he has conferred on his species a benefit of the highest order; and, for this reason, therefore, as a reward for a work admirably performed, and calculated to be eminently useful, but as little likely to be given to the world as it was desirable that it should be so,—I fully concur in the adjudication of the Council, and I am sure, you, gentlemen, will agree with me. Therefore, Mr. Jellett (turning to that gentleman), I present you with this Medal, and I may observe that I have an added pleasure in presenting it, because I had the good fortune to be present at the examination which raised you to the position you now hold in the University, and because I then ventured to predict that you were one for whom a bright future was in store. I now, with pleasure, see you realize a portion of that hope on the present occasion, and most sincerely do I trust that this is only the harbinger of more extensive and brighter triumphs yet to come.

Professor Jellett read a communication from Joseph Patton, Esq., Professor of Mathematics and Natural Philosophy in Elphinstone College, Bombay, on Hygrometry, and Dalton's Theory of Mixed Gases.

The object of the author in this paper is to controvert the ordinary theory that the particles of different gases have no mutual action. Commencing with the case of aqueous vapour suspended in the atmosphere, he adduces several considerations to show that the known tension of vapour at the surface of the earth could not be accounted for on the supposition that vapour is only compressed by vapour.

Thus, for example, the difference between the average elastic force of vapour at Bombay and Mahabaleshwar is equivalent to ·276 inch of mercury. The height of the latter place above Bombay is about 4500 feet, consequently this difference in the elastic force ought to be produced by the vapour contained in a column of air 4500 feet high. But even if we suppose that through the entire extent of this column the dew-point is 85°, the same as at the base, a supposition which would evidently greatly exaggerate the amount of vapour, Professor Patton shows that the pressure of such a column of vapour would give, for the difference between the tensions at the two places, but ·114 inch of mercury, not half the actual difference.

Similar conclusions are deduced from the observations of Humboldt, which extend to an altitude of nearly 20,000 feet. From these observations Professor Patton reasons as follows: Taking the dew-point, as observed by Humboldt, at the several heights, 0, 3281, 6562, 9843, 13,124, and 16,405 feet, and assuming, as the most unfavourable supposition, that throughout the entire column, between two points of observation, the dew-point is the same as at the base, he finds the total amount of vapour in a column 19,686 feet high. To this he adds one-fourth, as the amount of vapour existing above the highest point, and thus obtains the total amount of vapour existing in the entire atmospheric column.

The pressure of such an amount of vapour would only produce, at the base of the column, a tension corresponding to a dew-point of 47°, the actual dew-point being 81°. Professor Patton infers, therefore, that the actual tension of the vapour at the surface of the earth cannot depend solely upon the amount of *vapour* by which it is pressed. The same conclusion is deduced from the observations of M. Guy Lussac.

Professor Patton confirms this conclusion by arguments drawn from the meteorological phenomena of the tropics. He asserts that the hygrometer gives no indication of the moisture which produces the tremendous tropical rains, amounting sometimes to ten inches within twelve hours.

In further confirmation of his views, as to the mutual action of gases, the author adduces the following argument:—If vapour exerts no pressure upon dry air; and if we can by any means cut off the lowest stratum of vapour, we should thus diminish the total pressure by the weight of the vapour existing in the atmospheric column. Acting on this principle, Professor Patton takes a bent glass tube, both ends of which are open and turned upwards. Into this tube he pours a small quantity of mercury, having previously filled one arm nearly to the bottom with powdered chloride of calcium. The effect of this substance being to render the air which is in contact with it perfectly dry, Professor Patton argues that, according to the ordinary theory, the atmospheric vapour can exert no pressure upon the mercury in that side. Hence, the mercury in the two arms of the tube ought to show a difference of level corresponding to the weight of the vapour contained in the atmospheric column. No such difference, however, could be perceived, the mercury standing at precisely the same height in both columns. From all these considerations, the author infers that the amount of vapour in the atmospheric column is not given by the Hygrometer.

Passing from the case of vapour to that of gases in general, the author adduces certain experiments for the purpose of showing that different gases do press upon one another. Thus, for example, if a tube filled with phosphorus and cotton be inserted tightly into the neck of a bell-jar filled with water, and inverted upon a pneumatic trough, and if the air be admitted through an opening in the tube, the air so admitted will be deprived of its oxygen before it comes into contact with the water. The phosphoric acid being absorbed by the water, the pressure on the water in the jar is due only to the tension of the nitrogen and carbonic acid present in the atmosphere. If, then, oxygen did not press upon these gases, it is plain that this tension ought to be less than the atmospheric pressure. But as the water stands at the same height in the jar and in the trough, it appears that there is no such difference.

Professor Patton has also accounted for the law of Mariotte, as applied to mixed gases, by the supposition that caloric is the force which repels the particles of a gas from each other. Admitting the truth of this hypothesis, let p, p', p'' be the pressures of three different gases, v, v', v'' the volumes which are subsequently mixed, and n, n', n'' the numbers of molecules contained in the several units of volume. We have then

$$p = kn, \quad p' = kn', \quad p'' = kn'',$$

k being a coefficient depending upon the temperature, and therefore the same for all. If now these three gases be mixed in a vessel whose volume is V, the number of molecules contained in a unit of volume of the mixture will be

$$\frac{vn + v'n' + v''n''}{V},$$

and the pressure of this mixture on a unit of surface will be, as before, $k \times$ number of molecules in the unit of volume. Hence, denoting this pressure by P, we shall have

$$P = k\,\frac{vn + v'n' + v''n''}{V};$$

and therefore

$$VP = vp + v'p' + v''p'',$$

the same expression as that deduced under the supposition of non-mutual action.

Mr. Haughton mentioned that Mr. Patton, the author of the last paper, had forwarded to him a sum of money to provide a European collection of rocks and fossils, for the purpose of promoting the advancement of science among the Hindoos.

The Secretary exhibited an ancient circular piece of bronze, containing figures on both sides, the property of Mr. Quinn, of Belfast.

The Rev. J. H. Todd, D.D., Secretary, exhibited an ancient ecclesiastical bell, and read a letter from John Bell, Esq., of Dungannon, relative to it. The bell is the property of Mr. M'Clelland, of Dungannon, who has kindly permitted it to be exhibited to the Academy. It is said to have been found in the cabin of a poor fisherman, at Fahan, six miles north-west of Derry, on Lough Swilly, in Innishowen, and was recently purchased by Mr. M'Clelland. Fahan, or Fahan-mura, was a monastery, dedicated to St. Murus or Muranus, and founded by St. Columba (Colgan, Trias Thaum., p. 495 and 510). St. Murus, second Abbot of this house, flourished in the beginning of the seventh century, and from the fame of his sanctity has since been reputed its patron. Of the relics preserved in this monastery, Colgan mentions a MS. life of St. Columba, in Irish metre, written by St. Murus himself; a chronicle, also in Irish; the Bachull-Mura, or pastoral staff of St. Murus; and a MS. containing the proper office for the saint's festival (12th March): all of which existed in Colgan's time.

The Bachull-Mura is now in the collection of George Petrie, Esq., LL.D., and Mr. Bell is of opinion that the bell now exhibited to the Academy, having been found in the neighbourhood, and being undoubtedly a bell of the seventh century, may also be considered as the bell of St. Murus.

It is of bronze, with a top or handle of wood, decorated with silver. One side of the bell is also richly decorated with a crystal and gems, and with very elaborate silver ornaments, which cannot be later than the eleventh or twelfth century. What is singular respecting this bell is, that the ornaments are attached to the bell itself, not, as is usual in such relics, on a case or cover separate from the bell. Dr. Todd also pointed out to the Academy, that a portion of the ornament was loose, and that on removing it, a still more ancient ornament was exposed, representing the usual Irish knot-work deeply incised in the metal. The tone of the bell is, of course, destroyed by these ornaments, which are fastened by rivets to its side.

Mr. Bell states: "Like many other Irish square bells, it was probably used as a drinking-cup. It was customary to make women during their pregnancy drink from such bells, the people entertaining the idea, that a draught administered in a holy bell was possessed of peculiar virtue in diminishing the pains of childbirth."

Geo. Petrie, LL.D., made some remarks on the bell, and gave some additional evidence to show that it was the bell of St. Murus, mentioned by Colgan.

The thanks of the Academy were voted to Mr. M'Clelland for his kindness in exhibiting the bell, and for permission to have it deposited for some time for public inspection in the Academy Museum.

Dennis H. Kelly, Esq., read the following account of an artificial island, and certain antiquities recently discovered near Strokestown, County Roscommon:—

"About a mile to the west of Strokestown, in the County Roscommon, is Cluain Ꝼraoiċ (Cloonfree), the royal residence of the Kings of Connaught, of which frequent mention is made in the Annals of the Four Masters. Of this once royal residence, the sole present remains are, a square, or rather oblong fort, about ninety paces by seventy, with a deep single fosse, covered over with tangled brushwood. Immediately to the south of the ancient palace, at a distance of about 500 yards, is the extremity of the lake of *Cloonfree*, and nearly joining on to it that of *Cloonfinlough*, whilst about a mile further on, *Ardekillan* completes the chain; and it is the artificial islands in these lakes, but especially that in *Cloonfinlough*, that form the proper subject of this paper, and any one wishing to more completely identify the locality can easily do so by referring to Sheets 28, 29 Ordnance Survey, County Roscommon. Each of these lakes has one of these islands in it; that in *Cloonfree* is situated just opposite to the site of the ancient palace, on the mainland; that at *Cloonfinlough*, just opposite to the ruins of a small church, on the mainland, and that at *Ardekillan* in similar proximity to a ruined church, on the mainland. The one with which we are more immediately concerned is that in Cloonfinlough, Cluain fionn-loċ, "the enclosure of the white lake," a designation which it well merits, overlying, as it does, a stratum of very white shell marl.

"The operations of the drainage works now going on under the Board of Works, in the vicinity of Strokestown, have greatly lowered the level of the water in all these lakes, and last summer laid bare the artificial islet of Cloonfinlough, exposing the nature of its structure, and a considerable deposit of bones adjoining it, amongst which have been found a large number of very miscellaneous antiquities.

"The dimensions of the island are about 130 feet diameter;

it is constructed on oak piles (many of them showing the action of fire), driven into the soft marl, at regular distances, and tied together by horizontal oak stretchers, so as to form a triple stockade round it, with an interval of about five feet between each stockade. Outside of this, to the north-westward, are a number of irregularly placed piles, stretching a short distance from the islet, and it was adjoining to them the great deposit of bones was found. The centre of these stockades was laid with trunks of smallish oak trees, placed flat on the marl, and all pointing to a common centre, thus forming a platform whereon the island itself was constructed. When it was first observed, there was, jutting out from the island to the lake, towards the west, a kind of jetty or pier, formed of a double row of piles and stretchers running parallel, about eight feet asunder, and on which logs of timber were closely laid horizontally.

"Of this gangway, and of the stockades, there are now but very imperfect remains, so much has been broken up and removed by the peasantry.

"The deposit of bones, &c., close to this island, consisted of bones of cattle, deer, horses, swine, sheep, fowl, dogs, deer, both fallow and red, a few specimens (in general much broken) of the horns of the Irish elk, and one or two specimens of human remains, and amongst them a quantity of articles of a most miscellaneous description, some of apparently very great antiquity, and others of a much more recent date. Amongst these are spear-heads, bronze pins, some of exquisite workmanship, and scarcely any two of exactly the same form. A brass bowl, hammered out of the solid; two brass vessels, made of small pieces, most curiously rivetted together; a brooch of handsome workmanship; a variety of bone pins and implements; deer horn-combs, of very great artistic merit; horn discs, like backgammon men; knives, hooks, and hatchets of iron; swords and spear-heads; an iron implement, like what a baker uses for putting his loaves in the oven, made of sheet iron, curiously rivetted together, and having in the centre a circular ornament, with a cross in it, that has evidently once had an arabesque pattern on it; sundry miniature frying-pans, and a small whetstone; single and double bronze rings; one coin of the Emperor Hadrian; one bulla, Pope Paul V.; sundry silver coins, most of them Edwards, and one so late as James, 1690, and one silver coin, unfigured in any collection that I have seen.

"Between the island and the ruined church were found two canoes, hollowed out of single oak trees, but neither of them much more than two feet wide; the stern of one of them was perforated with numerous auger holes, about one inch each in diameter.

"On examining the structure of the island itself, which was effected by cutting a trench 20 feet long by 5 wide, as near the centre as possible, there was found, at about eight inches under the surface, which was covered with rank grass growing in a rich mould, a very close-laid pavement of irregular-sized boulder stones. When this was removed, a stratum of black earth was exposed, with occasional fragments of bones through it of swine, fowl, sheep, cattle, and deer; and about six inches beneath this, a considerable layer of burned earth, with several inches of unburned clay under it. Then came a second very closely-laid pavement of large-sized, flat-surfaced stones, beneath which were alternate layers of black earth and burned clay and marl, reaching down to the log platform, and interspersed, like the one above it, with occasional bones and fragments of bones; some few human remains, viz., one skull, and portions of some more were got on the exterior edge. No coffin-stone, chest, or other sepulchral remains.

"Amongst the bones found were some heads of oxen of the purest short-horn breed, precisely similar to those found at Dunshaughlin.

"The only structures of this description brought under public notice previously have been the stockade at Dunshaughlin, mentioned by Dr. Wilde, and one at Lough Fea in the County

Monaghan, very cursorily alluded to by Mr. Shirley in his publication; but W. T. Mulvaney, Esq., Commissioner of Public Works, informs me he has heard of two others in lakes in Cavan and Leitrim, laid bare by drainage, and for the particulars of which he has very politely written.

"It is remarkable, that the forms of the stockades at Dunshaughlin and Cloonfinlough are perfectly similar, that both were situate in lakes, and exposed by drainage operations; that opposite Cloonfinlough on the main land is a ruined church; opposite Dunshaughlin, a ruined structure; that near both canoes were found, and that the pins and other antiquarian remains, as well as the heads of oxen found, are precisely identical.

"It is thus, I think, quite manifest, that these islands are artificially constructed, and that originally they were inaccessible, except by boats, whilst from the circumstances of these boats being hollowed out of single trees, and some of them of very considerable size, the conclusion follows that they were constructed at a very remote period, when the art of boat-building was comparatively unknown, and ere the primeval forests had vanished from our soil; and this supposition would be strengthened by many of the pins and bronze ornaments found, whilst the horns of the Irish elk, long extinct, would similarly point to a very remote date. But along with these are also found other matters of much more recent date, and which would lead to quite a different conclusion.

"Amongst these latter articles are knives, *some of which have failed in the forging; combs in* an *incomplete state of manufacture;* deer-horns *sawn* in sunder, and shavings as if *left after a turner.* From these I am led to think, that whatever may have been its original occupants, in later times the little island resounded to the busy hum of industry, and that the smith, the brazier, the comb-maker, and the turner, there drove a brisk trade, and sometimes solaced their leisure in the construction of pretty toys, like the tiny plate-bucket in the possession of the post-mistress of Strokestown, and whose neatness of finish would do no discredit to our best modern cabinet-makers. It is turned in oak, and hooped with brass, four and a half inches high, and four inches diameter. There were originally a pair, but one was unfortunately broken.

"The purpose for which such a structure may have been made is altogether matter of conjecture, as no reference to such is made in any of our annals. Some have thought that they were places of sepulture, and the bones those of the victims offered at the entombment of some powerful chief; but a friend has suggested that such could not be the case: first, because that at such a ceremony, the custom was an holocaust, in which the animals would be consumed *en masse;* and, secondly, he knows of no instance of wild animals, like deer, captured in the chase, being so offered; but he then suggests, that these islands, inaccessible when the boats were secured, might not have been unacceptable retreats to the instruments of feudal tyranny, or to petty chieftains who lived by border robbery; and that, in the course of years, the bones thrown over the side by the little garrison might have accumulated to the extent of what have been found; and the pins and other articles of that date found along with them may well have been dropped in the carelessness of such vagrant life, whilst the rough culinary arrangements of former days might account for the burned earth. But it is a curious matter if such were the case, and I am inclined to deem it not far from the fact, that, amongst the numerous pins found, scarce any two are critically alike.

"He then goes on to suggest that, in later times, the island that had afforded a fastness to predatory chiefs might have become the residence of the artisan; and, combining the fact of the proximity of the ruined church, that such artisans might well have united the clerical and laical characters, and been monks, labouring at the smithy, the turning-lathe, or the foundry; and that this would account for the bones, horn, and iron articles of more recent date. The horn discs discovered may have been the draught-men with which the brethren amused themselves at a game of chequers, and we all know this was a favourite game amongst the ancient Irish. In the Caoıne Clanna Uıṙhcac, one of our most ancient tales, the beautiful Ꝺeıṗꝺpı is represented as engaged in a game of chequers with her lover, when their residence is treacherously assailed by the myrmidons of O'Connor. And in the Leaḃaıp na ᵹceapꞇ, the right of the chief of Siol Murry, and of the King of Chach, are stated to be certain chess-boards. Moreover, the brethren, on this supposition, may well have eked out their artistic earnings by their accustomed questing, and thus the coins of various dates are accounted for.

"Another friend, with more ingenuity than probability, has suggested that this island, where manifestly was a smithy, was the retreat of the smith who, in early ages of Irish history, was looked on as associated with magic rites, possessed of the evil eye, and shunned as an associate; and to this, St. Patrick's hymn at Tarah gives some countenance, where he mentions *Smiths* and Druids as those whose incantations he deprecates; but I own I look on this suggestion as very fanciful.

"The double pavement is again a difficulty; but here the suggestion of Mr. Mulvaney, Commissioner of the Board of Works (and whose extended acquaintance with drainage operations entitles any suggestion of his to the greatest weight) affords a solution. He says, he has no doubt that the levels of our inland lakes have frequently been suddenly and considerably raised by stoppages in the outfalls and accidental obstructions, like the falling in of a bank, or the accumulation of floating timber; and, supposing such to have occurred at Cloonfinlough, and nearly submerged the island, rapaciously occupied, it might have been raised afresh, and the new pavement laid for the convenience of its more peaceful occupants.

"The other two islands in Ardekillan and Cloonfree have not yet been examined. All that is really known of them is, that an external stockade is apparent round them, like that at Cloonfinlough. Near the former, Ardekillan, was found a boat forty feet in length, and four feet across the bow hollowed out of a single oak! and in which were a skull, a bronze pin, and a spear, which, by the liberality of Mr. R. Kelly, I am permitted to present to the Academy. The skull is perforated in the forehead, and has the mark of no less than twenty sword-cuts on it, showing the murderous conflict in which its owner must have been engaged; and near to it were found a neck-piece of iron, and twenty feet of rude chain attached, that would do credit to the dungeons of Naples, and by which its unhappy victim was made fast. These, which I believe are perfectly unique, Mr. R. Kelly has also permitted me to present to the Museum; and they certainly do not afford any very exaggerated idea of the humanity of our Milesian ancestors.

"In conclusion, I would venture to suggest to the Academy to have the other stockaded islands systematically examined in the ensuing summer, and by parties capable of doing far more justice to the subject than so unexperienced an antiquarian as the author of the present paper."

Robert Ball, LL.D., remarked that the discovery of bones of the Irish elk, in the locality described by Mr. Kelly, was not conclusive evidence that the other bones and the antiquities found with them were contemporary with the period of that animal in Ireland.

George Petrie, LL.D., made some remarks on ancient crannog islands, and on the iron articles discovered in those at Dunshaughlin and Cloonfree.

The Earl of Enniskillen made some remarks in relation to crannog islands, and read the following memorandum, which had been given to him by the Rev. William Smyth Burnside, with certain antiquities described therein, which he presented to the Museum of the Academy, as illustrative of discoveries of the same kind:

The fortified islands in lakes in Ireland were artificial, built upon piles of oak; upon them were constructed huts or crannoges. The red deer and elk were killed in the chase, and were brought in boats into the island; corn also was ground into meal by small hand-mills. Amongst several others are mentioned:—

1455. Lough Melge, between Fermanagh and Leitrim.

1512. Tullyline, in the county of Cavan.

1436. The Crannog of Logh Laohaire, near Clogher, in Tyrone, was taken by the sons of Brian Oge O'Neill. The O'Neills and Henry O'Neill came to the lake there; and they sent for Thomas Oge Maguire, and when he arrived, they made vessels to carry them to the Crannog, on which the sons of Brian Oge were. The sons of Brian Oge then agreed to surrender the Crannog to O'Neill, and make peace with him. This lake and Crannog have been in possession of the family of Burnside since before the siege of Derry; for the last two centuries it has been called Corcreevey. In the year 1845 the lake was drained, and the Crannog dug over, when the following antiquities were found, and are now presented to the Earl of Enniskillen by William Smyth Burnside, Clk.

1. A pair of bronze and iron manacles.
2. An ornamental comb worn round the neck.
3. Parts of a musical instrument.
4. An arrow-head.
5. A spear-head.
6. A smooth stone, used perhaps for slinging.

The Secretary of Council brought forward the following Report from the Committee of Publication respecting the Catalogue of the Museum.

The following is an outline of the plan which Dr. Petrie proposes to adopt. Though desirous to adhere as far as possible to a chronological arrangement of the objects, Dr. Petrie intends to class them, in the first instance, according to the material of which they are formed. Without assuming that all stone implements belong to the earliest period, we may say that a primitive people will generally employ stone in the manufacture of their weapons and tools. Accordingly, Dr. Petrie intends to commence with a fasciculus, comprising a Catalogue of the stone objects. From these he proposes to proceed, in order, to those formed of bronze, gold, iron, and silver; not that the material determines their respective dates, for abundant facts demonstrate the contrary, but because the prevailing use of a metal may be taken to indicate a certain phase of civilization. Thus there can be no doubt but that the period in which bronze articles were in general use preceded that in which iron was employed for like purposes; and yet instances similar to that brought under our notice this evening prove incontestibly that bronze and iron weapons were in use at the same time. So, again, it may be said of our silver antiques, that they belong to the times posterior to the introduction of Christianity into Ireland, and yet they are found occasionally in connexion with bronze and iron articles. To the first part of the Catalogue Dr. Petrie intends to prefix an introductory chapter, describing, so far as we have materials to illustrate it, the mode of life amongst the earliest inhabitants of the country. He will then proceed to catalogue the stone objects, dividing them into subordinate groups, consisting of weapons, implements, ornaments, &c., and arranging each group according to what he believes to be the age of the several specimens. Drawings of typical forms will be given; and the deviations of the rest will be noticed. He proposes, in all cases where we have the information, to mention the places where the several objects were found, and the names of the persons by whom they may have been presented to the Academy. To the Catalogue of the stone articles Dr. Petrie proposes to add a chapter on the clay urns found in ancient places of sepulture. As these objects belong to the pagan period, it appears more fitting to connect them with the class of stone articles than with any of the metallic groups.

As regards the time when the Council has reason to expect the execution of this plan, it will be most satisfactory to the Academy to hear that Dr. Petrie has pledged himself to devote his undivided attention to the preparation of the Catalogue, and to deposit the manuscript of at least the first portion of it with the Committee of Publication before the Stated Meeting of the Academy, in March, 1852.

It is hoped that the publication of Dr. Petrie's Catalogue will accomplish several important ends.

In the first instance, it will be a complete list of all the articles in the Museum, in which each specimen will have its own number. Thus the safe keeping of the objects will be provided for, and we shall no longer be absolutely dependent, as we now are, on the vigilance and integrity of our Curator.

Moreover, the visiters to the Museum will be able, by reference to the Catalogue, to ascertain the nature of each object, and satisfy the reasonable curiosity which our Collection is so well calculated to excite. As the Academy is an institution which derives a part of its resources from the State, it is but just that its Collections should be made as available as possible for the use of the public.

The introductory chapters to the several parts of the Catalogue will render it, in a great measure, a manual of Irish archæology, diffusing sound information on this subject. When such knowledge becomes more general, many articles of antiquarian interest will be saved from the fate to which they are now subject, through the ignorance of those into whose hands they fall.

It may be added, that the publication of such a Catalogue as is now contemplated will do much to promote the interest of the Museum itself. When its importance as a Collection illustrating the national history is better understood, increased donations will, doubtless, attest the regard in which it is held by all classes of our countrymen.

Monday, December 8th, 1851.

WILLIAM HAMILTON DRUMMOND, D. D., in the Chair.

The following antiquities, found in the lake of Cloonfree, were presented to the Museum of the Royal Irish Academy by Alonzo Lawder, Esq., of Cloonfinlough, Strokestown, through Robert Callwell, Esq.:

1. A horse-shoe, made of iron.
2. A fragment of iron, probably part of the hilt of a sword.
3. An iron spike, for butt-end of a spear.
4. A bone spear-head.
5. A bone pin.
6. An amber bead.
7. A bronze tweezer.
8. Ditto, broken, but of different matter.
9. A bronze pin, with ornamented head, having a cross and arrow-shaped device carved on two sides of it.
10. A very long bronze pin, with ornamented spike, head, and ring; a peculiarly fine specimen.
11. A small iron pin, with head bound with bronze wire, and small circular disc pendent.
12. An amber bead.
13. A buckle.
14. A bore's tusk.

The Secretary, in the absence of Sir W. R. Hamilton, read the following remarks on the connexion of Quaternions with continued fractions and quadratic equations.

1. If we write

$$u_x = \frac{b_1}{a_1 +}\ \frac{b_2}{a_2 +}\ \cdots\ \frac{b_x}{a_x} = \frac{N_x}{D_x},$$

it is known (see Sir J. F.W. Herschel's Treatise on Finite Differences) that the numerator and denominator of the resultant fraction satisfy two equations in differences, which are of one common form, namely,

$$N_{x+1} = N_x a_{x+1} + N_{x-1} b_{x+1},$$
$$D_{x+1} = D_x a_{x+1} + D_{x-1} b_{x+1}.$$

And by the nature of the reasoning employed, it will be found that these equations in differences, thus written, hold good for quaternions, as well as for ordinary fractions.

2. Supposing a and b to be two constant quaternions, these equations in differences are satisfied by supposing

$$N_x = Cq_1^x + C'q_2^x,$$
$$D_x = Eq_1^x + E'q_2^x,$$
$$C + C' = 0, \quad Cq_1 + C'q_2 = b,$$
$$E + E' = 1, \quad Eq_1 + E'q_2 = a;$$

C, C', E, E' being four constant quaternions, determined by the four last conditions, after finding two other and unequal quaternions, q_1 and q_2, which are among the roots of the quadratic equation,

$$q^2 = qa + b.$$

3. By pursuing this track it is found, with little or no difficulty, that

$$2u_x^{-1} + q_1^{-1} + q_2^{-1} = \frac{q_1^x + q_2^x}{q_1^x - q_2^x} \, \frac{q_1 - q_2}{b};$$

where

$$u_x = \left(\frac{b}{a+}\right)^x 0; \quad \frac{q_1 - q_2}{b} = q_1^{-1} - q_2^{-1};$$

q_1, q_2, being still supposed to be two unequal roots of the lately written quadratic equation in quaternions,

$$q^2 = qa + b.$$

4. Let the continued fraction in quaternions be

$$u_x = \left(\frac{j}{i+}\right)^x 0;$$

then the quadratic equation becomes

$$q^2 = qi + j:$$

and two unequal roots of it are the following:

$$q_1 = \tfrac{1}{2}(1 + i + j - k),$$
$$q_2 = \tfrac{1}{2}(-1 + i - j - k).$$

Substitution and reduction give hence these two expressions:

$$\left(\frac{j}{i+}\right)^{2n} 0 = \frac{\sin\frac{2n\pi}{3}}{i \sin\frac{2n\pi}{3} - k \sin\frac{(2n-1)\pi}{3}};$$

$$\frac{2 \div \left(\frac{j}{i+}\right)^{2n-1} 0}{i - k} = 1 - \frac{\sin\frac{(2n-1)\pi}{3}}{\sin\frac{2(n-1)\pi}{3} + j \sin\frac{2n\pi}{3}};$$

which may easily be verified by assigning particular values to n. No importance is attached by the writer to these particular results: they are merely offered as examples.

5. It may have appeared strange that Sir William R. Hamilton should have spoken of *two* unequal quaternions, as being *among* the roots, or *two of the roots*, of a *quadratic equation* in quaternions. Yet it was one of the earliest results of that calculus, respecting which he made (in November, 1843) his earliest communication to the Academy, that *such* a quadratic equation (if of the above-written form) has generally *six roots:* whereof, however, *two only* are *real quaternions,* while the other four may, by a very natural and analogical extension of received language, be called *imaginary quaternions.* But the theory of such *imaginary,* or *partially* imaginary quaternions, in short, the theory of what Sir William R. Hamilton has ventured to name "*Biquaternions,*" in a paper already published, appears to him to deserve to be the subject of a separate communication to the Academy.

The Rev. Samuel Haughton communicated a short account of an Aurora, visible in Dublin on the night of October 2, 1851. This Aurora passed the zenith; its crown, and the point of the horizon at which the streamers were vertical, being situated in the magnetic meridian. The transverse arcs were sensibly portions of great circles to a distance of about 45° from the horizon, and intersected the magnetic meridian at right angles. In the neighbourhood of the crown of the Aurora the transverse arcs were not great circles, and presented opposite curvatures at the different sides of the crown. At 8.30, P.M. the streamers to the west of magnetic north were red, the streamers to the east being colourless, or perhaps slightly yellowish. At 9, P.M. the bearing of the north pole-star was taken with a Kater's compass and another. The readings were 30° W. and 31° W.; assuming the mean of these, and subtracting the variation in Dublin, 26° 30′, this observation would appear to indicate a westerly deflection of 4° produced by the Aurora. The air at the time of observation was saturated with moisture; barom. 29·15 in.; dry bulb therm. 49°; wet bulb therm. 49°. The streamers seemed to intersect the transverse arcs at right angles, and to follow the deviations of the latter from great circles in the neighbourhood of the crown of the Aurora. The distance of the latter from zenith was not measured, but it appeared about the same as the distance of the north point of the Aurora from the meridian.

The Rev. Charles Graves, D. D., communicated a notice, extracted by Mr. Charles P. Mac Donnell from the Catalogue of MSS. in the Library of Cambray:

"Catalogue descriptif et raisonné des manuscrits de la Bibliothéque de Cambrai, par A. le Glay. Cambrai, in 8°. 1831. pp. 122.

"MS. 619. Canones Hibernici, in fol. vel. b. C. M. MS. a 2 colonnes, êcriture minuscule du 8 Siecle. À la fin du volume on lit la souscription suivante en lettres capitales hautes et enclavées, et en onciales : *Explicit liber canonum quem Dominus Albericus episcopus nobis Camaracensium et Atrabatensium fieri rogavit. Deo gratias. Amen.* Alberic qui fit confectionner ce volume, occupa les sieges de Cambrai et d'Arras depuis 763 jusques vers 790. Notre MS. a donc environ 1150 ans d'antiquité ; et pourtant ce n'est pas encore par là qu'il est le plus remarquable. Vers le milieu du volume dans un chapitre intitulé : *De bonis non recipiendis,* on trouve une espèce d'exhortation en langue vulgaire du temps, dont voici un echantillon : Ocus airde cruche archrist cember ichomus coirr ocus anme airesechethar flictu ar fedot indag nimrathit iraire arber. Je ne suis pas certain de n'avoir pas quelquefois confondus deux mots en un seul. Si ces phrases sont de l'ancien Irlandais, on ne concoit pas trop pourquoi Alberic aurait conservé ce langage étranger dans une allocution destinée aux peuples Francs, dont il avait la direction. Ne serait ce pas plutôt la langue Celtique qu'on parlait en France et dans les Iles Britanniques avant que la langue Romane se fait formé de la corruption du Latin mêlé avec les idiomes indigènes? Les canons contenus dans ce MS. sont ceux du concile tenu en Irelande vers 684. D. Luc d'Acheri en a inséré des extraits dans son *Spicilegium,* 2e edition, in fol. 1723, t. i. p. 492. Les Pères Martène et Durand, y ont ajouté une supplement dans leur *Thes. Nov. Anecd.* in fol. 1717, t. iv. p. 1 ; mais notre MS. offre beaucoup de choses qu'on ne trove pas dans ces extraits. Du reste il ne contient que les 38 1ers livres de la collection qui en a ordinairement 65. V. les additions [du Catalogue].

[Add. p. 242] :

"MS. No. 619. Depuis l'impression de cet article j'ai eu occasion d'examiner la Collection de David Wilkins, intitulée, *Concilia Magnæ Britt. et Hib.,* in fol., 4 vols. Lond. 1737. Je n'y ai pas trouvé le passage en langue vulgaire dont j'ai cité quelques lignes."

Dr. Graves pointed out the importance of having the antiquity of these Irish Canons established in so conclusive a manner, and adduced instances to show that they illustrated the early civil history of Ireland. Though professedly a collection of Ecclesiastical Canons, they contain amongst them several laws that are purely of a civil character, and many allusions to the existing state of society. In the ancient Brehon Laws, still extant in the Irish language, the very same institutions are to be found, forming parts of a system which is altogether similar and coherent. Thus the independent testimony of the Canons, whose age is now fully ascertained, demonstrates the genuineness and antiquity of our Brehon Laws.

Francis M. Jennings, Esq., presented a lithograph representing the great Cork Tree now growing at Summertown, near Cork, and described by J. C. Loudon, in the "Arboretum et Fruticum Britannicum," vol. iii. pl. 1916.

MONDAY, JANUARY 12TH, 1852.

JOHN ANSTER, LL.D., V.P., in the Chair.

JOSEPH DICKENSON, M.D., Joseph Beete Jukes, Esq., Thomas T. Kelly, Esq., and George Roe, Esq., were elected Members of the Academy.

Rev. Humphrey Lloyd, V.P., on the part of Maurice O'Connell, Esq., presented a collection of Meteorological Observations made at Darrynane Abbey in the years 1845 and 1846. He also explained that the views he had put forward respecting the influence of the Gulf Stream upon the climate of Ireland, had been entertained by the late Daniel O'Connell, Esq., who had noticed the more frequent arrival, during late years, of West Indian seeds, &c., upon the south-western coast of Ireland.

The Secretary of Council presented the following donations to the Museum:

A small frying-pan, found in the ford of the river Suck, near Corneen Castle, Ballinasloe, together with a quantity of the horns and other bones of deer. Presented by William T. Potts, Esq.

Four limpets, found with many others, in an ancient structure called the Giant's Grave, on the edge of Lough Aun, County Mayo, 700 feet above the level of the sea. Presented by Richard Glennan, Esq.

The Secretary of Council read the following letter from Dr. Griffin, of Limerick:

Limerick, November 26, 1851.

MY DEAR SIR,—Lord Dunraven requested me, some time since, to send you in a brief form the principal facts connected with the Limerick whirlwind of October 5th, 1851, that you might bring them under the notice of the Academy if they should seem of sufficient scientific interest. They may be divided into, first, those which indicate its general direction and limits; second, those which show its force and power; and, third, some singular circumstances that point out a mode of action, at particular points, extremely peculiar and unusual.

I went over the principal points visited by it the morning after its occurrence, and on one or two occasions afterwards. Many of the stories that had appeared in the newspapers were unfounded, such as a man being taken up and carried across the river by it, and other such fables. Some of its effects, however, were, as I have said, very extraordinary.

The 5th of October was an overcast and rather gusty day in Limerick. The thermometer stood at 51°, 55°, and 50°, at 9 A.M., 3 P.M., and 8 P.M. respectively. The barometer was steady at 29·604 at 9 A.M., and the same exactly at 2 P.M., but I have no observation of its condition at the moment of the whirlwind, nor at a later hour, nor is there any observation of the magnetic state either then or previously. The phenomenon took place about 5 h. 20 m. P.M., and did not occupy more than from five to ten minutes in its passage across the city. Taking two points on the Ordnance Map of the city of Limerick, one on the middle of Wellesley-bridge, the other at the Devil's Battery, near the Fever Hospital, if a straight line is drawn from the Clare side through these two points, such a line will cut most of the places visited by it in its greatest intensity. It was so strictly limited to this line, that at a distance of 150 feet on either side of it, its effects were hardly perceptible. The people in the higher parts of George's-street, and even at more moderate distances, had not heard of its occurrence until next morning. In the line I have mentioned, it was first felt about 100 yards or so to the west or north-west of the point first named; but I can hardly find any traces of it at the other side of the city beyond the point last spoken of.

Those who saw its approach, without being within its influence, say it looked like a dense column of smoke, as if from a house on fire. To such as were a little nearer, this appearance was accompanied by a loud, roaring noise, which they compared to that of a steamer discharging her steam after a voyage. The keeper of the toll-house on Wellesley-bridge, who had a good opportunity of witnessing it, says, "Some persons had come into the toll-house to take shelter from what they imagined an approaching shower, when suddenly a loud, roaring noise was heard a little to the north-west of it. On looking round, they saw the trees in that direction violently agitated, cracking and waving to and fro with great force; strong branches torn off and whirled about in the air. Presently it struck the river, close beside the toll-house, with a tremendous crash." I asked him what appearance the river presented? He said, *he could not see it at all;* it was covered from his view by a dense white vapour, like a fog, but through this he could see a number of row-boats that were lying at anchor near, lifted up and whirled about in the air with the utmost violence. When it had passed, these were found still lying at their anchors, but most of them upset, and all filled with water. As other indications of its violence, he mentioned that two women who were passing over the bridge in a donkey-cart were lifted out of the cart, blown across the bridge, and one of them would have been carried over the battlement had she not held fast by one of the turned stone pillars that supported it. Several other instances of its great power might be mentioned. On Arthur's-quay, the mainsail of a turf-boat, which lay over a rick of turf, black-tarred and heavy, being made of strong canvass, was lifted up, carried over the houses, and left upon the roof of a house in Denmark-street, about 150 yards off. The roof of a low shed, made of deal planks and rafters, in a timber-yard at the rere of Denmark-street, was taken up into the air, broken into pieces, several of which came down at various distances, some into another timber-yard about 200 yards off. I saw a great number of the planks and two of the rafters of the shed at this latter place; the rafters were 18 feet long, 9 inches wide, and 3 inches thick—one of them coming down endways, had entered the earth to a considerable depth, and was broken short off. The roofs of many of the houses, and stories in the track I have mentioned, were stripped of their slates to a greater or less, in some instances to a very considerable extent. In one place, two chimneys were pointed out to me, in a low situation, attached to a bakery; they were of great strength, being from 3 to 4 feet in the side, square built, and not more than 12 or 14 feet high. One of them was blown down completely, and the other partially. What has often before been remarked of storms was exemplified also in this, that its most violent effects were exhibited in situations that seemed very low, sheltered, and secure. A singular illustration of this remark was presented at the building called the Linen Hall, on the top of which is a little dome or cupola, surmounted by a slender and delicate model of a spinning-wheel; while many of the low places I have spoken of were visited with such tremendous effect, and while even the roof of this building itself was stripped of its slates in many places, both back and front, this little spinning-wheel, though high in the air, supported on a slender stem, and quite unsheltered, was wholly uninjured.

There are two points, however, which deserve a special notice, from the very peculiar action on them I have already alluded to. One was the office of Mr. Gleeson, the ship-agent, which is in a low angle, at the foot of a flight of stone steps, near the Swivel Bridge. Here there is a window about 12 or 14 feet wide, by 10 in height. This window was covered with shutters outside, and barred and bolted. The people were gone home; all the doors were shut, and there was no chimney nor fire-place in the room. When the storm had passed, the window-frame was found torn from its place and the glass all shattered. But what was most singular, this was evidently effected *by a force acting from within.* The bolts, which could not be drawn, brought the window-frame with them six or eight inches *towards* the street, particularly at one end, and it was clearly by the distortion of the frame the glass was broken, as the shutters were not taken off at all—the injury was exactly what one would expect to see if a quantity of gunpowder had been exploded in the room, and had forced out the window as the weakest point. The same circumstances almost exactly took place, under similar conditions, with respect to a window at Mr. Hogg's, situated near the angle between Honan's-quay and Arthur's-quay, and looking out upon the latter. This window is not so large as the one before spoken of, and the effects were not so violent; they were sufficiently so, however, to break some of the panes, and the slighter parts of the window-sash, the fractures running in such directions as showed that the force came from within. Indeed, it could hardly be otherwise, as the shutters lay close on the outside, and gave them complete protection. This was further proved by the fact, that some windows in other parts of the same side of the house, unprotected by shutters, had several panes broken, yet not a trace of broken glass could be found anywhere, neither in the room, on the window-sill, nor in the area below, nor on the flags around it. Some towels also, and a sheet, carried out of one of these windows, could never be found afterwards. A singular instance of the force of the squall occurred at the rere of the house, where a large piece of cast iron, of several hundred-weight, lying against an open window, was blown down by the blast, and shook the whole house in its fall.

The circumstance I have spoken of, of the force in both these cases acting from within, might be explained if one could suppose a sudden and violent expansion of the air within the room, occasioned by a vacuum, produced by some cause outside. Such a vacuum would also account for the violent rush of the air through the window at the rere of the house. On the whole, this phenomenon seems to resemble, or present in many points the same conditions as produce a water-spout at sea; but I am unwilling to add to the length of this letter by forming conjectures as to its cause, or suppositions which would account for all I have described. This I leave to better judges, confining myself at present to as accurate a detail of the facts as I could collect or procure.

Believe me, dear Sir,

Very sincerely yours,

Daniel Griffin, M.D.

The Rev. Charles Graves, F.T.C.D.

Rev. Humphrey Lloyd and Robert Mallet, Esq., made some remarks on the probable causes of some of the phenomena noticed by Dr. Griffin.

The Rev. William Reeves, D.D., exhibited an ancient deed, written on goat-skin, being a grant of certain lands in Islay, from Mac Donnell of the Isles to Brian Vicar Magee. Although a Scottish record, it is strictly conformable to the rules of Irish orthography and construction, showing that the peculiarities which now characterize the Scotch dialect of the Gaelic did not exist in 1408, the date of this instrument. The following copy has been carefully made, and a literal translation appended.

An ainim De Amen.

Ataimse mac Doṁnaill ag bronnaġ ⁊ taḃairt én ṁairg deg go leiṫ dḟearann uaim pḟein ⁊ om oiġriḃ do Bhrian Bicaire Mhagaoḋ ⁊ da oiġriḃ na ḋiaiġ go siorṫuiġe suṫáin, ar son a ḋeiġṡeirḃise dam pḟein agas dom aṫair roṁam; ⁊ so air ċunnraġ ⁊ ar ċoingioll go tteaḃraiḋ se ḟein agas iadsan daṁsa ⁊ dom oiġriḃ am ḋiaiġ go bliaḋanaṁail ceiṫre ba ionṁarḃṫaċum mo ṫiġe, agas agcás naċ mbiaḋ na baṫ sin ar fagail ḃearaiḋ an ḃrian huas agas a oiġrioġ ḋamsa agas dom oiġriḃ am ḋiaiġ ḋa ṁarg ⁊ ḋá ḟiċit marg ar son na mbo céadna huas. Agas ar na haḃaruiḃ ceadna ataimse ḋom ċeangal féin ⁊ ag ceangal moiġrioġ um ḋiaiġ go deirioġ an ḃeaṫa na fearainn sin moille le na dtorṫuiḃ mara agas tíre do ṡearaṁ agas do ċoinnṁeil don mḃriain ḃiocaire Mhagaoḋ huas do féin ⁊ da oiġriḃ na ḋiaiġ go siorṫuiġe agas go deireaġ an ḃeaṫa: agas ar iad so na fearainn sin do ṫugas do fein agas ḋá oiġriḃ na ḋiaiġ go siorṫuiġe sutain; [eadon], baile biorra, Maċaire learga riaḃoiġe, Cionntraġa, Grastol, Tocamol, Wreggoge; Da ġleann abstol, Cracobus, Cornubus, agas baile Néachtain. Agas ionnus go mbiaiḋ briġ neart agas láidireaċt ag an mbrontanas so ḃeiriom don mḃrian thuas agas ḋá oiġriḃ na ḋiaiḋ, ceanglam arís me féin ⁊ moiġrioġ mo ḋiaiġ go síorṫuiġe an cunrag ⁊ an brontanas so do ṡeara ⁊ do ċuinnḃeil ar buil don mḃrian reiṁraite ⁊ da oiġriġ na ḋiaiḋ go deirioġ an ḃeaṫa le cur mo láiṁe ⁊ mo ṡeala annso ṡíos a laṫair na ḃfiaġainn so ṡíos; agas an seiseaṁ lá do ṁís na bealtuine agas an ḃliadansa do ḃreit Criosta Míle ceiṫri cead agas a hoċt.

Mac Doṁnaill,
✗ ✗ ✗

a
Eon + Mc Doṁnaill
coṁarṫa

a
Pat: + Mc Briuin
coṁarṫa

Ferġaor Mc Beaṫa

a
Aodh + Mc Key
coṁarṫa

In the name of God. Amen.

I, Mac Donnell, am granting and giving eleven marks and a half of land from myself and from my heirs, to Brian Bicaire* Mag Aodh, and to his heirs after him for ever and ever, for his good services to myself and to my father before me; and this

* The Irish form of *Vicar*.

on condition and covenant that he and they shall give yearly to me and to my heirs after me, four cows fit to be slaughtered, for my house; and in case that these cows are not to be had the above Brian and his heirs shall give to me, and to my heirs after me, two marks and two score marks in lieu of the same cows aforesaid. And for the same causes I am binding myself and binding my heirs after me, to the end of existence, to maintain and defend these lands, together with their fruits of sea and land, for the above Brian Bicaire Mag Aodh, for himself, and for his heirs after him, in perpetuity, and to the end of existence. And these are the lands aforesaid which I have given to himself and to his heirs after him in perpetuity [viz.], Baile-Biorra, Machaire-learga-riabhoighe, Cionntragha, Graftol, Tocam-ol, Wreggoge,* the two Glenapstols,† Cracobus, and Baile-Neachtain. And that this grant may have force, strength, and validity, which I give unto the above Brian and to his heirs after him, I bind myself again and my heirs after me, to maintain and support in perpetuity this covenant and grant, for the aforesaid Brian, and for his heirs after him, to the end of existence, by putting my hand and my seal here below, in the presence of these witnesses below, and on the sixth day of the month of May, and in the year of the birth of Christ, one thousand four hundred and eight.

MAC DONNELL.
x x x

his
JOHN + MC DONNELL.
mark.

his
PAT + MAC BRIAN.
mark.

FARREES MAC BEATHA.

his
HUGH + MAC KEY.‡
mark.

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* This word is written in cursive hand in the original, and it is hard to determine whether it is *Wreggoge* or *Weeggoge*.

† This name signifies 'Glenn of the Apostles.'

‡ Here the name Mac Aodh assumes a phonetic form. It is to be observed,

The name Mac Aodh signifies 'Son of Hugh,'* and is pronounced in Scotland, as well as the south of Ireland, according to the provincial sound of the syllable Aodh, *Mackay;* but in the middle of Ireland, *Mackew;* and in Ulster, *Magee.* The family which bore it was akin to the Mac Donnells, and was commonly known as "Macgee of the Rinns of Islay."† When the Mac Donnells sought a permanent footing in Ireland, the Magees followed their fortunes, and obtained a settlement on the north-east coast of the county of Antrim. The tradition of the family, as stated by John Magee, the owner of the present document, is, that his ancestor, John Magee, who was cousin to Somhairb Boy Mac Donnell, came to Ireland with that chieftain to assist him in wresting the Route and Glynns from the Mac Quillins, and that, having rendered important services to him at the battle of Aura, he received, as a reward, the four quarterlands of Ballyukin, and two adjacent to Aura, in the parish of Culfeightrim, which continued in the possession of the family until the time of the present representative's grandfather.

It may be observed, also, that the peninsula on the coast of Antrim, near Larne, which was formerly called *Rinn Shevny*, having been occupied by the Magees in the early part of the sixteenth century, exchanged its ancient name for 'Mac Guyes-Isle,' or 'Island Magee,' the latter of which it bears at the present day.

The Mac Donnell who made the above grants was Donald, Lord of the Isles, who died in 1427.‡ His next brother, John of Islay, was ancestor of the Earls of Antrim.§

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however, that though the names Mac Gee and Mackay are of the same origin, the families so called were perfectly distinct.

* Mák-Kye, 1. Filius Hugonis.—Collectan. de Reb. Alban. p. 27. From Hugh Mac Donnell of Sleate, his son, John, and grandson, Donald, derived their patronymic of *Hughson*, a name now written *Hewson*. See Douglas, Peerage of Scotland, p. 363, *a*.

† Collectan. de Reb. Alban. pp. 297, 310.

‡ Douglas, Peerage of Scotland, p. 360.

§ Ibid., p. 359.

The lands which are recited in the grants are situate in the parish of Kildalton, on the south-east of the island of Islay, and most of the names still appear upon the county map. They are not Celtic in their form, and the writer of Parochial Memoirs, in the old Statistical Account of Scotland, observes, "All the farms round this fort [of Cheunn-Outh] have Danish names, such as Kennibus, Assibus, Kelibus, Lirebus, and Cragabus."* In reference to some other names, he adds, "There is, in the other end of the parish, the remains of an old church, at a place known by the name of Kilnaughtan. The nearest farm to this is called Baille Vicar, or the Vicar's Town; and there is joined to this farm the Clerk's *patch*, which is now of some value. There is, at the distance of four miles, a farm called Baile Naughtan."†

Rev. Charles Graves, D.D., exhibited rubbings of some monuments in the county of Kerry, presenting crosses, along with Ogham inscriptions. He stated, as the result of a careful examination of all the monuments of this kind seen by him in Kerry, that there were no grounds for the assertion that the crosses had been inscribed at a later period than the Ogham characters.

When a square stone is formed of a stratified material, the grain will be different in two of its adjacent faces; one face may also be more exposed to the action of the weather than another. These circumstances are, in many cases, sufficient to account for the fact, that some parts of an inscription are better preserved than the rest.

He also stated that the peculiar mode of execution observed in many of the inscriptions, namely, by punching rather than cutting, is common to the crosses and the Ogham strokes.

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* Statistical Account of Scotland, by Sir J. Sinclair, vol. xi. p. 292.

† Ibid., p. 295.

MONDAY, JANUARY 26TH, 1852.

THOMAS ROMNEY ROBINSON, D.D., PRESIDENT, in the Chair.

ON the recommendation of the Council, it was resolved:

That in place of chapter viii., section 6, of the By-Laws, the following be substituted:

"Papers read, and other business previously arranged by the Council transacted."

The Secretary read a letter from Messrs. Waterhouse and Co., presenting to the Academy two drawings by Mr. Watson, on a large scale, of the ancient brooch in their possession.

Sir William Betham presented a fragment of an alabaster hand found near Monkstown.

Lord Talbot de Malahide presented a very ancient bronze bell, said to have been found near Tuam.

Mr. Mallet read a Paper on the Results of the Discussion of the Great Earthquake Catalogue, prepared by the command of the British Association for the Advancement of Science.

He exhibited diagrams to the Academy discussing by curves the *distribution in time and space* of all recorded earthquakes, which have been collected in the great Catalogue of Earthquakes, prepared by command of the British Association for the Advancement of Science, embracing the whole historical period down to the end of the year 1850, and comprising about six thousand single earthquakes.

He stated the methods and precautions adopted in forming this large Catalogue, whose distribution is tabular. And from this, the largest basis of induction yet produced on the subject, he stated some of the principal conclusions that the discussion of the facts by the method of curves warranted.

The records of earthquakes become more and more numerous as navigation and travel have, in the course of time, become extended, though it is not probable that the actual number of earthquakes occurring at a remote antiquity was less than now.

Their extreme frequency, during the last two or three centuries, since the attention of mankind has been alive to the record of such phenomena, and intercourse has been more perfect, is such as fully to warrant the position of the author's first Report, that no day passes without one or more; and that they are the indices of a constantly and pretty uniformly present, cosmical force; "the re-action of the interior of the planet upon its exterior" having, however, epochs of greater disturbance and epochs of repose.

The peculiar features of the curves exhibited to the Academy were shown, and of the secondary deduced curves of maxima, &c., as also the deduced curves, showing the distribution of earthquakes with reference to seasons and months. These seem to indicate a preponderance in the winter months; but the author is disposed to view this result as accidental, although agreeing with the deduction of M. Perrey from his much more limited base of induction.

The author also exhibited and explained his large Chart of the World, on Mercator's projection, on which the distribution of earthquakes in space is laid down from the Catalogue, and, by a peculiar system of colouring, the relative intensity and area of disturbance, and the number or reduplication of shocks also indicated, for every locality over the whole explored surface of the earth.

He pointed out the results which this map indicated, and the differences between it and the maps of Johnston and Berghaus.

The largest habitually convulsed area now on the earth's surface is in and around the Gulf of Mexico; that exposed to the most violent and repeated shocks, the Javanese Archipelago, of which the island of Sumbava forms nearly the centre; while, probably, the most interesting earthquake tract now known is the great submarine one in the Atlantic Ocean, in latitude 0° to 1½° south, and west longitude, from 20° to 23° or 24°.

The places on the earth's surface as to which earthquake information is most wanted, and to be commended to the attention of travellers are, the great Ethiopian chain of mountains, and interior of Africa generally, Madagascar, Central and Northern Asia, where the earthquake regions seem to follow the courses of the great northern rivers, north of Lake Baikal, the north-west of North America, the Gallipagos Islands, and in Europe, Spain.

The President made some remarks upon Mr. Mallet's Paper.

Dr. Allman read a paper on the Homology of Organs and the Affinities of the Polyzoa and Tunicata.

In this communication it was the author's object to demonstrate that the affinities between the Tunicata and Polyzoa were even closer than what was generally imagined, and that almost every portion of the organization of the one had its corresponding homologue in the other. The hippocrepean Polyzoa are those which indicate most clearly the unity of type on which the two groups are constructed, and a comparison was therefore instituted between a *Clavelina* and a *Plumatella*. It was shown :—

1. That the respiratory sac of the one was in every particular homologous with the tentacular crown of the other; that the arms of the lophophore in Plumatella were represented by the "branchial sinus" in Clavelina, the tentacula in Plumatella by the transverse bars or vessels which spring off from each

side of this sinus; the calyciform membrane in the one by the external membrane of the respiratory sac in the other, and the oral valve-like organ of Plumatella by the "languets" of Clavelina reduced to a single one.

2. A similar homological identity was attempted to be shown in the Dermal system, and each of the three sacs demonstrated by Mr. Milne Edwards to exist in Clavelina was maintained to have its exact equivalent in the Polyzoa: the test of the tunicate would thus correspond to the external investment or ectocyst of the polyzoon; the mantle of the tunicate to the internal sac or endocyst of the polyzoon; and the internal tunic of the tunicate to the tentacular sheath of the polyzoon. It was further maintained, that the external orifice through which the tentacular crown is projected in the Polyzoa is equivalent to the respiratory and cloacal apertures of the Tunicata united; and that the point where the intestine opens externally in the Polyzoa corresponds to the point where it perforates the internal tunic in the Tunicata, the small space between the tentacula and their sheath, and which, during the exerted state, becomes obliterated, being equivalent to the cloaca of the Tunicata.

3. A similar resemblance was shown to exist in the digestive system.

4. It was maintained that the circulatory system of the Tunicata was but a very slight advance on that of the Polyzoa, while in the tunicate genus, Pelonaia, the absence of a heart reduces this system entirely to the type of the Polyzoa. Throughout the whole of the Tunicata and Polyzoa the great sinus system is identical in both.

5. The muscles existing in the mantle of the Tunicata are equivalent to corresponding fibres in the endocyst of Polyzoa, and the ultimate fibre is found to be striped in both groups.

6. It was endeavoured to be shown, that the great nervous ganglion was, both in the Tunicata and Polyzoa, equivalent to the branchial and cephalic ganglia of the higher mollusca fused

into one, and that the difference of position which exists between the Tunicata and Polyzoa, with respect to the position of the ganglion, is unimportant, being the necessary result of the other modifications of structure.

7. The generative systems of the two were then compared, and shown to present strong points of resemblance; and it was finally concluded that the Tunicata and Polyzoa were more closely allied to one another than either to any other branch of the animal kingdom. The inexpediency, however, of removing the Tunicata from the Mollusca, and placing them with the Polyzoa at the top of the Radiata, was insisted on, and it was, on the contrary, maintained, that the great group of the Acephalous Mollusca contained four principal types of form, which admitted of a subordinate grouping by two and two, namely, the Polyzoa and Tunicata, and the Brachiopoda and Lamellibranchiata.

Mr. W. T. Mulvany, on the part of the Commissioners of the Board of Works, presented several collections of antiquities made by the officers employed in different parts of Ireland in drainage operations.

He also presented a private collection of antiquities, found by Mr. Gray, and exhibited about sixty articles, the property of private individuals in the neighbourhood of Strokestown.

He also presented, on the part of Mr. Maclane, a two-pronged fork, with a carved ivory handle, representing the lion and unicorn fighting. This fork had been found at Limerick.

Mr. Mulvany then proceeded to give an account of the several collections presented by him to the Academy, and to explain the circumstances which led to their formation. As, however, several members were anxious to hear Mr. Mulvany's communication at greater length than the time would then allow, it was unanimously resolved that he be requested to read his paper *in extenso* on the next night of meeting.

Monday, February 9th, 1852.

JOHN ANSTER, Esq., LL. D., V. P., in the Chair.

Dr. Huband Smith (acting as Secretary in the absence of the Rev. Dr. Todd) read the minutes of the last meeting, and then proceeded to announce the receipt of the seal of William Foster, Bishop of Clogher, which had been found in a field adjoining the Archdeaconry of Connor. The donor was the Archdeacon of Connor, who was of opinion that this seal, though not by any means an ancient one, was of some value, as helping to complete the collection of episcopal seals which was in course of being formed by the Academy.

Sir William Betham was inclined to think that it was the seal of a recent Bishop of Clogher, who was the father of Judge Foster.

Dr. Petrie observed, that the collection of the seals of Irish Bishops, whether ancient or coming down to their own times, was one of the points to which the attention of the Academy had been directed. Already they had a pretty large collection of those seals, and if it were more generally known that they were anxious to preserve things of this kind, many persons who had such articles in their possession, and perhaps set but little value upon them, would, he felt sure, be glad to contribute them to the Museum of the Academy. The donors of such matters were, in his opinion, deserving of their best acknowledgments, and he therefore begged to move a vote of thanks to the Archdeacon of Connor for his valuable gift to the Museum.

The motion was seconded, and passed unanimously.

Sir William Betham exhibited two singular coins, made of bronze, which he was informed had been found at Rathfarnham, county Dublin. They bore the impress of a head, which resembled that on a coin of Antiochus in his possession. They were evidently of a great antiquity; but he could not positively say whether they were coins of Antiochus or of one of the Ptolemys. It was singular that they should have been found at Rathfarnham, where several Roman coins had been already discovered. They were every day finding antiquities of Greece and Rome; and notwithstanding what had transpired respecting the coins found in the foundations of Mr. Haliday's house, and those now in the possession of Mr. Cooke, of Parsonstown, the two coins which he then exhibited, with Mr. Glennon's permission, were in many respects singular and worthy of consideration.

Dr. Petrie remarked that the discovery of such coins at Rathfarnham was a circumstance well worthy of attention. At the last meeting but one of the Academy he commented on the fact of Roman coins being occasionally found at that place. Those exhibited by Sir William Betham were not Roman; they were actually Egyptian, and the eagle, independently of the inscriptions, clearly showed that they were so. It was strange that such coins should be found there; and if established by sufficient authority—something more than mere hearsay—it would be of the highest importance to have the fact placed upon record.

Sir William Betham said he knew nothing more of their history than what he had stated; but he had no doubt that, if compared with the published coins of Egypt and Syria, their precise character would be ascertained. The heads on several of those coins were similar to these on the two which he had exhibited.

A vote of thanks was passed to Mr. Glennon for having allowed the coins to be exhibited to the Academy.

Mr. Huband Smith next announced the donation of a large number of volumes, published by the Smithsonian Institution in the city of Washington.

A vote of thanks was passed to the Smithsonian Society for their donation.

Mr. Mulvany, in pursuance of a resolution passed at the last preceding meeting of the Academy, having read a Paper,* giving an account of a large collection of antiquities, presented to the Museum by the Commissioners of Public Works, and others:—

Sir William Betham, in allusion to the large metallic casting which formed a part of the collection, observed, that it bore the arms of Castile and Leon, the double-headed eagle and the Imperial Crown of Germany. There were also the two Spanish pillars, in allusion to the pillars of Hercules. It must, in his opinion, have belonged to the period of Charles V., or his son Philip, when he was King of Spain and Emperor of Germany at one and the same time.

Mr. Kelly said that the communication made by Mr. Mulvany being one of so much importance, as regarded the ancient history of Ireland, ought to be referred to the Council of the Academy, with a view to its publication. He therefore begged to propose a resolution to that effect, and at the same time a vote of thanks to the Board of Works for their valuable donation. They lived in times when discoveries of an extraordinary kind were of almost daily occurrence. Through discoveries in Australia and California great treasures were making their way into England; and he was proud to say that Mr. Mulvany's "diggings" bid fair to add to the historical lore of Ireland treasures as valuable as anything which had been heretofore contributed.

Dr. Petrie had great pleasure in seconding the motion. He

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* The particulars of this donation and Mr. Mulvany's remarks will appear as an Appendix.

said it would be impossible for any one to speak too highly of the value of the immense collection of antiquities presented that evening to the Academy by the Commissioners of Public Works. By this valuable donation they had acquired a great number of specimens quite new to their Museum; and those not new were, in many instances, more perfect than what they already possessed. In fact it was realizing a vision which he had formed in his mind many years ago—that Ireland might yet be the depository of the finest collection of Celtic and mediæval remains of any country in the world—and after that night he could scarcely entertain a doubt, there being now only one European collection which could compete with theirs, that his vision would shortly be realized. He might mention one fact with regard to the large number of iron articles presented on that as well as on former occasions,—that until within a few years back there never had been preserved in any collection an iron antique of any kind. Nothing was known with respect to their age; and the antiquarians of those days, though they attached great importance to objects of bronze, gold, and silver, treated iron with contempt; the result was, that they could learn nothing whatever of the state of society, so far as weapons were concerned, when the use of bronze was discontinued. A discovery, not sufficiently appreciated at the time, in one of the Crannoge islands, in the county of Meath, was the first circumstance which gave them a notion of the value of these things. The iron articles found at Dunshaughlin being associated with ornamented antiques, of which the age had been previously ascertained, at once supplied them with a clue to their own antiquity, and the conclusion then formed had since been fully borne out by the collections forwarded by the Shannon Commissioners. For a long period, a sword in his own collection was the only iron article preserved in any Irish museum; and on one occasion, when he added to it an iron hatchet which he believed ancient, he was induced to withdraw it by the ridicule it created, and the article was ultimately lost. He would like, if he had the power, to express the deep sense of thankfulness which he felt, and which he was sure the Academy must also feel, to those gentlemen for doing a thing which had added so much to the interest of the Museum, and, he might say, even to the wealth of the city, for he looked forward to the period when their collection would attract educated strangers from all parts of Europe, as they knew it had already done from England. They were well aware that it had furthered the progress of art and manufacture by the impetus which it had given to the reproduction of ancient ornaments; and it would, perhaps, illustrate the state of society in the British islands more fully than could be attempted to be done in England, for the people of that country must often look to them for correct information upon that subject. The value of this collection was beyond estimation, and he had, therefore, cordially seconded the vote of thanks proposed by Mr. Kelly, as an expression of the gratitude they felt towards the Commissioners for their truly valuable donation.

Motion carried with acclamation.

The Hon. George Gough moved a vote of thanks to Mr. Gray for his great kindness in placing his own private collection at the disposal of the Academy; to the other gentlemen connected with the Board of Works; and also to Dr. Connor; who had permitted their antiquities to be exhibited.

The motion was seconded by Dr. Petrie, and adopted unanimously.

Monday, February 23rd, 1852.

THOMAS ROMNEY ROBINSON, D.D., President, in the Chair.

On the recommendation of the Council, it was Resolved:—

I. That the Academy do authorize the payment of the rent of the new Academy House for the half-year commencing 29th September, 1851.

II. That the Academy do authorize the payment of the sum of £100 to the Dawson-street Club, for fixtures in the new Academy House.

III. That the Academy do take the necessary steps to dispose of its existing interest in the lease of the house which it now occupies.

It was also Resolved :—

That the President, Council, and Officers of the Academy be requested to draw up an Address to His Excellency the Lord Lieutenant, expressing the grateful sense entertained by the Academy of the important benefits which he has conferred upon them.

The Rev. Samuel Butcher, D. D., read a Paper by the Rev. Francis Crawford, on the affinity of Hebrew to the Celtic dialects. The author, in a former communication to the Academy, whilst considering merely the formative elements, had pointed out some modes of stem-formation common to both. In the present paper he proposes to consider the analogies afforded by the radical parts of the words, and for this purpose adduces a list of upwards of *five hundred* Hebrew words, which he considers intimately related to a corresponding number of words in Celtic. Of this list the great majority appear to him so clearly identical with their Celtic equivalents, that he considers their relationship almost obvious at a glance;

whilst to trace the affinity of the remainder it is necessary to take into account certain euphonic or dialectic changes which some initial letters have undergone in passing from one dialect to another. Thus, for example, many Hebrew words possess an initial letter which is wanting in their Celtic representatives, e.g.:

א־גרוף, the fist, ...	cnoḃ, the fist.
א־כל, to eat, ...	ceal-aim, to eat.
א־מיר, the top-summit, . .	mir, the top.
ג־מד, a staff, rod, . . .	maide, a rod, staff.
נ־כס, riches, ...	cas, money.
נ־קד, spotted, ...	caiḋe, a spot.
ס־פון, a covering, ...	suan, a covering.
ש־לג, snow, ...	laoġ, snow.
ש־מט, to forgive, ...	maiṫ-im, to forgive.

A remarkable exception to this takes place in the case of certain Hebrew words commencing with the liquids *l* or *r*, and whose counterparts in Celtic have some other letter prefixed. This prefixed letter, in the case of words beginning with *l*, is generally *g* or *c*, and in words beginning with *r* is frequently *d*, though it also is sometimes a guttural, labial, sibilant, or a vowel, e.g.:—

לוט, a veil or covering, . .	g-loṫ, a veil or covering.
לחם, to fight, ...	g-leicim, to fight.
לכד, to take, ...	g-lacaḋ, to take.
רום, elevation, height, . .	d-rom, a hill.
רקם, to adorn, beautify, . .	d-reacaim, to adorn.
רעה, to love, ...	g-raiġeaḋ, to love.
רב, many, ...	S-raḃ, many.
רפא, to cure, ...	s-reapaḋ, a cure.

The writer then notices certain Hebrew letters represented by other different letters in Celtic, as צ by *sc* or *sg*, and also by *d*, and ה by *t* or *th*, e.g.:—

צל, a shadow, ...	scail, a shadow.
צלל, to tingle, ...	sgall-am, to tingle.

צבא, to fight, ...	deabaḋ, a dispute.
ציון, Zion, a fortress, . . .	dion, a fortress, hill.
צפר, to haste, ...	deifir, haste.

and in the case of ח :—

חבל, darkness, ...	teiṁeal, darkness.
חרג, killing, ...	torg, killing.
חוך, to go, ...	toic-im, to go.

The last dialectic peculiarity which the writer notices is the fact, that certain Hebrew letters seem to have dropped a liquid (particularly *l* or *r*) after an initial consonant, which liquid is retained in Celtic, e. g. :—

כמר, a priest, ...	cruimṫear, a priest.
כפא, to contract, ...	crapaḋ, to contract.
עון, time, ...	cron, time.
חונן, to practise sorcery (Poel),	cron-aim, to bewitch.
חנמל, some insect destructive to trees (Gesenius),	crinṁiol, a wood-louse.

In conclusion, Mr. Crawford expresses his conviction of the utility of the study of the Celtic dialect to a right understanding of Hebrew, and consequently to the true interpretation of Scripture.

The President communicated the following notice of a correction of the ordinary theorem by which the magnifying power of a telescope is determined.

Sir William Herschel long since noticed, that in his four-feet reflector he once saw the ring of Saturn without an eye-glass, but this remark does not seem to have been attended to by subsequent authors of optical treatises. It was, however, recalled to Dr. Robinson's thoughts by his observing that double stars appear in the 15-inch reflector of the Armagh Observatory considerably more separated than is due to the estimated magnifying power, and still more orcibly by his finding that Lord Rosse's six feet showed without an eye-glass the components of Castor more than a diameter and a half of the larger apart. A still more decisive case is his seeing ζ^2 Caneri wide double, and the third star as an elongation of its neighbour, though so close. The cause is obvious, but as its effects in large telescopes cannot be neglected, he asks permission to state the necessary correction.

In the telescope an image formed by the objective part is viewed at a small distance by the ocular part. It is commonly assumed that this distance is the focus of a lens equivalent to the ocular part, and hence the magnifying power, $= \frac{F}{f}$, the ratio of the focal lengths of the objective and ocular. This ratio is easily shown to be that of the diameters of the objective, and its image formed by the ocular; and, therefore, the common method of determining the power is to measure the diameter of this image by a dynameter, and divide by it that of the objective.

But in examining a minute object, we do not place it in the principal focus of the lens, or see it by parallel rays. With the unaided eye it is always placed at a certain distance V, which, I believe, in most eyes is about six inches; the ocular must, therefore, be placed so that the rays shall enter the eye with the divergence $\frac{1}{V}$, and hence, if ϕ = its distance from the image $\frac{1}{\phi} = \frac{1}{f} + \frac{1}{V}$, and the magnifying power,

$$M = \frac{F}{\phi} = \frac{F}{f} + \frac{F}{V}.$$

The theoretical magnifying power must therefore be increased by the ratio of the focal length of the objective to the least distance of distinct vision, and if there be no ocular or $f = \infty$, the latter term still expresses it. With this adjustment of the lenses, the dynameter gives an expression of the power still wider from the truth.

$$M' = \frac{F}{\phi} - \frac{F}{V} - \frac{f}{f+V},$$

and it must therefore be increased by these two terms, of which, however, the last is unimportant. The power with the eye alone is, therefore, to be added to that given by the eye-piece. In Lord Rosse's telescope $F = 54$ feet, and, therefore, this addition is 108, quite sufficient to separate pretty close double stars. In the Armagh reflector, which is of Cassegrain's construction, it is even greater, being 138 with the highest convex mirror of 12 inches focus.

The Academy then adjourned to Wednesday, the 25th February, 1852, at 4 o'Clock, P. M.

Tuesday, March 16th, 1852. (Stated Meeting.)

THOMAS ROMNEY ROBINSON, D.D., President, in the Chair.

It was Resolved:—

That the Answer given by the late Lord Lieutenant to the Address of the Academy, as reported in the Dublin Evening Post of the 26th of February, be entered on the Minutes.

The following is the Address, with His Excellency's Answer:—

"*To His Excellency the Right Honourable George William Frederick Earl of Clarendon, Lord Lieutenant General and General Governor of Ireland, &c.*

"May it please your Excellency,

"We, the President and Members of the Royal Irish Academy, beg to express our deep sense, not merely of the important benefit which has recently been conferred upon us by your Excellency, but of the active and intelligent sympathy with which you have invariably encouraged our exertions and forwarded our objects. We had hoped to give utterance to these feelings in a more public and impressive form, on our approaching inauguration in the new abode which you have provided for us; but, at least, we will not permit your Excellency's official connexion with us, as Visitor of the Academy, to terminate without a distinct expression of our gratitude for the way in which the duties of that office have been performed by your Excellency.

"The exertions of the Academy were long fettered by the nature of the locality in which, for the last sixty years, it has been established. Its deliverance from this evil could only be effected by the union of the power to aid it with the mind which is capable of appreciating its claims; and it found both in your Excellency. You not only received the statements which were laid before you on its part with the courtesy befitting your exalted rank, but you took them up like one who felt the real dignity of intellect; you made them your own, and gave them a weight without which they might possibly have passed unheeded, and, certainly, would never have attained the present full success.

"For this—which is, in fact, a gift of new life and power to the Academy—it it our duty to thank your Excellency, and not for this only.

"We could mention many other instances, though presented in a less tangible form, in which the same enlightened estimation of our objects has been shown—one, however, ought not to be passed by without special acknowledgment: the Commission which, we trust, will result in the publication of the Brehon Laws—a work of the highest value, from its bearings on the ancient history and literature of Ireland.

"In fine, of all who for a long period have filled your Excellency's high office, there is none to whom we are so deeply indebted, or whose name will be more closely connected with the prosperity and progress of the Royal Irish Academy."

ANSWER.

"Gentlemen,—It was my intention to return a written answer to the Address which you have done me the honour to present, but having been unable to prepare it, by business connected with my departure, and by some unexpected interruptions this morning, I must beg you to accept the extemporaneous expression of my gratitude for your Address, which will always rank high among the agreeable recollections I carry away with me from this country.

"The Royal Irish Academy is, to my mind, one of the most national Institutions in Ireland. I entertain for many of its members the highest personal respect; and I consider that the zeal and liberality with which they have sustained the Institution, and carried out its objects, entitle them to be classed among national benefactors. It was, therefore, with peculiar satisfaction that I became instrumental in rendering to the Academy the service of which it stood in need; but I must not take undue credit to myself for this, as it is largely shared by Dr. Robinson, who, as a man of science, pointed out what was necessary, and, as a man of business, showed how it could be accomplished. His letter, with the authority of his great name, needed but little recommendation from me to Lord John Russell or the Chancellor of the Exchequer, and I hope that the new building will be found adequate to the purpose of rendering your inestimable possessions more useful and accessible to the public. I attach great importance to the publication of the Brehon Laws, both in a political and literary point of view, and I cannot doubt that my successor, when made aware of the circumstances, will feel under the same obligation that I do to Dr. Todd and Dr. Graves, for the truly patriotic spirit with which they have undertaken this arduous work; neither can I doubt that from Her Majesty's Government they will receive all the encouragement and assistance they may require. For myself, permit me to say, that in this or any other matter involving the interests of the Royal Irish Academy, I hope you will freely command my services; they will be given with all the devotion of personal friendship and the desire to do good to Ireland, which I have always felt during my residence among you, and which I assure you will in no respect be diminished by the termination of my official career."

The Secretary of Council read the following Report:—

The Council, in presenting their Annual Report to the Academy, have more than ordinary reason to congratulate it on its efficient and prosperous state. The circumstance of our meeting in this new abode, so much more commodious than the one we formerly occupied, and so much more commensurate with the wants and the dignity of the Academy, is a conclusive proof of the estimation in which it is held. By thus liberally providing for our accommodation, the Government of the country has established a permanent memorial of the approbation with which it regards the Academy, and which the Queen's Representative has recently expressed in the most ample and gratifying terms. It remains for the Academy to pursue its vocation with fresh energy, and to prove itself deserving of national support, as the chief body representing Science and Literature in Ireland.

For the information of members who may not be fully aware of the circumstances connected with our tenure of the former Academy House, and our removal to the present one, the Council have thought it expedient to lay before you a brief statement of these matters.

The first meetings of the Academy were held in the house of its first President, the Earl of Charlemont. On his application to the Commissioners of Inland Navigation, the Academy was then granted the use of their house No. 114, Grafton-street, then called the Navigation House. The Commissioners having moved a few years afterwards to a different office, the Academy continued to occupy the same premises, and finally prevailed upon the Government to present it with the interest which the Government possessed in the lease of the house. This was done by a King's Letter in the year 1788. For some years after this date, annual grants of various amounts were made by the Irish Treasury to enable the Academy to defray its rent: but finally, in the years 1800 and 1801, two Acts of Parliament were passed, respectively granting annual sums not exceeding £50 and £116 13*s.* (late Irish currency); the former "to defray the expenses of the Establishment;" the latter for the express purpose of paying the rent of the Academy House; but, in fact, it was understood that these sums were intended to pay the various charges incidental upon the house accommodation of the Academy. From this source, after the deduction of certain official charges, the Academy has continued ever since to derive an annual income of £146 17*s.* 8*d.* This is entirely distinct from the grant first made in 1816, which is annually inserted in the Treasury Estimates, and which has always been appropriated to the general purposes of the Academy.

The interest of which the Academy ultimately became possessed in the house in Grafton-street is as follows:—The ground and the house belongs to the Corporation of the City of Dublin, by whom it was let on a lease for three lives, renewable during a period of 60 years, to a tenant under whose representative the Academy holds. This period of 60 years expired in Easter, 1851, when it appeared that two of the lives then in the lease were those of persons above 70 years of age, whilst of the third nothing was known, as the person had not been heard of for many years. Thus it was manifest that the Academy's tenure of the house, depending upon two such advanced lives, was near its termination.

Under these circumstances, the President made energetic representations to the Government, praying that a permanent and suitable residence might be granted to the Academy. This application was successful. The Government being assured that the house in which we now are was in every respect eligible, obtained a lease of it at a rent of £155 17*s.* 6*d.* per annum. For the payment of this, our annual grant under Acts of Parliament, of £146 17*s.* 8*d.*, is available in the first instance, and is to be handed over, half-yearly, by the Treasurer of the Academy, to the Commissioners of the Board of Public Works, who will put the balance in their annual estimates.

The Academy House being for the future placed on the same footing as other public buildings, its repairs will be undertaken by the Commissioners of the Board of Works, and at their charge. For the purpose of putting it into a fit state to meet all the requisitions of the Academy, the Commissioners expect to obtain a special Parliamentary Grant for additions, alterations, and repairs, to be executed in the course of the current year. The proposed additions consist of a fire-proof building on the ground-floor at the rere of the house, containing a Museum and a Library; the latter on such a scale as to answer for a meeting-room on occasions when a very large assemblage of persons is expected to take place. It is intended to hold the ordinary meetings of the Academy in the large room above stairs, whilst the smaller room adjoining it will be appropriated as a Council-room. The improvements projected by the Commissioners of the Board of Works will, it is hoped, commence in August.

A portion of the expense of removal has unavoidably fallen upon the Academy. It was necessary to compensate the late occupants for gas-fittings and other fixtures, and also to pay the rent of the house for the half-year preceding the date at which the tenure of it by the Government commences. To meet these charges the Academy, at a recent meeting, authorized the payment of 177 18*s.* 8*d.* It is hoped, however, that this sum will be more than reimbursed when the Academy's interest in the house in Grafton-street has been disposed of, the value of that interest being now considerably greater than it was when the application was made to Government for a new place of residence. Since that time the landlord under whom the Academy holds was advised to take proceedings in the Court of Chancery to compel the Corporation to insert a new life in the head-lease, on the ground that the person about whose life a doubt existed had been so long missing, that there was a reasonable presumption of the death previous to Easter, 1851. The application having been granted by the Court, the life of a young person was inserted in the lease; and the Academy's interest in it has thus become so much more valuable that the sale of it is likely to realize a considerable sum.

The third part of the twenty-second volume of the Transactions of the Academy has been printed off, and its publication is only delayed pending the execution of two etchings illustrating Dr. Kennedy Bailie's paper on the University Anaglyphs.

The first part of the fifth volume of the Proceedings was published during the past year. By a rigid adherence to a resolution of the Council, respecting the abstracts of communications made to the Academy, the Editor has been enabled regularly to furnish the members with a printed report of the proceedings of each meeting within a few days after its occurrence. The working of this system will, no doubt, be much facilitated when its nature and objects are better understood. Any member applying for leave to make a communication to the Academy is expected to send in, at the same time, exactly such an abstract of its contents, as is fit to appear in the Proceedings. This summary ought to set forth clearly the general nature of the communication, and the results announced in it, without transgressing those limits which the very name of an abstract suggests.

The Committee of Science has had the satisfaction of witnessing the completion of the series of Meteorological and Tidal Observations, which the co-operation of the Coast Guard Department has enabled them to procure. In the subjoined Report, submitted by that Committee to the Council, the Academy will find a statement of the progress hitherto made towards the accomplishment of these important scientific objects. They engaged the attention of the Academy soon after its foundation; and though the greatest credit is due to the present Committee of Science for having organized a more perfect system, and attained to infinitely more extensive results; the historian of science ought not to omit mention of the establishment in Ireland, under the superintendence of the Academy, of twenty stations for barometric and thermometric observations so long ago as the year 1787.

The Academy's Library has been enriched during the past year by the acquisition of a large collection of Irish MSS., purchased from Sir William Betham by means of a subscription. To this the Academy itself contributed £100. The remaining sum of £403, necessary to complete the purchase-money, was furnished by private individuals, who, in so doing, testified their opinion that the materials of ancient Irish history ought not to be scattered or removed from the country, but deposited in a public institution where they are likely to be preserved with care, and made generally accessible.

Out of a grant of £50, placed at the disposal of the Committee of Antiquities, £47 3*s.* 2*d.* has been expended, during the past year, in the purchase of antiquities for the Museum. But the principal accessions which it has received have been in the way of donations. It is fresh in the recollection of the Academy that the Commissioners of Public Works have presented to the Academy, through Mr. Mulvany, a numerous and valuable collection of antiquities discovered in the progress of the works carried on by order of the Commissioners in different parts of Ireland. The great value of this donation has been enhanced by the care which has been taken to record the exact locality in which the several objects were found.

The Academy, at a former stated meeting, adopted a plan recommended by the Council for the preparation of a Catalogue of the Museum. The Council, regarding this work not only as desirable for the information of visiters, and the promotion of Archæological Science, but even as essential for the safe keeping of the Museum itself, regret extremely that they have not been able before now to report its completion. They had hoped, at all events, to announce this evening the fulfilment of Dr. Petrie's promise to place the manuscript catalogue of the stone articles in the hands of the Committee of Publication, before the 16th of March. For an account of the progress actually made, and an explanation of the causes of the delay which has arisen in the execution of the work, the Council beg to refer to the annexed statement from Dr. Petrie. It is right to observe, that Dr. Petrie now contemplates a plan of compiling the Catalogue different from that sanctioned by the Academy:—

"Dr. Petrie states that he has given a considerable portion of time to the classification and cataloguing of the portion of the Museum consisting of stone implements, &c., and he had expected that he should have been able to fulfil his promise to the Academy made at its last Stated Meeting. He deeply regrets, however, that in this expectation he has been disappointed. The number of the articles to be noticed, with the particulars necessary to make the Catalogue of real value, and such as he believes will be expected by the antiquaries of Europe, has been found to be far beyond what he had conceived, and must necessarily require a greater expenditure of time than he had asked. He trusts, however, that if the Academy will allow him to proceed on his own comprehensive plan, he may be able, by unremitting attention to it, to have it finished before the Academy breaks up for the summer vacation: and he adds, that he would be very reluctant to engage in a work of a merely popular character, such as one comprised within the limited number of pages originally proposed, as he cannot conceive that such a work would be creditable to the Academy, or worthy of himself."

During the past year the following new members have been elected:—

John Barker, M.D.
William Kelly, M.D.
Francis Codd, Esq.
Rev. Johnston Brydges Sayers.
Vincent Scully, Esq., Q.C.
Robert D. Lyons, M.B.
Ven. Marcus Gervais Beresford, Archdeacon of Ardagh.
Christopher Fleming, M.D.
Thomas Hone, Esq.
Robert Ross, of Bladensburg.
Catterson Smith, Esq.
Joseph Napier Higgins, Esq.
Joseph Dickinson, M.D.
Joseph Beete Jukes, A. M.
Thomas Tear Kelly, Esq.
George Roe, Esq.
John Edward Pigot, Esq.
Mons. Amadil De la Ponce.

The following have been removed by death:—

Ordinary Members.

John Cash, Esq.
Andrew Carmichael, Esq.
Rev. Franc Sadleir, D. D. (late Provost of Trinity College, Dublin).

Honorary Members.

Heinrich Christian Schumacher.
Sir Charles König.
Thomas Moore, Esq.

FOURTH REPORT OF THE COMMITTEE OF SCIENCE RELATIVE TO THE METEOROLOGICAL AND TIDAL OBSERVATIONS.

[Received by the Council, March 13, 1852.]

The Meteorological and Tidal Observations, under the superintendence of the Officers of the Coast Guard, being now completed, the Committee of Science deem it their duty to lay before the Council a brief account of the progress of the undertaking, from the period of their last Report to the present time.

In the course of the summer of 1851 all the stations were visited, for the second time, by Dr. Lloyd, Professor Haughton, and Mr. Galbraith. The result of this visit was in the highest degree satisfactory. The instruments were, with few exceptions, in perfect order; the observers were attentive, and generally interested in their work; and there was no reason to question the accuracy of the observations. During this tour of inspection the differences of level between the zeros of the tide-gauges and the Ordnance bench-marks were remeasured. The results of these measurements are given below.*

Copies of the observations having been transmitted monthly to the Academy, the Meteorological Observations were handed over by the Council to Dr. Lloyd, and the Tidal Observations to Professor Haughton, these gentlemen having undertaken to reduce and discuss them. By this arrangement the work of reduction was begun soon after the commencement of the observations, and it is now far advanced.

As respects the Tidal Observations, it is to be noted that the chain of stations on the eastern coast is remarkably complete; so that the interesting but obscure phenomena of the Channel Tide will probably be completely elucidated. The data for the discussion of the Ocean Tide, on the western coast, are not so complete, owing to the difficulty of obtaining suitable positions for the erection of the gauges. At Kilrush, in the mouth of the Shannon, the tide-gauge was washed away by the violence of the sea; in Clew Bay, the Committee were compelled to abandon the contemplated observations, owing to the character of the beach; and at Killybegs it was found necessary to erect a tide-pole in place of a gauge, and to limit the observations to those taken on term-days. This deficiency in the number of the western stations is, however, of less importance, owing to the comparatively simple character of the Ocean Tide.

The Meteorological Observations appear to have been made and recorded with great care. In the early months, as was anticipated, some mistakes were made; but they were soon discovered and pointed out; and during the year 1851 they do not appear to have recurred. The readings of the maximum thermometer are, at some of the stations, too high, especially during the summer months, owing to the influence of radiation on the instrument; but in all other

* See Appendix, No. II.

respects the observations are very satisfactory. On the whole, a very complete body of results has been obtained with instruments carefully compared, and according to one uniform system ; and there is every reason to believe that it will prove a valuable contribution to the physical geography of Ireland.

The Committee deeming it desirable that the Meteorological Observations should not be discontinued, an application was recently made, on their suggestion, by the Council to the Ballast Board, requesting that such observations should be made at certain of the light-houses, in addition to those at which observations were taken since the commencement of 1851. This application has been most favourably received by the Ballast Board ; and there is every reason to hope that arrangements will shortly be made by that body for a *permanent* system of Meteorological Observations upon the plan laid down by the Academy.

As respects the expenses of the undertaking, the Committee are happy to be able to state that they have not exceeded the sum placed at their disposal by the Academy and by private subscription. The grant of the Academy, for the purchase and erection of the instruments, amounted to £225. Of this sum, £224 18*s.* 8*d.* was expended for that purpose; and the cost of printing, stationery, and other contingencies, amounted to £50 6*s.* 4*d.*, making a total sum of £275 5*s.* paid by the Academy. The subscriptions (which were contributed to enable the Committee to offer gratuities to the men engaged in the laborious service of the Tidal Observations, and to defray sundry other incidental expenses) amounted to £126, of which sum £117 10*s.* 6*d.* has been expended, leaving a small balance in hand. The total expenditure thus amounts to £392 15*s.* 6*d.*, a detailed account of which is presented herewith.*

The Committee cannot close their Report without bearing testimony to the care, fidelity, and skill displayed by the men connected with the Coast Guard Service to whom the observations were intrusted by the inspecting officers. They are reluctant to name individuals where all were deserving. But they cannot refrain from noticing specially the services of Mr. James Davis, chief boatman

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* See Appendix, No. III.

at Courtown, and of John Foreman and Thomas Cherry, commissioned boatmen at Donaghadee and Portrush. Through the assiduity and intelligence of the first-named observer, we now possess the data for the solution of the remarkable phenomena presented by the Tides at Courtown; and to the others we are indebted for records, both Meteorological and Tidal, which, in accuracy and fulness, leave nothing to be desired.

It was Resolved,—That the Report of the Council be adopted and printed in the Proceedings.

The Ballot for the annual election having closed, the scrutineers reported that the following gentlemen were elected Officers and Council for the ensuing year:—

President.—Rev. Thomas R. Robinson, D.D.

Treasurer.—Robert Ball, LL.D.

Secretary to the Academy.—Rev. James H. Todd, D.D.

Secretary to the Council.—Rev. Charles Graves, D.D.

Secretary of Foreign Correspondence.—Rev. Samuel Butcher, D.D.

Librarian.—Rev. William H. Drummond, D.D.

Clerk and Assistant Librarian.—Mr. Edward Clibborn.

Committee of Science.

Sir William R. Hamilton, LL.D.; Rev. Humphrey Lloyd, D.D.; James Apjohn, M.D.; Robert Ball, LL.D.; Sir Robert Kane, M.D.; George J. Allman, M.D.; Rev. Samuel Haughton, A.M.

Committee of Polite Literature.

Rev. William H. Drummond, D.D.; Rev. Charles W. Wall, D.D.; John Anster, LL.D.; Rev. Charles Graves, D.D.; Rev. Samuel Butcher, D.D.; Digby P. Starkey, Esq.; Rev. John H. Jellett, A.M.

Committee of Antiquities.

George Petrie, LL. D.; Rev. James H. Todd, D. D.; J. Huband Smith, Esq., A. M.; Samuel Ferguson, Esq.; Aquilla Smith, M. D.; Earl of Dunraven; T. A. Larcom, Esq., R. E.

The President, under his hand and seal, nominated the following Vice-Presidents for the current year:

John Anster, LL. D.; James Apjohn, M. D.; Rev. Humphrey Lloyd, D. D.; Thomas A. Larcom, Esq., R. E.

It was Resolved,—That the Council be empowered to prepare an Address to the Earl of Eglinton, Lord Lieutenant, and that the Academy be summoned on the day appointed by His Excellency, to wait upon him with the Address.

On the part of the Commissioners of the Board of Public Works, Mr. W. T. Mulvany presented three thin gold plates, which had been recently found in the bed of a tributary of the river Erne, running between Ballina and Crossdoney, in the townland of Belville, county of Cavan.

Dr. Petrie moved that the warmest thanks of the Academy be given to the Board of Works for this interesting donation, observing, that they were, as specimens, not merely new to us, but new, he believed, to every other collection of gold antiquities.

Dr. Petrie presented to the Museum a silver coin, on the part of Mr. J. R. Walsh. He had received a letter from Mr. Walsh, who had forwarded the coin, stating that it was found at a depth of three feet from the surface, in a field which formed a part of his (Mr. Walsh's) property at Martinstown, Kilmallock, County Limerick, and suggesting that it was a Scotch coin, which might have been dropped by some soldier who took part in the wars of Cromwell. Dr. Petrie explained that it was a penny of the Scottish King, Alexander III., who commenced his reign in the year 1249. It was in excellent preservation, and, though not a coin of remarkable rarity, it derived some interest from the locality in which it was found.

Mr. Bergin explained a mode of preserving rusted iron antiques, which he had been led to adopt under the following circumstances:—Some months ago, Professor Ormsby, of the United States, announced the discovery, by himself, of a compound of one part of lard and three parts of resin well mixed, which he recommended as a means of preserving steel from becoming rusty; stating that if one side of a plate of steel were coated with his composition, and the other not, it would be found at the end of some months that the side which was not so protected would be covered with rust, while the other would be perfectly free from it. Reflecting on this fact, it occurred to him that if the rusty articles in the Museum were immersed in this fatty resinous preparation, their character and appearance would be preserved for the future unaltered; and, accordingly, having tried it with a rusty javelin-head, he found that its colour and characteristics were wholly unaffected by the experiment.

The Rev. Dr. Todd exhibited some iron spears used by the Kaffirs and Bushmen. These weapons were presented to the Museum by Dr. Irwin, who had resided for several years in Southern Africa, and although the donation did not, properly speaking, come within the category of Irish antiquities, yet the articles resembled others of the same class which had been found in Ireland. These iron articles had been forged with stone hammers by the tribes who made use of them in warfare. Dr. Irwin, who had actually witnessed the manufacture of some of them, stated that they were forged with stones used as hammers and anvils. On that account they possessed some interest, in connexion with the antiquities of Ireland, as showing that a great progress might be made in the manufacture of iron weapons without iron hammers and anvils; and, therefore, that the use of stone hammers was quite consistent with the existence of iron weapons. This fact seemed, in some degree, to invalidate the theory of certain antiquaries who attempted to draw a definite line of demarcation between an iron and a stone period. The iron weapons might have been forged with the ancient stone implements, and therefore may have come into use before the stone had been abandoned.

Dr. Petrie thought the position taken by Dr. Todd an untenable one. It was quite possible, as well as natural, that when the Kaffirs, who were accustomed to the use of stone, came into contact with civilized men and obtained articles of iron, they would try to shape them into weapons with the stone hammers which they had been in the habit of using for other purposes.

Dr. Ball stated, that when the Cape of Good Hope was first discovered by Europeans, their attention was attracted by the beauty and perfection of the weapons found in the hands of the natives, manufactured by themselves from native iron.

Sir William Hamilton presented Tables containing a series of meteorological observations, made and drawn up by his assistant, Mr. Charles Thompson.

A vote of thanks was given to Mr. Thompson for having devoted his time and attention to a subject in which the Academy took so deep an interest.

MONDAY, APRIL 12TH, 1852.

JAMES APJOHN, M. D., VICE-PRESIDENT, in the Chair.

HENRY H. HEAD, M. D., William Nelson Irwin, Esq., James Sheridan Muspratt, Esq., and Henry John Porter, Esq., were elected Members of the Academy.

On the recommendation of the Council, it was Resolved:

That £50 be placed at the disposal of the Council to defray the expense of moving from Grafton-street to the present house in Dawson-street; and also,—

That the Council be authorized to dispose of the interest of the Academy in the lease of the house, 114, Grafton-street.

The following Address to the Earl of Eglinton, Lord Lieutenant of Ireland, &c., prepared by the Council, was read, together with His Excellency's Answer thereto:—

"*To His Excellency Archibald William, Earl of Eglinton and Winton, Lord Lieutenant General and General Governor of Ireland, &c.*

"MAY IT PLEASE YOUR EXCELLENCY,

"We, the President and Members of the Royal Irish Academy, beg to offer to your Excellency our respectful congratulations on your arrival in Ireland in the high character of Representative of our beloved and most gracious Sovereign.

"The Charter by which our Society was incorporated, in the twenty-sixth year of the reign of King George III., has nominated the Lord Lieutenant of Ireland ex-officio the Visitor of the Academy.

"The relation in which we are thus placed to your Excellency encourages us to hope that you will be pleased to inquire into the character and objects of our Society. If the manner in which we have discharged the important duties intrusted to us should meet with your Excellency's approval, we doubt not that you will take a lively interest in our proceedings, and extend to us that support which the efforts we have made for the advancement of science and learning in this country may seem to your Excellency to deserve.

"By the constitution of the Academy, we are incorporated for the threefold object of promoting Science, Polite Literature, and Antiquities, and the Council of the Academy consists of three Committees, each charged with the direction of the Academy's labours in one of these departments of learning.

"That we have not been unsuccessful in the cultivation of these studies is evidenced, we trust, by the Transactions we have published, which are already well and widely known.

"Through the favour shown to us by your Excellency's predecessor, the Earl of Clarendon, the Academy has become possessed of a house, provided for us by Government, to which we have only removed during the last week.

"In these more enlarged and suitable premises we hope in a short time to arrange and display our Museum and Library, so as to make them more accessible to Students, as well as more attractive and instructive to the Public.

"Amidst the unhappy divisions which have unfortunately distracted this country for so many years, the Royal Irish Academy has always been neutral ground; and it is with pride and pleasure we reflect, that even if we had directly done nothing for the advancement of learning in Ireland, the labours of the Academy would not have been vain were it only for the evidence they afford, that in the cultivation of intellectual pursuits it is possible to unite in a harmony, which has never been disturbed, those who differ, notwithstanding, upon the most momentous subjects.

"We trust that your Excellency's administration of the high office confided to you by our most gracious Sovereign will not only tend to the peace and prosperity of Ireland, and the development of the internal and commercial resources of the country, but also to the advancement of the scientific and literary pursuits to which the Royal Irish Academy is especially devoted."

ANSWER.

"Mr. President and Gentlemen,—I thank you for your kind congratulation on my arrival here as the Representative of our most gracious Queen, and I am gratified to hear that in the high position in which Her Majesty has been pleased to place me, I am *ex-officio* the Visitor of the Royal Irish Academy.

"Owing to the numerous duties which have occupied me during the short period I have been in this country, I have had but little time to inquire into the character or object of your Society; but on looking over the list of names of the Members who are enrolled in it, I feel convinced that your efforts for the advancement of polite literature, science, and antiquarian researches must have been successful, and productive of great advantages.

"I am glad to hear that, owing to the kindness of Lord Clarendon, the Academy is now provided with a suitable house, and I sincerely join in the hopes you have expressed, that the new arrangements you are about to make will be beneficial to the student as well as interesting and instructive to the public."

Dr. Petrie presented, from Mr. William Wakeman, a Roman coin of "the younger Faustina," found at Navan. It was a rather curious circumstance that Roman coins should be so frequently discovered in that particular locality.

The Chair having been taken by Major Larcom,—

Dr. Apjohn made a communication, the object of which was to demonstrate the fallacy of the doctrine that, in order to produce a given volume of vapour, having a given elastic force, the same quantity of fuel must be consumed, irrespective of the nature of the liquids employed.

"It has been frequently proposed to substitute the vapour of some volatile liquid, such as alcohol or ether, for that of water in the steam-engine, under the idea that by so doing fuel would be economized; and the proposal appears *primâ facie* plausible, seeing that their boiling points are not only lower than that of water, but that the same is true of their specific heats, and of the latent heats of their vapours. This idea would seem to have struck at different times the minds of different persons, and the Rev. Mr. Cartwright, a gentleman of great mechanical genius, and celebrated for his mechanical inventions, actually devised a most ingenious form of steam-engine,* in which the piston was to be moved by the vapour of alcohol.

"Mr. Ainger, in a notice brought by him before the Royal Institution, London, in February, 1830, on the Economy of the Steam-Engine, would seem to be the first person who publicly dissented from such views; and he has certainly the merit of having shown the insufficiency of the data generally used by those who, previous to his time, calculated that the substitution of more volatile liquids for water would lead to a considerable saving of fuel. The conclusion, however, at which he arrives, that, leaving the original cost of the liquids out of consideration, water would be as economical a liquid as alcohol or ether, I believe to be quite erroneous; and as the question at issue is one of some practical importance, I shall proceed to state succinctly the method of calculation which I have employed in discussing it, and the precise results at which I have arrived.

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* See Philosophical Magazine, vol. I.

"As the vapours of different liquids have at their respective boiling points the same elastic force, equal volumes of them will produce equal mechanical effects. In order, therefore, to the solution of the question under consideration, it will only be necessary to calculate the weights of the different liquids, water included, which give equal volumes of vapours, and to determine the quantities of caloric necessary for the conversion of them into vapour.

"Now as the volume of a vapour, like that of any other form of matter, is represented by its weight or mass, divided by its specific gravity, if we put

$$\frac{x}{s'} = \frac{1}{s},$$

x being the weight of any vapour, whose specific gravity is s', and s the specific gravity of the vapour of water, we will get

$$x = \frac{s'}{s},$$

that is, the weight of any liquid which, at its boiling point, gives a volume of vapour equal to that given by a weight of water represented by unity at its boiling point, is got by dividing the specific gravity of the vapour by that of steam. But the specific gravities to be used in this computation are not those usually given in books, each of which is referred to a different unit, viz., air at the same temperature, and under the same pressure as the vapour, but the specific gravities of the vapours at the respective boiling points of the several liquids, compared to the standard unit, viz., air at 60°, and under a pressure of 30°. In the following Tables, the former specific gravities are found in the second, and the others in the third column, the latter being in each case got by multiplying the former by $\frac{518}{458 + t}$, t being the boiling point of the liquid which yields the vapour. In the fourth column we have the weights, which would give equal volumes of vapours, calculated by the expression $x = \frac{s'}{s}$ already given, the values of s and s' being taken from the third column.

1.	2. Specific Gravity referred to air at Boiling points.	3. Specific gravity at Boiling points referred to air at 60°.	4. Weights, giving equal volumes of vapour.
Water, . .	.622	.480	1.000
Wood Spirit,	1.120	.950	1.979
Alcohol, . .	1.613	1.322	2.754
Ether, . . .	2.586	2.397	4.993

"It is now easy to assign the quantities of caloric necessary to produce an equal volume of the vapour of each liquid at their respective boiling points, for these will obviously be represented by the expression

$$mc\,\{(t-50)+l\}$$

m being for each liquid its number in column 4, c its specific heat, t its boiling point, and l the latent heat of its vapour at the temperature of ebullition. When, with the aid of the annexed Table,—

	Boiling Points.	Specific Heats.	Latent Heats.
Water, . .	212°	1.00	961.8
Wood Spirit,	151.7	.67	475.2
Alcohol, . .	172.4	.64	374.4
Ether, . . .	100.4	.50	163.8

which exhibits the specific and latent heats on which most reliance can be placed, the numerical calculation is made, the following are the results:—

Water, . . .	1129	1.000
Wood Spirit, .	764.8	.676
Alcohol, . . .	875.5	.775
Ether, . . .	534.7	.473

"The mere inspection of these numbers is sufficient to show that Mr. Ainger is in error, or that by substituting for water, wood spirit, alcohol, or ether, the same moving force will be obtained, and with a great saving of fuel. With wood spirit, about two-thirds, with alcohol, about three-fourths, and with ether, somewhat less than half the caloric required by water will suffice.

"To the use, however, of such liquids there are obvious objections. Their cost is considerable compared to that of water, and as they evolve at atmospheric temperatures vapours of a considerable elastic force, they will, from imperfect condensation, resist the motion of the piston, and thus give rise to an appreciable loss of power. But, notwithstanding this practical difficulty, which, by the way, is not in the cases of alcohol and wood spirit one of a very formidable nature, the theoretic conclusion is no less certain, that equal volumes of the vapours of different liquids, formed at their respective boiling points under the pressure of a single atmosphere, *do not* require for their production equal quantities of caloric."

Dr. Todd exhibited a fragment of an ancient Pentateuch roll, written on leather, in the square Hebrew character, and containing a portion of the book of Leviticus, from chap. xx. 19, to xxii. 23. It was found by Ford Leathley, Esq., in the tomb said to be Absalom's tomb, at Jerusalem, December 7th, 1842.

It is written without points or accents, and with scarcely any divisions between the words, but the character or style of the writing does not indicate a very remote antiquity. It is probably a MS. of the fourteenth century, and is evidently a fragment of one of the smaller Pentateuch rolls, written for the use of the synagogue. It is customary with the Jews to bury such rolls with their dead, when they had become injured or worn with use, and also if, upon examination, they had been found to contain any error, which could not, consistently with Talmudic rules, be corrected or removed. Such MSS., also, as had fallen into the hands of Christians or Pagans, were looked upon as having contracted an indelible stain of impurity, and were therefore buried with the dead. To this superstition we probably owe the loss of many ancient and precious MSS.

The fragment exhibited to the Academy, Dr. Todd stated, coincided exactly with the Masoretic text. He had read and transcribed every word of it that was legible, and he did not find a single instance of deviation from the received text of the Masoretic Bible. It is therefore of no value whatsoever in a critical point of view, and is only to be regarded as a curious specimen of a leather MS., a class of MSS. which is every day becoming more rare. The modern Jewish Pentateuch rolls, that is to say, those of more recent date than the fifteenth century, are in general written upon parchment, and not on skin or leather. The Talmudic Tract called מסכת ספרים, which contains directions for the writing of these MSS., permits them to be written either on leather or parchment, and gives rules for preparing the material in both cases. If written on leather, the skin is to be first stripped of its hair, and hardened with salt, flour, galls, &c., or else it is split into two, and prepared for writing in a similar way. If split, the thicker portion, which in the living animal was next the flesh, is called by the Jews דקסוסטוס *Docsostos* (a corrupt Greek word, which is probably διχαστὸς, from διχάζω), and if this be used, the writing must be upon the side which was next the flesh; but if the undivided skin be used (which they call גויל), the writing must be on the side which was under the hair. The thinner membrane obtained after splitting the skin, they call קלף, and in writing on this, the side next the flesh must be used. These are not superstitious rules; but are adopted to secure greater facility and perfection in the writing. The skin of an animal which is (according to the ceremonial law) unclean, is not to be used in writing the law, nor unless it be prepared for this especial purpose by a Jew. If prepared by a Gentile, or even by a Jew, if not destined from the beginning for this especial purpose, it cannot be used for writing the Law. And there exists a curious rule, a remnant of the ancient hatred between the Jews and Samaritans, viz., that a copy of the Law written by a Samaritan must be burned; a copy written by a Gentile, or by an Apostate Jew, or by a slave, or a woman, or even by a minor not yet of age, must be buried.

The fragment exhibited to the Academy is probably part of a MS. which possessed some of these ceremonial defects, and was therefore buried. But there are also other defects besides those mentioned, of a much more minute and unimportant nature, such as clerical errors or inaccuracies of various kinds, which rendered a Pentateuch unfit for synagogue use, although not altogether profane, or unfit for all use. Such MSS. were sometimes employed in schools to instruct children, and to prepare young men for the office of synagogue readers. When worn out, or so far injured as to be unfit for this purpose, they were buried with the dead, inclosed in a vessel of earthenware, and placed in the hand or on the breast of the corpse. But this was always regarded as a high compliment to the deceased, and an evidence of the esteem in which his moral and religious character was held by his brethren. Tradition says that this custom was first introduced at the burial of King Hezekiah, and that this was the peculiar honour which the Scripture says was paid him by the nation. (2 Chron. xxxii. 33.) A copy of the law was laid on his breast, and proclamation was made, קיים זה מה שכתוב בזה. "He had fulfilled what is written therein."*

As an illustration of this class of Hebrew MSS., Dr. Todd exhibited two fac similes of MSS. recently found at a synagogue of Chinese Jews, at a place called K'ae-fung-foo, the

* Wagenseil. Sota. p. 310.

capital of Ho-nan province, in China. The existence of this Jewish colony has been known for a couple of centuries, from the report of the Jesuit missionaries, and other occasional notices of travellers, and since the treaty made by our Government with the Chinese at Nanking, in 1842, several benevolent persons in England have interested themselves in the condition of the Jews in China. Amongst others a lady, not long deceased, bequeathed a sum of money for the purpose of defraying the expenses of an inquiry into their condition. The present Bishop of Victoria, Dr. George Smith, undertook to direct the general plan and management of the undertaking, and, under his auspices, two native Chinese Christians were sent to visit the synagogue at K'ae-fung-foo.

The journals kept by these emissaries have recently been printed at Shangae, in English, with some introductory remarks by the Bishop. Without giving the details of their discoveries, which would be out of place here, it is enough to say that, in their first visit in November and December, 1850, they brought back eight MSS., containing portions of the Old Testament in Hebrew, described as written on thick paper, bound in silk; from the nature of the paper and binding they were judged to be of Persian origin; the writing seemed to have been executed by means of a style, and they had all the vowel-points and accents. The rolls now exhibited to the Academy are fac similes of two of these MSS., executed by Chinese artists on wooden blocks, and printed on Chinese paper. As the originals are written with points, and on paper, it is evident that these MSS. are not synagogue rolls, but of the class called private rolls, which are written for private use, or for assisting the members of the congregation to follow more readily the synagogue reader; and the form of the character, together with the fact that they do not in any respect differ from our common Rabbinical text, renders it impossible to assign to them a much higher antiquity than the 15th century of our era. The use of the sign *Raphe*, to indicate the aspirated letters, is an evidence that these MSS. cannot be later than that period; this mark will be found in regular use wherever these letters occur throughout the MSS. The two volumes (for they are *volumes* in the original sense of that word), now exhibited to the Academy, each contain one of the fifty-four sections, into which the Jews divide the Law for weekly reading, namely the 13th, or ואלה שמות, containing Exod. i. to vi. 1, inclusive; and the 23rd, called אלה פקודי, containing Exod. xxxviii. 21, to xl. 38, inclusive.

In the account which the Jesuit missionary, Father Gozani, has given of the Synagogue of K'ae-fung-foo, in 1704, published in the *Lettres édifiantes et curieuses,* he states that there were in the sanctuary thirteen recesses, each containing a Pentateuch roll, one for Moses, and one for each of the twelve tribes of Israel, as the Jews informed him. One of these rolls, he tells us, which was the most ancient and authentic of them, having suffered damage from the overflow of the river Hoam-ho (yellow river), on which the town stands, the Jews had caused the other twelve copies to be made, as security against a similar accident. He tells us further, that in another part of the synagogue was a great number of ancient boxes or coffers, each containing a section of the Pentateuch, and other books of the Scripture; his words are:—" Un de ces livres fut heureusement sauvé de la grande inondation du fleuve *Hoam-ho* qui submergea la ville de *Cai-fom-fou,* capitale de cette Province. Comme les lettres de ce livre ont été moüillées, et qu'elles sont presque à demi effacées, ces Juifs ont en soin d'en faire douze copies, quils gardent soigneusement dans les douze tabernacles, dont je viens de parler. Ou voit encore en deux autres endroits de cette synagogue plusieurs anciens coffres, òu ils conservent avec soin un grand nombre de petits livres, dans lesquels ils ont divisé le Pentateuque de Moïse, qu'ils appellent *Takim,* et les autre livres de leur Loy."*

* Lettres Edif. et Cur. tom. vii., p. 7.

The rolls exhibited to the Academy are evidently copied from two of these smaller MSS., containing the separate sections of the Law; and it is remarkable that the Chinese emissaries of Bishop Smith, at their recent visit to the synagogue, found the very same number of Pentateuch rolls which existed in Father Gozani's time, together with a large number (they do not say exactly how many) of the smaller MSS. As it was thought very desirable to possess some of these MSS., on the chance of their proving to be of great antiquity, and therefore valuable for critical purposes, Bishop Smith sent back his Chinese missionaries, furnished with the means of making purchases, to pay a second visit to the Jewish colony. This expedition was undertaken in July last, and was attended with complete success. They assembled the whole congregation, to the number of 300, in the synagogue, and publicly announced the object of their visit. The bargain was struck, and six of the larger synagogue rolls were purchased for 40 *taels* of silver, or about £130. These are described as written without points, on sheep-skins sewed together, as is usual in this class of MSS.; they contain each a copy of the whole Pentateuch, and are in excellent preservation, except one, which has suffered injury in a flood, and this one is unfortunately that which is supposed to be of the greatest critical value, having been, in all probability, the original from which the others were copied, as Father Gozani has recorded. If so however, and if the story told him of the transcription of the others be true, it is probable that this is the only one which can be of any real value. Forty other smaller MSS. were also procured, but no description of them or of their contents, has been given by the Bishop of Victoria. Some of these MSS., however, he tells us, have been sent to London.

Major Larcom stated that he had received a letter from Captain Broughton, who is now in Hong Kong, relative to the very same publication by the Bishop of Victoria, to which Dr. Todd had alluded. It would be seen from the following extract of this letter that Captain Broughton, in that distant land, still remembered the Academy :—

"*Hong Kong*, 29*th January*, 1852.

"I have a pamphlet for you which you may consider a curiosity. You may not have heard of the discovery in China of a sect of Jews, quite in the interior, 700 miles from the coast. They were found at a place called K'ae-fung-foo, last year, by two Chinese missionaries, who brought back with them six Rolls of the Law, each containing a complete copy of the Pentateuch, which are written on thick sheep-skins, sewed together. The account of their journey and discoveries was published. I shall take an early opportunity of sending you one, which, when done with, I beg you will present to the Academy. It will be accompanied with fac-similes of the MSS., copied by the Chinese, who are very expert at such work. They have outlived their language, while they retain to the full extent their exclusive caste and habits. Not a single individual could read the Hebrew books. They had been without a rabbi for fifty years, which may account, in addition to their poverty and destitute state at present, for their having parted with the rolls so easily. By the kindness of the the Bishop here, I have been able to obtain the pamphlet, journey, and fac-similes, and I shall send them to you by the first safe hand."

The thanks of the Academy were voted to Captain Broughton.

Sir William R. Hamilton made some remarks on continued Fractions, and on their connexion with Quaternions, but desired to reserve a fuller account of his views for a future meeting of the Academy.

Monday, April 26th, 1852.

THOMAS ROMNEY ROBINSON, D. D., President, in the Chair.

The Rev. Dr. Todd, Secretary of the Academy, presented, on the part of the Rev. William Thomson, a bronze fibula, found in a fort in the townland of Drumgurra, in Farney, and also an autograph letter of Dean Swift; which was forwarded for presentation to the Museum by Mr. P. Brophy. The letter, which was addressed to William Walker, the Lord Mayor of Dublin at the time, had been discovered by Mr. Brophy amongst the papers of Mrs. Catherine Walker.

The following is a copy of the document:—

"My Lord,—I enterely forgot, yesterday, a small Affair, —which I did intend to mention to your Lordship. About six months ago My Lord Orrery desired me to recommend the son of an old faithfull Servant who is still his Domestick in England, one Catharine Reyley to be admitted into the blue-coat Hospital. I apply^{ed} accordingly to the late Lord Mayor very frequently, but could never obtain that Justice. I have been these many years a governor of that Hospital, and have recommended fewer boys than perhaps any other Governors : and My Lord Orrery as he is a most valuable person in all Respects, as well as a great Friend to this Kingdom, hath a good Title to Recommend for so small a Favour. The Boys name is Edward Reyly. I have sent him with his Mother, to attend and get one of the Servants to deliver this Letter to Your Lordship. and I hope you will please to order his Admitance this day. He hath been already measured, and is tall enough for the standerd.

"I wish your Lordship success in your administration, equall if possible to your deserts, and am with the greatest

Respect, My Lord, your Lordship's most obedient and most humble servant,

"JONATH: SWIFT.

"*Deanery-House October 7th*, 1737."

Dr. Todd was permitted by the Rev. Edward S. Abbott, Prebendary of St. John's, to exhibit to the Academy an original Bull of Pope Nicholas III., which is preserved in the archives of Christ Church Cathedral, dated in the second year of his pontificate, A. D. 1279. It commissions the Archdeacon of Leighlin to inquire into the case of the Prior and Chapter of Christ Church, who complained that the prior and two other canons had been unjustly excommunicated by John, vicar of Balrothery. The following is a copy of this document:—

"Nicolaus episcopus, servus servorum Dei, dilecto filio. . . Archidiacono Lechlinensi salutem et apostolicam benedictionem. Conquesti sunt nobis . . . Prior et Capitulum Cathedralis ecclesie Sancte Trinitatis Dublinen. ordinis Sancti Augustini quod Johannes perpetuus vicarius ecclesie de Balitridir* Dublinen. dioc. in Willm̃ tunc priorem,† Reginaldum tunc officialem ipsius capituli sede Dublinen. vacante‡ ac Philippum de Schitsebȳr ejusdem ecclesie canonicos in quos nullam habebat jurisdictionem ordinariam seu etiam delegatam communiter excommunicationis sententiam temeritate propria promulgavit. Ideoque discretioni tue per apostolica scripta mandamus qua-

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* *Bilitridir.*] Now Balrothery.

† *Willm̃ tunc priorem.*] William de Gran, who was prior of Christ Church 1263 to 1280, and also was Lord Chancellor of Ireland.

‡ *Sede Dublinen. vacante.*] The See of Dublin was vacant from the death of Archbishop Fulk Sandford, in 1271 to 1279, in which year the Pope having declared null the elections of the Chapters of Christ Church and St. Patrick's, who had chosen two different persons, nominated to the see John de Derlington, an Englishman, who had been collector of *Peter pence* for the Court of Rome in England.

tenus partibus convocatis audias causam et appellatione remota debito fine decidas faciens quod decreveris per censuram ecclesiasticam firmiter observari. Testes autem qui fuerint nominati, si se gratia odio vel timore subtraxerint censura simili appellatione cessante compellas veritati testimonium perhibere. Dat. Viterbii non. Octobr. Pontificatus nostri anno secundo."

A vote of thanks was passed to the Rev. Mr. Thomson and Mr. Brophy for their interesting donations, and to the Rev. Mr. Abbott for his kindness in allowing the Papal Bull to be exhibited to the Academy.

The Rev. Dr. Graves read a paper on a generalization of the Symbolic Statement of Taylor's Theorem.

Lagrange was the first to show that Taylor's theorem admits of the symbolic statement,

$$\phi\,(x + h) = e^{h\frac{d}{dx}}\,\phi(x).$$

The object of the present paper is to discuss the problem of determining that more general symbol which shall have the effect of changing x into any proposed function of x, such as $\psi\,(x)$, throughout the whole of a given function $\phi\,(x)$, which is made the subject of the operation.

The following synthetic course leads readily to the desired end. As the effect of the symbol

$$e^{\frac{d}{dx}}$$

is to change x into $x + 1$, it appears that

$$e^{\frac{d}{df(x)}} \text{ or } e^{\frac{1}{f'(x)}\frac{d}{dx}} \qquad (a)$$

will change $f(x)$ into $f(x) + 1$; and consequently will have the effect of changing x into $\psi\,(x)$ where

$$\psi\,(x) = f^{-1}\{f(x) + 1\} \qquad (b)$$

Developing the symbol of operation (a) we shall now find, as an extension of Taylor's theorem, that

$$\phi\{\psi(x)\}=\phi(x)+\frac{1}{f'(x)}\frac{d\phi(x)}{dx}+\frac{1}{1.2}\frac{1}{f'(x)}\frac{d}{dx}\frac{1}{f'(x)}\frac{d\phi(x)}{dx}+\&c.$$

Here, as in Taylor's theorem, the first term is $\phi\,(x)$; and each of the rest is deduced from the one which precedes it by a uniform process. ψ being given, the form of $f'(x)$, or of its primitive $f(x)$, must be determined by the equation (b). This, as it stands, is a functional equation, but it may be reduced to an equation in finite differences, of the first order, and of a degree which depends on the nature of the function ψ. For, if we make $x=f^{-1}(y)$, it becomes

$$\psi\{f^{-1}(y)\}=f^{-1}(y+1).$$

When, on the other hand, we desire to ascertain the power of any proposed symbol of the form (a), we must first *integrate* $f'(x)$, and then *invert* the function $f\,(x)$, in order to determine the form of ψ. Upon the possibility of effecting these two operations depends the success of this attempt to interpret the symbol. Pursuing this method, we obtain interesting results, of which the following are examples:—

1. The effect of $e^{x\frac{d}{dx}}$ is to change x into ex.

2. The effect of $e^{x^n\frac{d}{dx}}$ is to change x into $\{x^{1-n}+1-n\}^{\frac{1}{1-n}}$.

3. The effect of $e^{\log m\left\{x+\frac{n}{m-1}\right\}\frac{d}{dx}}$ is to change x into $mx+n$.

4. The effect of $e^{x\log x\frac{d}{dx}}$ is to change x into x^e.

It is worthy of notice, that the general solution of the equation (b) would lead to important results in the theory of functional equations. For we shall have

$$\psi^2(x) = f^{-1}\{f(x) + 2\}$$
$$\psi^3(x) = f^{-1}\{f(x) + 3\}$$
$$\psi^n(x) = f^{-1}\{f(x) + n\}$$

Hence, amongst other consequences, it is evident that any functional equation of the form

$$A_n \psi^n(x) + A_{n-1}, \psi^{n-1}(x) + \ldots + A\psi(x) + A_0 x = 0,$$

in which A_n, A_{n-1}, &c., are constants, may be reduced at once to a linear equation in finite differences with constant coefficients.

We might also invert the function $\psi(x)$ since

$$\psi^{-1}(x) = f^{-1}\{f(x) - 1\}$$

Dr. Graves stated that, in a continuation of the present paper he would lay before the Academy the results which he had obtained in discussing the symbol

$$e^{L\frac{d}{dx} + M\frac{d}{dy} + N\frac{d}{dz}}$$

in which L, M, N, are functions of x, y, and z; and which has the effect of changing x, y, and z respectively into certain functions of x, y, and z, whose form depends upon that of L, M, and N. One example of this kind has been already communicated to the Academy in a paper read by Dr. Graves on the 9th of June, 1851.

The Chair having been taken by the Rev. Dr. Lloyd,

The President communicated the results of four years' experience, at his own observatory, of the effects produced by the vicinity of a railroad.

"Amid the ever increasing requirements of improved accuracy which the progress of science is pressing on astronomical observers, it becomes important to avoid every possibility of error; to remove every cause that may, in the slightest degree, add to the difficulties that inevitably oppose our advance towards precision. The zenith sectors, the mural circles, the transits, which, forty years ago, were regarded as almost miracles of perfection, are fast sinking into neglect, and are displaced by inventions of higher promise. But instruments may be improved in vain unless they be used with skill proportioned to their improvement, and withdrawn from disturbances which may overwhelm their augmented power. Such disturbances, it is my purpose to show, may easily exist in the vicinity of a railroad. This matter has already attracted attention in consequence of two attempts to carry lines at about 800 feet from the Observatory of Greenwich, and experiments relating to it have been made by Captain Denham, Mr. Airy, and myself, whose results, differing only in degree, have been published by order of the House of Commons. Captain Denham, observing at Liverpool, on Sandstone Rock, took altitudes of the sun with a sextant, of low magnifying power, and a small reflecting surface of mercury, and found that the image was disturbed to the distance of 1110 feet. Immediately above the Tunnel he found the vibration scarcely sensible. Mr. Airy's experiments were made at Greenwich, on gravel, and at Kensal Green on clay; viewing with a small telescope the wires of a collimator reflected in mercury, his limits were in one case 1100 feet, in the other, 2200. My trials were made in the (now vanished) Dodder bank Distillery, 1055 feet from the Dublin and Kingstown line, observing with a large repeating circle the image of a land object reflected in a circular vessel of mercury, eight inches diameter. The soil here is mere silt, of great depth and *uniform density*, and, therefore, well adapted to propagate tremors. Accordingly, they were observed as far as the Terminus on one hand, 6434 feet along the line, and the Booterstown Station, on the other, 10893 feet. The wave of earth-vibration was much more extended before the engine than behind it, as, indeed, might be expected from the nature of the disturbing force; it was also felt long before the sound of the train was audible.* I also found that when an object was bisected, and the level of the circle read, both were found to have varied after the passage of a few trains; and that the wires were ill-defined, and the stars blurred by the transit of a heavy engine.

"Sir James South, also, made reflection observations on stars, with a very powerful telescope, near Watford, on chalk full of fissures and very heterogenous, with results analogous to the preceding, but, I believe, of less intensity; these, unfortunately, have not yet been published.

"These observations, though fully significant, were made under conditions much less favourable than those which exist in fixed observatories; but I regret that I am able to complete them in this respect by my own experience. In 1848 the Ulster Railway was opened, and I soon found reason to congratulate myself on having resisted the original scheme which would have carried its line only 480 feet from my transit. The Armagh Observatory stands on ground probably corresponding in its vibrative power to that at Kensal Green. Underneath it is about 130 feet of dense clay, resting on mountain limestone, and the same clay is exposed in some deep cuttings on the line. The hill descends 90 feet, and rises from the valley 40 to the Terminus, which is the nearest point of the line, its horizontal distance being 2100 feet. The trains are light and few, five up and five down, and the velocity moderate, not averaging, so near the Terminus, 20 miles per hour.† The Terminus bears 50° west of my north meridian mark, and

* This is adverse to an opinion expressed by Mr. Robert Stephenson, that this tremor of mercury is chiefly caused by the sonorous vibrations of the air. On one day the artillery was practising with shot from 24-pounders at the Pigeon House, and though the reports were heavy, the mercury was comparatively little affected.

† The average weight of engine and carriages is 40 ton, to which may be added 5 more for passengers.

the line crosses the meridian at an angle of 40° nearly, so that I scarcely anticipated any sensible tremors.

"I, however, have found that all the phenomena which I observed at Dodder bank are reproduced here.

"1. Disturbance of the mercurial horizon. The importance of the observations made with this can scarcely be overrated. In the case of stars, they give the index correction of a circle, the verification of its divisions, and the means of eliminating flexion; nor are they less useful for the transit. But another application of them, in which the reflected image of a telescope's own wires is made to coincide with the direct one, is perhaps even more valuable, and is coming into general use. Both require almost absolute quiescence of the mercury; an agitation of it, which no other method of examination can appreciate, will make the image nebulous and confused, or even cause it to oscillate round its true place. Even a moderate breeze of wind will do this; and therefore, as the amount of time during which such observations can be perfectly made is so limited, the introduction of any extra disturbance is injurious to an extent much more than proportioned to its actual duration. Now, I find that with an outgoing train, the image is so much disturbed as to make its coincidence doubtful for $4^m\ 36^s$ on an average: in one instance even for $6^m\ 17^s$, at which time, assuming the velocity as given above, the distance must have been 11,130 feet. The mercury vessel is the same which was used in my former experiments; but the magnifying power is the habitual observing one of 250. The time of disturbance for the incoming train is seven seconds less. During half this time the image cannot be seen, and occasionally the waves on the mercury are directly visible to the eye.

"2. In bisecting a star, or making a coincidence of the wire's images, the circle is moved by a fine screw. However perfect its centre work may be, or however complete the adaptation of counterpoises and friction wheels, an amount of friction must remain equal to many pounds at its place of action; all the parts, therefore, which intervene between the pivots of the instrument and the point of resistance of the largest screw must be under strain equal to the moment of this friction. But, as is well known, any slight tremor will relieve a part of the friction, and the circle must take a new position. Accordingly, I find that if (for example) I make the two images coincide by moving the reflected from right to left before a train, when that has passed it will be found to have started from two to four seconds towards the left, and *vice versâ*. This I think the most dangerous of all these disturbances; for if a train passes after the star is bisected, and while the observer is reading the microscope, the whole or a part of this jump will be changed to the star's place, and the direction of the error will depend on that in which the screw was last turned. I have, therefore, been obliged to establish it as a standing rule, that all such cases are to be noticed in the journal, and the observations rejected.

"3. The adjustments appear to be slightly affected; of this, however, I cannot speak with confidence, except in respect of the horizontality of the circle's axis, and its meridian position. The transit instrument has always been kept closely adjusted, and, therefore, cannot show these deviations; and the index correction of the circle is by its construction scarcely liable to change but by extreme violence. The circle's axis is levelled, by first correcting collimation in right ascension with two collimating telescopes, and then making the images of the central wire coincide; so that it can be at any time easily examined. It is kept in position by two check-nuts, on a strong screw, and formerly would remain many months before it erred to the amount of five seconds, which it was not allowed to pass. At present as great a change will sometimes occur in four days, and that abruptly. The disturbance in azimuth is less in amount, and I think independent of the other. I have not detected any effect on the clock.

"4. It certainly produces some optical indistinctness, which at so great a distance I did not expect. At first a train passed at noon; and we were surprised to find that the sun's limbs, though perfectly well defined at the first wires, would sometimes suddenly, as it were, shiver and become confused so as to preclude all observing; a little attention to the steam-whistle explained its cause, and had not the train been suppressed, we must have neglected solar observations for half the year. The effect was similar in both instruments, but I think greater in the circle. With respect to stars, it was chiefly studied on the pole-star, whose slow motion gave ample leisure to examine the appearances. In general, the star became a luminous blot of an elliptic form; but when the air was perfectly still, so that the definition was perfect, the phenomena were much more striking. In such cases the star is a mere point surrounded by a system of coloured rings; these, about five minutes before the train came in, elongated themselves with rapid oscillations nearly in the meridian. In another minute the central point began to dilate, and as it met the lesser axis of the distorted rings they coalesced, till all became a bright blur, as large as the inner ring, in two minutes more. As the speed was diminished, traces of the rings re-appeared, and when the train stopped, all was as at first. As respects stellar astronomy, this is not of much importance, for it will cause the loss of only two or at most three observations for each train, and only a rare chance could make it interfere with an occultation; with the sun it is otherwise, but I trust that there are no railway directors who would not in such a case alter their arrangements, so as to leave the 20^m before and after noon free.

"I will conclude by suggesting whether, henceforward, it will not be prudent, in selecting sites for observatories, to choose with special reference to the ground's capability of conducting tremors, and ascertain it by trial. From what I have stated, it seems probable that a deep and homogeneous substratum is in this respect the very worst; while the beautiful experiments of Mr. Mallet, which have so lately been before the Academy, show that even the elasticity of granite is lowered by its joints and veins almost to a parity with incoherent sand. A gradual change of direction, such as is given by the little valley that I have described as intervening between me and the Terminus, has no effect; but I think that a more considerable one might exert considerable power in deadening the wave. It, therefore, is not unlikely that a mass of discontinuous rock, rising abruptly one or two hundred feet above a railway, would be but little affected by it.

MONDAY, MAY 10TH, 1852.

JAMES APJOHN, M. D., VICE-PRESIDENT, in the Chair.

ARTHUR LEARED, M. B., was elected a Member of the Academy.

It was Resolved, on the recommendation of the Council:—

That a sum not exceeding £50 be placed at the disposal of the Committee appointed to prepare a Catalogue of the Museum.

The Secretary presented, for Major John Bonner, a bronze pin, found with a quantity of human bones, on the lands of Henry Gillespie, Esq., near Rathfarnham; for R. M. Carnegie, Esq., a copper hatchet-head; and for Pakenham Mahon, Esq., a circular impression on wood, produced, apparently, by a red-hot iron stamp, found in Clonfinn Lough.

The Secretary exhibited, for John Moorehead, M. D., a portion of the horn of an Irish elk, found under four feet of peat and five feet of blue clay, in the Public Drainage Works at Annagh-na-Carrig, Newbliss, County Monaghan, by Mr. Coe, Civil Engineer. Dr. Moorehead was satisfied, from inquiries made by himself, that the fragment of horn was now in the same state in which it was when disinterred, yet its surface contains various marks made with a knife, together with the letters J and E in Roman characters.

Rev. H. Lloyd exhibited a number of autograph letters, the property of —— Lynch, Esq., by Lord Lyttleton, Lord Chesterfield, the Duke of Northumberland (1766), Alexander Pope, Dean Swift, Esq., and Sir Humphrey Davy (1811).

Mr. Grubb communicated to the Academy an improvement lately effected by him in the mode of illuminating objects under examination in the compound microscope.

After noticing the several improvements which have been made within the last few years in the *optical* part of this instrument, Mr. Grubb remarked, that its *mechanical* arrangements have not undergone corresponding improvements, and are still defective in some important respects. Among these, Mr. Grubb noticed the power of directing the illuminating beam on the object at all angles of incidence and in all azimuths, and of registering the position at which peculiar effects are obtained. He referred to the very ingenious method proposed by his friend, Mr. Thomas F. Bergin, for remedying in part this defect, and which consisted in the employment of a combination of a rhombic prism with Mr. Shadbolt's parabolic reflector. By means of this arrangement Mr. Bergin was able to direct upon the object a beam of light at *one fixed* angle of oblique incidence, but in *all* azimuths. Mr. Grubb then proceeded to describe his improvement, which gives the power of directing the beam at *any* angle of incidence and in *any* azimuth, and also enables the operator to register its position at any time, and consequently to restore it with perfect certainty.

"I assume," said Mr. Grubb, "the existence of an illuminating beam, achromatized and adjustable as to the angle of convergence, the shape of its section, and the position of its focus, and I seek to effect the objects described above, *first*, by moving this beam in a plane passing through the optical axis round the focus of the instrument as its centre, and, *secondly*, by rotating the object itself in a plane perpendicular to that axis round the same point. As the optical axis in the instrument I use is vertical, these planes are respectively vertical and horizontal.

"I have fulfilled the first condition by mounting a suitable illuminator on a vertical circular sector (nearly a complete circumference) concentric with the focus; this part of the arrangement enables me to throw the beam on the object at all angles of incidence, whether from beneath, as in the case of translucent, or from above, in the case of opaque objects, and as the sector is graduated, I have the power of observing and restoring any position at pleasure.

"To fulfil the second condition, the stage of the microscope is made to revolve round the optical axis, and in a plane perpendicular to it. This is effected by constructing the stage on entirely a new plan, in which the slow motions are obtained from concentric rings forming a part of the stage itself, and equally available in every position of the latter. By this arrangement the beam of light may be thrown on an object in any azimuth, and a suitable graduation of the stage enables the observer to register and restore its position at any time.

"Hereafter," continued Mr. Grubb, "I hope to lay before the Academy some of the results obtained by the use of these arrangements; at present I shall conclude by observing that they are of a highly interesting character, and likely to lead to important discoveries."

Dr. Allman presented to the Academy the results of some unfinished observations he is at present engaged in on the Claviform and Sertularian Zoophytes. He has found that the medusoid structure, hitherto supposed to be confined to the free locomotive gemmæ of these animals, exists also in the fixed ovisacs, though generally so far disguised as to render it easily overlooked. This structure he has found in Coryne, Syncoryne, Tubularia, Cordylophora, and Sertularia; and he believed himself justified in generalizing the observed facts into the proposition that a medusoid structure in some form is necessary in these zoophytes for the production of true ova.

Monday, May 24th, 1852.

THOMAS ROMNEY ROBINSON, D. D., President, in the Chair.

Mr. J. Huband Smith exhibited a stone urn, with a glass urn, found in a tumulus at Dunadry, county of Antrim.

On its surface there was a rich, black, loamy soil, and the farmer on whose land it was, having resolved to spread it over the adjoining ground, proceeded to remove it for that purpose, and in doing so came to the cairn, in which he discovered, at a depth of three feet from the surface, on the eastern side, and lying horizontally, a human skeleton, having on its head a ring of lignite, and at the feet the stone urn, and a little glass ring. The urn was distinguished from those found hitherto, by having handles at the sides and a brass cover upon the top. The mound, which was exceedingly large, was now entirely effaced.

A vote of thanks was passed to Mr. Smith.

Sir William R. Hamilton read a supplementary Paper in illustration of his communication of the 8th of December last, on the connexion of Quaternions with continued fractions and quadratic equations.

In this paper he assigned the four Biquaternions which are the *imaginary* roots of the equation

$$q^2 = qi + j;$$

and showed that *these* were as well adapted as the two *real* roots assigned in his former communication, to furnish the real quaternion value of the continued fraction,

$$\left(\frac{j}{i+}\right)^x 0.$$

He also showed that when the continued fraction

$$u_x = \left(\frac{b}{a+}\right)^x 0$$

converges to a *limit*,

$$u = u_\infty = \left(\frac{b}{a+}\right)^\infty 0,$$

the two quaternions a and b being supposed to be given and real, then this limit u is equal to *that one of the two real roots of the quadratic equations in quaternions*,

$$u^2 + ua = b,$$

which has the lesser tensor; and gave geometrical illustrations of these results.

The *two real* quaternion roots of the quadratic equation, $q^2 = qi + j$, being, as in the abstract of December, 1851,

$$q_1 = \tfrac{1}{2}(1+i+j-k), \; q_2 = \tfrac{1}{2}(-1+i-j-k),$$

it is now shown that the *four imaginary* roots are

$$q_3 = \frac{i}{2}(1+\sqrt{-3}) - k, \qquad q_4 = \frac{i}{2}(1-\sqrt{-3}) - k,$$

$$q_5 = \tfrac{1}{2}(i+k) + \tfrac{1}{2}(1-j)\sqrt{-3}, \quad q_6 = \tfrac{1}{2}(i+k) - \tfrac{1}{2}(1-j)\sqrt{-3};$$

but that in whatever manner we group them, *two by two, even* by taking *one* real and *one* imaginary root, the formula

$$u_x = (1-v_x)^{-1}(v_x q_1 - q_2), \text{ or } \frac{u_x + q_2}{u_x + q_1} = v_x,$$

where $v_x = q_2{}^x v_0 q_1{}^{-x}$, $v_0 = \dfrac{u_0 + q_2}{u_0 + q_1}$, and which is at once simpler and more general than the equations previously communicated, conducts still to values of the continued fraction u_x, or $\left(\dfrac{j}{i+}\right)^x 0$, which agree with those formerly found, and may be collected into the following period of six terms,

$$u_0 = 0, \; u_1 = k, \; u_2 = \tfrac{1}{2}(k-i), \; u_3 = k - i, \; u_4 = -i, \; u_5 = \infty,$$
$$u_6 = 0, \; u_7 = k, \; \&c.$$

In general it may be remembered that q_1, q_2, are roots of the quadratic equation $q^2 = qa + b$.

As an example of a continued fraction in quaternions which, instead of thus *circulating*, *converges* to a limit, the general value of

$$u_x = \left(\frac{10j}{5i+}\right)^x c$$

was assigned for any arbitrary quaternion c, by the help of the quadratic equation

$$q^2 = 5qi + 10j;$$

and it was shewn that with only one exception, namely, the case when $c = (2k - 4i)$, the limit in question was (for *every other* value of c),

$$u = \left(\frac{10j}{5i+}\right)^{\infty} c = 2k - i.$$

The Rev. Dr. Todd read a paper on the Khorsabad inscriptions, by the Rev. Dr. Hincks. This was the sequel to a paper read on the 25th of June, 1849, and printed in the twenty-second volume of the Transactions of the Academy. To that paper, which was chiefly occupied with the ideographic element in the Assyrian inscriptions, and with chronological investigations respecting them, an appendix was added, in which the phonetic characters were arranged. It was maintained that they were all syllabic, and that the elementary syllables represented four vowels and seven different forms of combinations of a vowel and a consonant; all of which, however, were not in use in the case of every consonant, while some syllables had more than one representation.

Up to the date of the publication of this paper, it was maintained by all other writers on the subject that the elementary characters represented the letters of a Semitic alphabet, though it was not denied that some characters represented combinations of two others. After a considerable part of the present paper was written, Colonel Rawlinson, abandoning his former theory of the characters representing letters, proposed syllabic values for them; he, however, admitted only three vowels in place of four, and six forms of simple syllables in place of seven. The existence of four vowels, *a*, *i*, *u*, and one equivalent to the first Sanscrit vowel, or Hebrew *Sheva mobile*, is here maintained, and of a class of syllables which it terminates.

All the characters which represent syllables that cannot be resolved into more simple ones, are then exhibited with their values. They are arranged in the order of the letters of the Hebrew alphabet; six vowels, which may be considered as the Aleph series, heading the list; then seven, in which Beth predominates, and so to the end. After the leading value of each character is given, its secondary phonetic value or values, if it have any, and also its ideographic values, are stated. The characters thus enumerated are in number 115, to which 153 phonetic values are attached. With respect to 91 of these values, Dr. Hincks and Colonel Rawlinson are perfectly agreed; and of these Dr. Hincks claims to have been the first to publish the values of 66, the other 25 having been first published by Colonel Rawlinson. As to 42 values, they differ; but the difference for the most part arises from Colonel Rawlinson not admitting the short vowel, which Dr. Hincks supposes to terminate certain syllables. Finally, there are 20 new values given, as to which Colonel Rawlinson has said nothing.

Dr. Hincks is acquainted with more than 60 other values of characters which do not represent elementary syllables, which he has not been able to arrange in the present paper, but which he hopes to arrange before long.

An appendix is added, containing a modification of the chronological system of the former paper. The Khorsabad King was not called Khinnilin, and could not have been the Chinzirus of the Canon. He was not *Lord paramount* of Babylon, but after his twelfth year its *immediate king*. He was the Sargon of Isaiah; and Dr. Hincks supposes him to have been the Arkianus of the Canon of Ptolemy. His predecessor, Marduk Baladan, is said to have held Babylon twelve years, which is the exact time that the Canon gives to Mardokempadus, the predecessor of Arkianus. After this he was driven to Chaldea. Dr. Hincks maintains that his father, Yagin, the Yugæus of the Canon, was also the father of Sargon, and that having conquered Assyria, he left it to Sargon, while his ancient kingdom of Chaldea was assigned to Marduk Baladan. On this supposition he accounts for the cancelled inscriptions on the reverse of the pavements, in which the title of King of Babylon, borne by most other kings of Assyria, is omitted.

Alexander Mac Donnell, Esq., communicated, through Dr. Apjohn, a notice on the results of certain experiments instituted by him for fixing the atomic weight of magnesium.

In experimenting on the true atomic weight of magnesium, the method which I used was to find the exact composition of sulphate of magnesia, a salt whose formula is known with certainty to be $Mg\,O,\,S\,O_3 + 7\,H\,O$, and which admits of being rendered perfectly anhydrous without losing any of its acid.

Some of the crystallized salt was deprived of all hygrometric moisture by placing it in the vicinity of a dish of oil of vitriol under the receiver of an air-pump. The water of crystallization being then expelled by a low red heat, the composition of the crystallized salt was found to be—

Water, ...	51.17	51.13	51.14	51.26	51.28	51.29
Sulphate of Magnesia,	48.83	48.87	48.86	48.74	48.72	48.71
	100	100	100	100	100	100

The sulphuric acid was then precipitated from the anhydrous salt with chloride of barium. The sulphuric acid calculated from the sulphate of barites thus formed showed the composition of the anhydrous salt to be—

Sulphuric acid, .	66.67	66.73	66.64	66.65	66.69
Magnesia, . .	33.33	33.27	33.36	33.35	33.31
	100	100	100	100	100

The means of these two series of results gives the following as the true composition of the salt—

Crystallized salt,	Water, ...	51.21
	Sulphate of magnesia,	48.79
		100
Anhydrous salt,	Sulphuric acid, ...	66.67
	Magnesia, ...	33.33
		100

If the atomic weight of magnesium was 12.7, the composition of the salt would be—

Crystallized salt,	Water, ...	50.93
	Sulphate of magnesia,	49.07
		100
Anhydrous salt,	Sulphuric acid, ...	65.89
	Magnesia, ...	34.11
		100

If the atomic weight of magnesium was 12, the composition of the salt would be—

Crystallized salt,	Water, ...	51.22
	Sulphate of Magnesia, .	48.78
		100
Anhydrous salt,	Sulphuric acid, . . .	66.667
	Magnesia, ...	33.333
		100

It will be seen at once how very nearly the atomic weight of 12 corresponds with the composition given by experiment.

In order to further test the correctness of the conclusion thus arrived at, I added 108.60 grains of anhydrous chloride of barium to 60.05 grains of anhydrous sulphate of magnesia. This gave 116.65 grains of sulphate of barites; to the washings of this I added sulphuric acid, which gave 4.97 grains of sulphate of barites, which is equivalent to 4.43 grains of chloride of barium. I must, therefore, have used 4.43 grains of chloride of barium more than was necessary to precipitate all the sulphuric acid from the sulphate of magnesia, so that 104.17 grains of chloride of barium is sufficient to precipitate all the sulphuric acid from 60.05 of sulphate of magnesia, or 104 grains of chloride of barium would precipitate the sulphuric acid from 59.95 grains of sulphate of magnesia. This makes the atomic weight of magnesia 19.95, or *quam proxime*, 20.

My final experiment was as follows :—

I dissolved 41.44 grains of pure magnesia in sulphuric acid, and having evaporated the solution to dryness, and exposed the residuum to a low red heat for about an hour and a half, the resulting sulphate of magnesia was found to weigh 124.40 grains. 41.44 grains, therefore, of magnesia, and 82.96 of sulphuric acid, form 124.40 grains of sulphate of magnesia; or 40 grains of sulphuric acid and 19.98 grains of magnesia form 59.98 grains of sulphate of magnesia, which gives 19.98 as the atomic weight of magnesia. If 12.7 was the atomic weight of magnesium, 41.44 grains of magnesia would have given 121.51 grains of sulphate of magnesia, and not 124.40 grains.

N.B.—The following were the atomic weights used in calculating the experiments just described :—

$$SO_3 = 40$$
$$Cl = 35.5$$
$$Ba = 68.5$$

MONDAY, JUNE 14TH, 1852.

THOMAS ROMNEY ROBINSON, D. D., PRESIDENT, in the Chair.

LUNDY E. FOOT, Esq., was elected a Member of the Academy.

On the recommendation of the Council, it was Resolved:—

That the sum of £50 be placed at the disposal of the Committee of Antiquities for the purchase of articles for the Museum.

The Secretary exhibited a pass, dated 29th August, 1687, granted by King James II. to "The Betty of Dublin," William Patrick, master, to allow the said ship to make one voyage from Dublin to Lisbon. Attached to this document were the signatures of the King and Pepys.

Sir William Betham presented a drawing of an ancient canoe found in the river Brosna, under the temporary bridge at Firbane; on the 2nd of May, 1851; also, an impression of a wooden seal found at Wigan, and bearing the inscription,

+ SIG: OSWALDI DE BOLTVNE.

Dr. Apjohn made some remarks upon the chemical composition and optical characters of a rare mineral called Pennine, presented to the Museum of Trinity College by Professor Jellett, and brought by him from the Valley of St. Nicholas, in Switzerland.

This mineral, having been for some time considered as a new one, was submitted to analysis in the Laboratory of Trinity College, and with the following results:—

Silex,	33.64
Alumina,	10.64
Protoxide of iron,	8.83
Magnesia,	34.95
Water,	12.40
Oxide of chrome,	a trace.
	100.46

This analysis was twice repeated by Mr. Alex. MacDonnell, who obtained numbers almost identical with those above given, and which it is, therefore, unnecessary to adduce. These numbers, it may be easily shown, correspond very exactly with the empirical formula,—

$$Si\,O_3 + 3\,Al_2\,O_3 + 29\,R\,O + 21\,H\,O;$$

and the atoms may be so arranged as to give the rational formula,—

$$3\,(Al_2\,O_3,\,Si\,O_3) + 8\,(3\,R\,O,\,Si\,O_3,\,2\,H\,O) + 5\,(R\,O,\,H\,O).$$

Pennine, it was subsequently found, had been previously twice analyzed, first by Schweitzer, whose results do not differ very widely from those just given, and afterwards by Marignac and Descloiseaux, who are generally considered to have accurately fixed its constitution. They give the following as its empirical formula, viz.:—

$$5\,Si\,O_3 + 2\,Al_2\,O_3 + 12\,R\,O + 10\,H\,O,$$

which, as is obvious, is utterly irreconcileable with the analysis just brought under the notice of the Academy. As respects the cause of these discrepancies, the conjecture may be hazarded, that they are due to the presence of intermixed portions of other minerals. The specimens, for example, of Pennine, brought to Dublin by Professor Jellett, are (some of them) intersected by threads of talc, and incrusted with minute grossular garnets in perfect dodecahedral crystals.

The crystalline system of Pennine is usually set down as the *third*, the most common crystal being an acute rhombohedron, whose apices are deeply truncated. The specimen, however, of this mineral received from Professor Jellett occurring in six-sided prisms, which appeared to have the property of depolarizing a ray of light transmitted along the prismatic axis, it was inferred that they were biaxal, and, therefore, belonged to the right prismatic system. This opinion, however, had to be abandoned, as the double system of rings characteristic of biaxal crystals could not be developed, so that the depolarizing power of these crystals in the direction of the optic axis must be attributed to laminar polarization, or to the same cause which is known to communicate double refractive properties to analcime and certain other crystals in the regular system.

Dr. Petrie exhibited some Irish antiquities lately obtained by Mr. Kelly, of Armagh.

Dr. Apjohn exhibited a portion of bell-wire melted by lightning on the 3rd of June last, in the house of Richard Penefather Lloyd, Esq., 19, Herbert-place.

The lightning struck the chimney of the adjacent house, No. 18, where it dislocated the bricks immediately under one of the chimney pots. From this it passed to the gutter running between the back and front roofs of Mr. Lloyd's house, and entered the attic story by a spark, between a holdfast supporting the gutter and the bell-wire within, making a small perforation in the wall. At this point the wire was fused, and in two other places, namely, at the level of the bed-rooms underneath, and in the vicinity of the drawing-room door. Its further progress could not be traced, and the only visible effects of its traject were the destruction of the bell-wire and an irregular blackening of the wall at the points at which the fusion took place, a result which was probably due to the charring of the paint by the heat of the spark which must have occurred wherever the continuity of the conductor along which the lightning was passing was destroyed. No shock or other inconvenience of any kind was experienced by the inmates of the house, with the exception of the consternation produced by the deafening sound of the stroke.

The President suggested that the blackening of the wall may have been produced by the combustion of the wire, and its dissipation in the form of the black oxide of copper.

The President gave an account of some experiments made by him in electro-magnetism.

The discovery of the electro-magnet induced hopes that it might be advantageously employed as a moving power, and numerous attempts to effect this have been made. But though probably it cannot be used economically for this purpose, yet many cases occur where cost is but a secondary consideration, and where an electro-magnetic machine would be highly convenient. In reference to them, his friend, Mr. Bergin, had endeavoured to construct one suited to the wants of the laboratory or workshop, and in the course of his experiments had consulted Dr. Robinson as to the conditions of current helices, &c., which would produce a given power with least expenditure of battery materials. On these heads he was surprised to find how little is known, and commenced experimenting to instruct himself, and he offers the results which he found, as useful to the practical magnetician, but still more (which was his chief object in pursuing them so far) as offering useful data to those who, like Professor William Thomson, of Glasgow, are engaged in investigating the theory of magnetic induction.

Without intending to enter on that theory, he pointed out the conditions of electro-magnetic excitation, indicated the existence of the coercive force in iron, and explained its agency in producing the permanent magnetism, and another state, which he terms residual excitation,—that, namely, in virtue of which an electro-magnet, which has been excited, continues to attract its keeper even when the current is cut off.

His researches extended to—

1. The relation between a magnet's power and the intensity of the current passing through its helices.

2. The effect of the distribution and number of its spires of wire.

3. That of the unexcited portion of the magnetic circuit.

4. That of the material, iron, or hard steel; and—

5. The influence of the length and diameter of the magnet.

The present communication referred to the first only; the others being reserved for future occasions.

He then described his apparatus.

The electro-magnet consisted of two cylinders of soft iron, 2 inches diameter, and 12 long, fixed on an iron base, 6 inches asunder. On these were placed helices of the same length, containing 638 turns of lapped copper wire, No. 12; the magnet weighs 26 lbs., and its keeper 7. The attractive force is measured by a weighing machine, composed of two levers, the lower of which acts as a steel-yard. The ratio of its leverage is nearly 60, and it can be depended on to $\frac{1}{2000}$ of the load weighed.

The currents were measured by a tangent Rheometer, whose construction was detailed; its needle's length is $\frac{1}{9}$ of the diameter of its circular conductor, and its law was verified by the voltameter up to a deflection of 72°.

They were equalized by a new Rheostat, which he had formerly exhibited to the Academy, and of which he gave some further details. The variable wire is palladium, and it is surrounded by water, both to cool it and to give a measure of its temperature. Unless a correction be applied for that change of resistance, which depends on heat, he thought no rheostat measures are to be trusted. As approximations to the resistance of this wire, he gave that, assuming his unit of current to be that which decomposes a grain of water in five minutes, the intensity of a Grove's cell is 47.28 inches of it. He gave another in terms of the electrolytic intensity of water, stating, however, the uncertainty which attaches to this latter measure. It is not affected by the quantity of acid in the electrolyte, or the size of the electrodes; it is by heat, and by the intensity of the battery. The latter, however, he regarded as only an apparent error, but had not yet fully investigated it.

The results which he obtained were exhibited in a tabular form, giving the lifting power, the residual magnetism, and the residual excitation for 35 different currents from 0.04 to 6.85.

The first of these is influenced by various circumstances.

1. A magnet requires its load to be gradually increased.

2. It requires time for the full development of its power; with the highest current used, not less than five minutes; with the lower, fifteen.

3. Like permanent magnets, its power is diminished by temperature. He found that in this one the reduction is 0.00033 for each degree above 60°.

4. It is influenced by the molecular change which produces permanent magnetism, being greatest when that is least.

It is not proportional in any part of the range included by these experiments to the intensity of the exciting current, and the ratio between them decreases very rapidly as the latter is increased. From this fact it follows, that a magnet has a limit beyond which its power cannot go, in this one probably under 1000 lbs. A current 1 enables it to lift 500 lbs., and one of 6.85 only 775. When the magnet has acquired permanent magnetism, a feeble negative current (in the opposite direction) will not destroy that condition, nor change the usual direction of the polarity, but merely lessen the lift. With higher powers these effects do take place; but the negative lifts are less than the other until they amount to half the maximum (a point which seems critical in electro-magnetism). This degree of excitation should, therefore, be used in all machines when the polarity is to be reversed.

The maximum residual magnetism observed in this magnet is 8.88 lbs., but in general only 4.44. By long excitation its molecular constitution is sometimes disturbed, so that this quantity is thus increased, but it recovers by rest.

The residual excitation, or power which remains after excitation has ceased, is always of the same amount, 130.68, if that would have passed half the maximum; below that it bears a continually increasing ratio to the full power till it becomes two-thirds of it. If, while the magnet is in this state, a current that would of itself produce the same lift be passed, the effect is not doubled, but only increased by one-third. A negative current, if powerful, destroys this condition; if feeble, only lessens it.

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MONDAY, JUNE 28TH, 1852.

THOMAS ROMNEY ROBINSON, D. D., PRESIDENT, in the Chair.

MR. BERGIN read a paper on the illumination of objects in the microscope.

"All who are accustomed to the use of the microscope are necessarily aware of the vast improvements which have been effected within the last twenty years or little more. Prior to that, the compound microscope was almost worthless as an instrument of research, and inquiries as to minute structures were carried on by means of single lenses, or of combinations acting as single lenses: and when we look to the works remaining to us of the earlier microscopic observers, as Leeuwenhoek, Grew, Malpighi, and others, it is truly wonderful what they effected. However, the labour of such investigations with such means, or even with the jewel lenses of Pritchard, the doublets of Wollaston, or the triplets of Holland, was, as every one who has used them well knows, immense, and the injury to the sight caused by high powers unfortunately very great and enduring. All this, however, has been so amply and ably treated by the writers of the last few years, that it is quite unnecessary now to go into the subject.

"It is scarcely requisite to say that, in the compound microscope, as in the telescope, the object-glass forms an ærial picture of the object under examination, which picture is examined by the eye-piece, the prominent difference being that with the telescope—the subject being remote, and the rays of light from it being approximately parallel, the image is formed nearly in the principal focus of the object-glass, and is smaller and proportionably more luminous than the object; while in the microscope, the object being near to the focal point of the object-glass, the image is formed in the conjugate focus, and is considerably larger and proportionably less luminous than the object itself. With both instruments the observer sees the object by the rays of light passing from it through the object-glass,—directly, if it be a luminous body,—by reflection at its surface from the source of light, if it be opaque,—or finally, if it be translucent, by transmission through its substance; but I think it will not be disputed that in all cases the origin of the light, which is the means of vision, is the points which are seen.

"Now, as the clearness of vision depends on the quantity of light which reaches the eye, it is manifestly important that the object-glass should have an aperture as large as possible; and here the modern object-glass, by correction of aberrations, spherical as well as chromatic, lends its wondrous aid.

"There is, however, one wide difference between the object-glasses of telescopes and of microscopes:—in both, the penetration, that is, the development of minute features depends on the quantity of light admitted, but in the former, which are corrected for incident light, nearly parallel the quantity depends on the diameter of the object-glass, irrespective of the distance of the object. In the microscopic the corrections are for divergent light, and as the quantity admitted with a given aperture is largely increased by bringing the lens closer to the origin of light, the correction of the aberrations for divergent pencils, especially those of such extraordinary divergence as are now used, complicates the problem immensely; and to this, no doubt, it is owing that so long an interval of time elapsed after the achromatic object-glass of the telescope was perfected, before similar improvements were applied to the microscope. Indeed, notwithstanding the high mathematical genius of some, and the great practical skill of others, who attended to this subject, it was not till after the publication of Joseph Jackson Lyster's paper in the Philosophical Transactions for the year 1830, that the microscopist received with certainty a really efficient achromatic object-glass.

"Immediately after the publication of this important paper, the attention of our best opticians was directed to the microscope, and that race of improvement began which has led to such truly marvellous results.

"To be able to use a divergent pencil, of from 20° to 30°, was then thought to be a great triumph, but by successive steps our artists have now, for deep powers, mastered pencils far exceeding 100°. I have one by Nachet of Paris admitting 123°. I see Ross has accomplished an object-glass equivalent to one-fifth of an inch focus of 135° aperture; he has made several of one-twelfth focus amounting to 145°. Smith and Beck of London make objectives of very large angle; and in a recent number of Silliman's Journal it is announced that that truly worthy transatlantic competitor in this field, Spencer, has completed an object-glass of about one-twelfth inch focus, well utilizing a pencil of no less than 175°! Perhaps there has not been achieved any greater triumph of human skill, whether in reducing to practice the laws of light, or in moulding them to the further development of nature, than these object-glasses.

"But though so much has been accomplished, in the construction of the instrument, there probably remains much, not less important, respecting the arrangement of its illumination, as yet undiscovered; and as I believe every new fact in this department is valuable, I hope for the Academy's indulgence while submitting to it some of my results.

"For a very long period, much prior to the date of Mr. Lyster's paper, I have been a practitioner with the microscope. The instrument has always been a source of very high enjoyment to me, but as my avocations have, I regret to say, prevented my being a continuous investigator, I have wished, and, as far as I could, sought to be an improver. For the first few years I worked with the single microscope in its various forms of single lenses, doublets, jewels, and triplets; it is therefore from personal experience I have referred to the fatigue and to the permanent injury of sight which they produce. My most constant object has been to improve, if I could, the preparation of the object for vision, especially what is technically called its illumination.

"When I commenced, the only mode of illumination in use was the light of the sky by day, or of a candle or lamp by night, reflected on the back of the object, and occasionally condensed by a lens, but the quantity of colour thus produced rendered this far from satisfactory. When Pritchard introduced his exceedingly commodious form of achromatic microscope, of one of which I soon became possessed, he gave the means of applying the direct light of a candle to the back of the object without the intervention of any mirror or condensing lens. This, besides being so exceedingly convenient and so free from trouble, was so great an improvement on the previous mode, that for a long time I rested satisfied with it. Meanwhile the improvements in achromatic object-glasses continued to progress, slowly, it is true, at first, still, very decidedly, and as from time to time objectives of larger aperture were made, the simple illumination became less and less efficient; recourse was then had to the so-called achromatic illumination: that is, forming by means of an achromatic lens an image of the luminary coincident with the object under examination; this acted very satisfactorily with some objects, but not so much so with others, but the image of the source of light always mingled inconveniently with the object under examination. Then came Read's dark ground illumination, in which, by means of a very oblique pencil of light, the object was shown luminous on the dark field of the instrument. It would however be tedious and useless to follow up minutely these slow advances; it is sufficient for my purpose to say that such as I have described was the state of the matter when I began to examine the subject.

"It appeared to me that, in transmitting light through a translucent object under the microscope, the image does not reach the eye by reason of the interception or coloration, by the parts of the object, of the light diverging from its original source; but that in fact each part which so intercepts one and transmits another portion of the ray acts as an origin of light; and that from every point of the object this light diverges in every direction as from an original source. Now, the microscope is designed to give vision by light thus divergent; all else is an intruder, and does harm by causing fog and glare, which tend to obscure by overpowering the ærial picture.

"That this divergence of light from the surface after transmission through the substance does exist, admits, I think, of no doubt.

"Suppose a pencil of light passing through a dark space, and across the line of vision of a spectator, no impression whatever will be conveyed to his eye, save by reflection from particles floating in the atmosphere: let a translucent object of any kind be so placed that the pencil must pass through it, and immediately, no matter what may be the obliquity of direction from the eye of the observer to the anterior surface of the object, it will become visible.

"Taking it then, as established that the only rays of light which assist in forming the ærial picture on which microscopic vision depends are those which diverge from the object under observation, it follows that all other rays which enter the instrument, if they reach the eye, tend to confusion, and it becomes important to ascertain the best method of admitting such useless rays, when they cannot, or it is not desired that they should, be excluded. Without occupying time by discussing this point, I believe, as the result of consideration and experiment, that these rays ought to enter either so obliquely as to pass entirely across the axis, and thus not reach the eye at all, which is the condition of black ground illumination; or that they should be as nearly as possible parallel, in which case they come to a focus, close behind the object-glass, and, therefore, by their rapid divergence the greater part are thrown against the non-reflecting inside surface of the tube, and are thus absorbed, leaving but a small portion round the axis of the cone to reach the eye in a diffused state, giving a field more or less luminous according to the distance of their focus from the eye.

"Having satisfied myself of the truth of these premises, I sought for a construction which would realize them; first addressing myself to parallel light with a luminous field.

"To obtain a parallel beam of condensed light is very difficult, if at all practicable, therefore we must seek for the nearest approximation to it. Single lenses of any kind form an image of the source of light, which, being coincident with the object under observation, mingles with it, and tends to confusion. I tried the image of a white disc of plaster of Paris, of a plate of unpolished silver, and other substances; but after a variety of trials, I ultimately found that the pencil emergent from the eye-piece of a telescope, when adjusted for distinct vision of a distant object, was the closest approximation I could obtain to that for which I sought; and accordingly I have adopted it with, as I conceive, very great advantage. My present arrangement consists of a disc of grey glass, strongly illuminated, an object-glass (so, for convenience, I call the lens nearest to the grey glass) and an eye-glass, that from which the illuminating beam passes to the object.

"These are each adjustable for distance, and should be so adjusted that, looking through the eye-glass you get a distinct image of the grey glass. The illuminator, thus arranged, is placed behind the object to be examined, this latter must then be adjusted for distinct vision through the microscope; a low power, say one inch, is convenient for this purpose; next, the illuminator must be so adjusted, as to distance behind the stage, that the circular spot of light which would be used, if a dynameter was applied to measure the power of the miniature telescope, shall be perfectly coincident with the object, which is then ready for examination with any power you please to apply.

"Such is the state in which I now use this illuminator, and I think I may say that all who have seen its performance, amongst whom our respected President has had the most frequent opportunities, will agree with me as to its superior efficiency.

"It is now some ten or twelve years since I first tried this arrangement; for a very long interval I was obliged to discontinue the use of the microscope, and it is only within a few months I have again returned to it. This much I feel it necessary to say in explanation of not having before this given any public description of the arrangement, and still more for not having further developed and improved it, in which respect much still remains to be done,—chiefly in determining the ratios of the lenses composing the instrument, in relation to the diameter of the illuminating beam, which at present I incline to believe should just fill the field of view, especially for objectives of such large aperture as are now in use; as these, if the illuminating spot be larger than the field, collect too much of the light, which it is the object of the construction to get rid of. Whether this may be best effected by varying the distance between the lenses of the illuminator, or by stops or diaphragms external to the illuminating eye-glass, I have not yet tried, or whether there should be a variety of eye-glasses for the various powers.

"In my present illuminator the spot of light is about once and a half the diameter of the field of my inch power; yet with half-inch or quarter-inch objectives it gives such views of vegetable tissues, of fossil woods or teeth, and such like, as I have never otherwise seen, whether as regards distinctness and manifest truthfulness of details, or neatness of definition of the exterior edges; and with one-eighth objective of 108° aperture it, by direct light, distinctly shows both sets of lines on several of the more difficult test naviculæ, separating some of them into dots; but on this class of objects I have as yet done so little that I am unwilling to go into any details. Corroborative of the value of parallel light for illumination, I may here refer to a recent experiment. An achromatic microscope was directed to the minute but intensely brilliant image of the sun, formed by a solar microscope twelve or fourteen feet distant; here the rays could have had but a very few seconds of divergence, but the most minute details were shown with exquisite definition.

"With respect to the other mode of dealing with the useless rays before referred to, causing them to enter so obliquely as to pass entirely across the axis, and thus prevent their reaching the eye at all, I considered that it would be of value if not only the amount of obliquity but also the azimuth of the oblique ray in reference to the object could be varied by the observer, my impression being that in this manner many characteristic features of structure might be developed which with direct light could be seen but with difficulty, if at all: such as diseppiments in cellular tissues, elevations or depressions on the surface, or such like. I believed these would be rendered visible by the shadows they would cast. To effect this I at the time (ten or twelve years since) designed an instrument which would wholly revolve round the illuminated object as a centre of spherical motion. I showed models of this at the time to various friends, but I never proceeded to the construction. Since that time many exceedingly ingenious arrangements for so-called oblique illlumination have been brought forward; for instance, by Thomas Ross, Wenham, Shadbolt, Amici, Nachet, Nobert, Topping, and others, all of which are so fully described in Queckett's admirable work that it is unnecessary to do more than refer to the volume. With the exception, however, of Nachet's oblique prism, all these arrangements are in fact for direct illumination, stopping off the centre of the cone of rays before alluded to, and thus leaving the field of the instrument dark, little or no light reaching the eye but that coming from the object under examination; but as this light reaches the object equally from all azimuths, there are not any shadows the formation of which I conceive to be the distinguishing characteristic of oblique illumination.

"Among several of these illuminators, I procured during the last summer that which is known as the Paraboloid. This produces an annulus of light with a dark centre, but as it (like most of the others) throws the light obliquely but uniformly on every side of the object, there are, of course, no shadows. It occurred to me that by a slight addition this instrument offered the means of testing my old theory of oblique illumination with variable azimuth. The instrument consists of a solid paraboloid of glass, with a plane base, the focus near to the summit, which summit is ground away to form a spherical cavity, the centre of which coincides with the focus of the parabola; the middle of this spherical cavity is furnished with a dark stop; the action is, that parallel light falling perpendicularly on the base passes into the glass without refraction, and from the inner surface is reflected to the focus, which it reaches through the sides of the spherical cavity, also without refraction. The effect is, as I have before said, a speck of light at the focus, which is unfolded above or below into an annulus of light, with a dark centre; the object being adjusted perfectly coincident with this focal speck, is seen by the light radiating from its surface as before described, but the field is devoid of light.

"My addition to this is a glass prism producing two internal total reflections at right angles to each other; this prism is fixed to a disc of brass below the base of the paraboloid, and prevents any light reaching this latter till after the two reflections, by which it is confined to one side of the base of the paraboloid and of course reaches the focus and the object at one side only, and by rotating the paraboloid (I believe it ought to be an ellipsoid) and prism to-together, this oblique illumination may be carried round the entire field of the microscope.

"This arrangement has realized my expectations. Having got it ready in October last, the first object on which I tried its capabilities was the Podura scale, an object which has been observed vastly more than any other test. I immediately saw appearances indicative of a structure entirely unknown before. In one azimuth of the light the scale appeared obscure and structureless, except that it was studded over with minute, nearly transparent dots, more resembling oil-glands in the leaves of the myrtaceæ than anything else with which I am acquainted.

"By rotating the light, faint shadows began to be visible in connexion with these dots, and when one-fourth of a revolution or thereabouts was completed, the dots had disappeared and the scale seemed to be covered, thatched as it were, with short, slender, cylindrical appendages; continuing the rotation in the same direction the scale gradually became obscure as before; these appendages ceased to be visible, and at the end of a second quarter revolution the luminous dots again appeared, more faint than at the opposite azimuth, still unquestionably there; completing the revolution, the same succession of appearances recurred until, on returning to the original azimuth, the dots re-appeared as luminous as at first.

"From frequent repetition of this observation, I am satisfied that this scale, instead of being covered with sculptured lines or folds, as was once believed, or with dark hairs, as figured by Queckett, is in reality covered with cylindrical appendages like quills, but which are either hollow or quite translucent through their axes.

"I infer this from finding that the several appearances are invariably and only seen with certain azimuths of the illumination; the bright dots when the light enters from the base of the scale; the fainter ones when it enters from the opposite extremity; and the cylindrical appearances when it enters at the side of the scale, in the longitudinal direction of which these appendages lie.

"Again, with the scale of the Lepisma, this is clearly seen to be furnished with elevated ridges or lines running from one end to the other; and that the appearance of curved transverse lines, as seen by ordinary light, is caused by crenulations in the upper edge of these ridges. I might cite other cases, but these are enough to prove that this arrangement is capable of showing forms of structure which had not been previously recognised.

"I ought here to say I have since found that Nachet's oblique prism is capable of showing these peculiarities of structure, but I have been unable to recognise their existence by any of the other arrangements to which I have referred.

"I was able to exhibit these effects to our President on the evening of our first meeting this session, and soon after to other brothers of the microscope, including my friend Mr. Grubb. I mention this because I feel satisfaction in believing, as I do, that seeing this was not without its effect in leading to the exceedingly beautiful and efficient construction which he exhibited and explained to the Academy a short time since.

"I was unfortunately not here on that evening, but I have had various opportunities of using his contrivance, and gladly bear my testimony to the admirable arrangements he has effected for extending to the utmost limits the power of altering both the obliquity and azimuth of the light while in the act of observing, with the further advantage of being able, by means of graduated circles, to record with facility and precision all the adjustments by which any phenomenon has been observed.

"In conclusion, I wish it to be understood that the present communication is intended only to set forth the principles on which depend the proper illumination of objects under examination by the microscope; and that where I have described apparatus, I by no means consider it as perfect or as the best for the purpose, but I thought it right to state the means by which I tested the views put forward, hoping that others having more leisure and better qualified than I am will turn their attention to the subject, and give to the microscopist the best means of illuminating the objects of his study, thereby enabling him to reap the full benefit of the improvements which have been effected on the visual part of the instrument."

Monday, November 8th, 1852.

THE LORD CHIEF BARON in the Chair.

The Rev. Dr. Todd announced the receipt of the following donations:—

Portions of two quern-stones, deer-horns, &c.; presented by George Woods, Esq.

A portion of red deer-horns; presented by the Rev. Richard Wrightson.

A cast in plaster of Paris of a sculptured headstone with two Ogham inscriptions, from Bressay, one of the Shetland islands; presented by Albert Way, Esq.

Two casts, representing stone moulds for bronze axe-heads, and ring, found in England; presented by Albert Way, Esq.

Casts in plaster of Paris, representing stone moulds for bronze swords, found in England; presented by Lord Talbot de Malahide.

A cast in plaster of Paris, representing a cross-legged effigy of a knight in chain armour, bearing the arms of De Cantaville on his shield. Taken from the original monument in the church of Kilfane, county of Kilkenny; presented by the Kilkenny Archæological Society.

An ancient bronze implement; presented by Robert Mallet, Esq.

A silver ornament, representing a star, found in the foundation of the old Augustinian Priory in Enniscorthy; presented by the Rev. Thomas Murphy, R.C.C. of Enniscorthy.

A stone, used probably as an instrument or tool, having been discovered in the same pit with the stone mould for casting arrow-heads, found at Belturbet; presented by Patrick Brophy, Esq.

A small bucket made out of solid wood, and nicely mounted with bronze handle and hoops, found in the crannog in

Cloonfinlough, near Strokestown; presented by Mrs. Ferns, of Strokestown, through Pakenham Mahon, Esq.

The following articles, presented by his Grace the Duke of Northumberland, from the collection of Roger Walker, Esq.: A portion of the worm of a still; a sword handle; a beadle's mace-head; a male dress; a woman's dress; a brogue or shoe; a shop or slave badge; an iron mounting of a spade; an iron sickle; crolats or ring of bells; a lump of wax; a scull cap.

An ancient chambered iron swivel cannon, made of bars, secured by means of hoops; found on the coast of the county Wexford; presented by Matthew E. Talbot, Esq.

A small miscellaneous collection of Irish antiquities, consisting of articles of stone, bronze, and silver, collected by the late Leslie Ogilby, Esq., and presented in his name by his executors.

A silver seal (apparently a bishop's seal, having a pall quartered with the arms); presented by Abraham Warburton, Esq.

An ancient iron arrow-head, found in the icy regions of Dorrefeldt, Norway; presented by William T. Potts, Esq.

A series of drawings of the designs on the stone cross at Moon, county Kildare; presented by Thomas Chandlee, Esq.

A vote of thanks was then moved to the several persons by whom the foregoing donations were presented to the Museum.

The Lord Chief Baron, in putting the motion, said that their thanks were especially due to the Duke of Northumberland and all other persons who, finding articles of more interest to others than to themselves, sent them forward to their proper homes, where their value would be duly appreciated.

Dr. Aquilla Smith read the following account of certain Scotch coins and counterfeits found in Ireland:—

"In the month of April, 1852, a few coins were found near Pettigoe, in the County of Fermanagh; Mr. Barton, on whose property the coins were discovered, left them with Mr. Clibborn, who placed them in my hands, and informed me that Mr. Barton would be obliged by any information respecting them.

"The lot consists of fourteen coins—three groats of David II., along with nine groats and two half-groats of Robert II.; all the groats are of the type of the Edinburgh mint, and the half-groats are from the mint at Perth.

"Scotch coins of an early period are frequently found in Ireland, and though many hundreds of them have passed through my hands, I never met with or heard of any similar to the coins I am about to describe. Ten of those coins are forgeries of a very peculiar kind, fabricated with a degree of ingenuity well calculated to impose on the rude and ignorant people of the fourteenth century. Two of the groats, and the two half-groats, are genuine silver coins. The specific gravity of one of the groats is 10·6. Each of the false groats consists of two very thin discs of silver, having interposed a piece of copper of somewhat smaller diameter, and much thicker than the silver, and they seem to have been struck between dies in the usual manner. As to the means by which the different metals were made to adhere, I found on attempting to separate one of the discs of silver from the copper, that it was detached without much difficulty, and that the metals had been united by solder, which has been corroded at the margin so as to expose the mode of fabrication.

"The dies from which these coins were struck, though well executed and bearing a very close resemblance to the dies of the genuine coins, retain the marks as if of a file, and the surface of the coins has a streaked appearance. The letters are not sharp and well defined like those on the genuine silver coins, a defect owing to the want of solidity arising from the different metals not being perfectly soldered together.

"Of the ten spurious coins, five are from different dies, a fact which proves that forgery was carried on to a great extent, and in a systematic manner; nor is it at all surprising that they should be found associated with genuine coins, for one of the most notorious swindlers of the present day is in the habit of offering for sale genuine coins mixed up with forgeries.

"The spuriousness of those coins is at once detected by the separation of the metallic discs at the margin, but independent of this evidence, their deficiency in weight would enable a well-informed numismatist to pronounce without hesitation that they were not genuine regal coins. The central piece of copper was evidently intended to impart weight and solidity, yet, even with this addition, most of them are little more than half the legal weight of the groats of David and Robert, which should be about sixty-one grains, whereas the average weight of the ten false coins is a fraction less than thirty-seven grains, the heaviest being forty-eight grains, and the lightest thirty-one; of the four genuine coins, one groat weighs fifty-seven grains, and one of the half-groats weighs thirty grains.

"To determine, as near as possible, the period at which these forgeries were fabricated, it is necessary to refer to a few particular dates. David II., when only five years old, succeeded to the throne of Scotland in 1329. He was dethroned within a couple of years and retired to France, from whence he was recalled in 1342. On the 17th of October, 1346, he was taken prisoner at the battle of Neville's Cross, and committed to the Tower of London, from which imprisonment he was released in 1357, by Edward III., for a ransom of 100,000 marks. He died in 1371, and was succeeded by his maternal uncle, Robert II., who died in 1390.

"In 1347, it was ordained by Act of Parliament that all good money of England should be received within the realm of Scotland, according to its true value in England.

"In 1358, David, King of Scotland, came in person to

London, and petitioned King Edward, that the coins of England and Scotland might be interchangeably current in both kingdoms upon equal terms, which request was granted in consideration of the great humility of the King of Scotland.

"In 1365, a new coinage was ordered in Scotland, to be made equivalent and conformable to the current money of England in weight and fineness, and to have a notable sign on it to distinguish it from all other money already struck.

"In 1367, the standard of the coinage in Scotland was reduced to £1 9*s.* 4*d.* the pound tale, the money to be of the same fineness as the last coinage, or that of England: the effect of which was, to reduce the weight of the groat from 72 grains to 61·36.

"So much light foreign money had been brought into England in 1367, it was found necessary to issue an order that no money of the coin of Scotland, or of any other country, except the king's coins in gold and silver, should be current in the kingdom.

"The Scottish money was again cried down by proclamation in England in 1372, which was rendered necessary by the advantage which the Scotch had taken of the difference in intrinsic value between their money and that of England; for they collected the latter, and coined it into their own money, which was of less weight. It seems, however, that this ordinance was insufficient to check a practice from which a considerable profit accrued; for in the following year (1373), the Commons petitioned 'that four pence Scotch should go for no more than three pence English, and, if the Scotch should diminish their money on that account, that the current value of it should be again brought down' (Ruding, vol. ii. p. 208, second edition, 8vo.), which petition was granted, an Act passed in the following year (1374), and proclamation was made to that effect in Berwick-upon-Tweed; and similar ordinances were made in 1381 and 1387.

"Mr. Lindsay observes, that there are 'many mint and privy marks (probably the notable signs directed by the Act of 1365), particularly on the larger coins' of David II.; and that the coins of Robert II. 'resemble in type those of his predecessor, but exhibit fewer privy marks or ornaments, the only remarkable one being the letter B behind the king's head on several of the groats' (View of the Coinage of Scotland, p. 20 and 22).

"The signification of this letter B has given rise to much discussion, but Mr. Lindsay, with much probability, conjectures that it is the initial of Bonachius of Florence, who was moneyer of Robert III. in 1393.

"Five of those spurious coins exhibit the 'notable sign' or privy mark, as it is usually called. The groat of David, No. 3, has a small D along with the pellets, in the quarter of the reverse corresponding with the letters VILL. Two of Robert's groats, Nos. 4 and 5, have a cross behind the king's crown. No. 6 has a large B in the same situation; and No. 7 has the small B (the only mark noticed by Mr. Lindsay), which also occurs on the Perth half-groat, No. 13, which is a genuine coin, very nearly of the standard weight.

"The existence on the coins of Robert of two privy marks (the cross and large B), which have not been observed on his genuine groats, is remarkable. That similar marks were used by the authorized moneyers, and that the originals will be discovered, may be assumed, for it is not to be supposed that forgers who so closely imitated the types and varieties of the regal coins would venture to adopt marks which were intended to distinguish the coinage of 1365 from all other money already struck, or, in the words of the Act: 'And ane notable sign sal be upon it, quhereby it may be evidently knawen fra all other money alreadie striken' (Cardonnel, Numismata Scotiæ, Appendix, No. V.)

"It now only remains to attempt to fix, with as much precision as possible, the period at which these coins were fabricated.

"In 1365 the coinage of Scotland was equivalent, in weight and fineness, to the current money of England, at which time the weight of the English groat was seventy-two grains. In 1367 the weight of the Scotch groat was reduced to about sixty-one and a half grains, and no further change took place from that time to 1385, when money was ordered to be made of the same standard as in 1367.

"The coin of Scotland and other countries was forbidden in 1367 to be current in England, so much light money had been brought into the kingdom; and in 1373 it was ordained that four pence Scotch should pass for no more than three pence in England; and similar ordinances were made in 1381 and 1387.

"From the evidence of these Acts, and the coins themselves, it appears that the weight of the money of Scotland had been much reduced during the reign of Robert II. That these coins were fabricated subsequent to the year 1371 there can be no doubt, and if Mr. Lindsay's conjecture as to the signification of the letter B, used as a privy mark, be admitted, it is probable they were made towards the close of the reign of Robert, who died in 1390; only three years before we find mention of Bonachius (*monetarium nostrum*) who possibly may have been employed some years previously in the royal mint."

List *of Fourteen Scotch Coins* (*chiefly forgeries*), *which were discovered in April*, 1852, *near Pettigoe, in the County of Fermanagh, on the property of Mr. Barton.*

David II., 1329–1371.

1.	Groat.	Edinburgh.	weight 47	grains.	Genuine.
2.	,,	,,	57	,,	,,
3.	,,	,,	35	,,	False.

D in the quarter of the reverse, corresponding with the letters VILL.

Robert II., 1371–1390.

4.	Groat.	Edinburgh. weight	$31\frac{1}{2}$	grains.	False.	✠	behind the crown.
5.	,,	,,	31	,,	,,	✠	,,
6.	,,	,,	34	,,	,,	B	,,
7.	,,	,,	$37\frac{1}{2}$	,,	,,	B	,,
8.	,,	,,	$33\frac{1}{2}$	,,	,,		
9.	,,	,,	$37\frac{1}{2}$	,,	,,		
10.	,,	,,	$47\frac{1}{2}$	,,	,,		
11.	,,	,,	$32\frac{1}{2}$	,,	,,		
12.	,,	,,	48	,,	,,		
13.	Half-groat,	Perth.	30	,,	Genuine.		
14.	,,	,,	25	,,	,,	B	behind the crown.

Nos. 4 and 5 are from the same dies.

Nos. 8, 9, 10, 11, and 12, are from the same dies.

An Edinburgh groat of Robert II., weight 58 grains, and an Aberdeen penny of David II., weight 16 grains (both genuine), were found at the same time, in the vicinity of the fourteen coins above described.

TUESDAY, NOVEMBER 30th, 1852. (Stated Meeting.)

THOMAS ROMNEY ROBINSON, D. D., PRESIDENT, in the Chair.

ON the recommendation of the Council, the following were elected Honorary Members of the Academy:—

In the Department of Science.

ELIE DE BEAUMONT.
M. V. REGNAULT.
AUGUSTIN-LOUIS CAUCHY.

In the Department of Polite Literature.

WILLIAM H. PRESCOTT.
RIGHT HON. THOMAS B. MACAULAY.

The Secretary of Council made the following statement of the grounds on which the recommendation was made:—

"Although I occupy the place of the Secretary of the Academy, who is unavoidably absent to-night, it is in the performance of my proper function, as Secretary to the Council, that I undertake on this occasion to lay before the Academy some information respecting the individuals whom the Council has recommended to your notice as worthy of being elected Honorary Members of our body. During the last President's tenure of office a very important change was made in the regulations respecting the admission of Honorary Members. In those past times, which are sometimes improperly called 'good old times,' it was our custom to elect as Honorary Members persons who happened to be recommended by two or three influential Members of the Academy; and these persons were admitted to what ought to be a high honour without due consideration of their pretensions to it. In consequence of this practice very serious evils arose; the dignity of the Academy was compromised, its place amongst the scientific bodies of Europe was lowered, and its influence, as the chief scientific body in our own country, was greatly diminished. But our last President, to whom we owe so much for his wise administration of the affairs of the Academy, looked upon this practice as one which needed reformation, and accordingly, with the aid of the Officers of the Academy, he drew up a code of regulations respecting the admission of Honorary Members, to which the Academy at large, after due deliberation, gave its cordial approval. It was thus determined that we should have a fixed number of Honorary Members, the number having been previous to that time unlimited; and it was also thought reasonable to distribute these honours in a particular manner, by electing a certain number of Members in the several departments of Science, Polite Literature, and Antiquities. Sixty being the whole number of places reserved for Honorary Members, it was deemed only reasonable that half that number should be devoted to Science in its numerous phases, whilst one-fourth was reserved for scholars distinguished in Polite Literature, and as many more for the cultivators of Archæology. We are now bound to elect at least one-half of our Honorary Members, in each section, from persons who are not natives of the British Islands. Formerly a very considerable proportion of our Honorary Members were natives of our own country, and the claims of learned men on the Continent were not sufficiently attended to. This brief explanation will account for the fact that, in the present instance, the Council has not recommended the names of men who, nevertheless, hold a leading place among the *savans* of Europe. Those who have watched the progress of science in these countries may, on looking over the list of our Honorary Members, observe with surprise the omission of the name of Faraday. It is, indeed, an omission of which we have reason to be ashamed; but the present Council is not to be censured, because the name of Faraday is not now recommended for your choice. The operation of our rule, in point of fact, precludes the election of Faraday on the present occasion, as it requires that all persons elected in the department of Science should be foreigners. Not so, however, in the section of Polite Literature. We are there free to elect natives of these islands, and we have to fill one vacancy which, as Irishmen, interested in literature, we deeply deplore. Of the two vacancies which have occurred in that department during the past year, one was caused by the death of our own great poet, Thomas Moore—as we had, not long before, occasion to lament the loss of the great British poet, Wordsworth. But when we came to consider how the places in the section of Polite Literature were filled, we found that several of the Members lately elected were Continental scholars, distinguished as philologists; and it was, therefore, our desire, if possible, to elect, in the present instance, those who represented other branches of Polite Literature, Many names, the claims of all of which would be recognised by the Meeting, were brought before the Council, but ultimately, after the most careful consideration, those which appear on the summons paper, viz., William H. Prescott and Thomas B. Macaulay, were selected. As a Member of the Committee of Polite Literature, perhaps it would be appropriate for me to say a few words on behalf of the two latter candidates, if indeed anything I could urge would recommend them to the Academy; and it may appear fitting that I should leave to the Committee of Science the honour of speaking on behalf of the candidates selected in their department, namely, Messrs. Elie de Beaumont, M. V. Regnault, and Augustin-Louis Cauchy, all of them Frenchmen, who have distinguished themselves in various branches of science But, speaking in my capacity of Secretary to the Council, I may be allowed to mention briefly the claims of the several candidates now offered to your approbation. The first-named gentleman, M. Elie de Beaumont, was elected many years ago a Member of the Institute of France in the department of Geology. In the year 1844 he was raised to the rank of Vice-

President, and in the year following became President of the Institute. His researches have extended to almost every part of the globe; but as a Frenchman he has not failed in his duty to his own country, having constructed a Geological Map of France. He has also devoted much of his attention to the phenomena of volcanic action. The estimation in which his abilities as a scientific man are held is so high, that whenever the French Government has had occasion to issue instructions to persons engaged in voyages of discovery, M. Elie de Beaumont has been constantly requested to draw them up. The career of M. Regnault has been different. He was elected a Member of the Institute in the department of Chemistry, and has specially distinguished himself by his researches with respect to specific heats, the dilatation, the elastic force, the density and compressibility of gases and fluids. In short, he occupies so high a place amongst the chemists of France that those who are interested in the welfare of the Academy will deem it an honour to have him enrolled amongst its Members. M. Augustin-Louis Cauchy, the third name on the paper, is a veteran analyst, who has carried his scientific conquests into almost every region of Mathematics. He is also well known in these countries as a philosopher who has applied the resources of analysis to the discussion of the most difficult questions of Physical Optics. If I were to enumerate the whole of his published works, and give the Academy an idea of their contents, the task would, I am sure, occupy me for the greater part of a day. As regards the gentlemen who are proposed for election in the department of Polite Literature, I feel that it becomes me to say but little. For me to rise and advocate the claims of a Macaulay or a Prescott would be quite out of place. The Members of the Academy know that they will do themselves honour, and increase the respect in which the Academy is held by learned bodies abroad, if they enrol amongst their Members men of such world-wide celebrity as these. Macaulay, the historian, the critic, the poet, the philosopher, —however individuals may find fault with his history, dissent from his criticism, censure his poems, or dispute his philosophy,—must still be regarded as one of the foremost literary men in the world. And when we come to consider what the other candidate, who is now proposed for election, has done in spite of the obstacles raised up by a natural infirmity, we must feel constrained to double the praise which his literary works might extort from us. Early in life deprived by accident of the sight of one eye, and scarcely able to make any use of the other for many years, this persevering scholar procured from the Royal Archives of Madrid the immense mass of MSS. collected by Muñoz, the historiographer of the Indies, and with the help of a secretary, whom he employed to read the documents aloud, he extracted from them the materials necessary for the composition of his Histories of the Conquest of Mexico and Peru. Then, blind as he was, he dictated, and even partly wrote, the works which have charmed and instructed so many of those whom I address. Though he afterwards obtained a partial recovery of sight, it was so incomplete that he must be numbered amongst the great blind authors of the world,—with Homer, Milton, and the learned author of the Conquest of England by the Normans, another blind historian of our own time. These are the names recommended by the Council; and though other deserving names may suggest themselves to the minds of some of you, I trust that the Academy will consider that the choice of the Council has been made with due deliberation. I hope, too, that the Members will pardon my own imperfect advocacy of the claims of the candidates; and if, while endeavouring to support them, I have said a word that can militate to their prejudice, I beg that you will allow the very names to plead for themselves, and will vote in accordance with the merits of the distinguished men who bear them."

The President said he thought the Meeting would agree with him that the apology which the Secretary had made for his advocacy was one wholly unnecessary; and that he should be requested to furnish them with a copy of his Address, in order that it might be inserted on the Minutes. Having pointed out the merits of the different candidates for the privilege of Honorary Membership, the President concluded by saying that, for his own part, he thought a more judicious selection could not possibly have been made ; and he derived peculiar satisfaction from the circumstance that the Council, in making their choice, had not confined themselves to their own continent, but had gone across the Atlantic. Every true friend of science must notice with pleasure the rapid advance which the Americans were making in every branch of learning, and especially in the departments of Geology, Mathematics, and Astronomy, in the last of which Sciences they were not only following their own steps, but even rivalling their instructors ; and, therefore, it is our duty not merely to feel grateful for their co-operation, but to give them whatever aid may be afforded by the expression of admiration and regard, or by the due appreciation of their labours.

Mr. Hogan exhibited some ancient vases, the property of a friend of his, and stated that the owner was willing to allow the Academy to select from his collection as many objects of the kind as it might be thought desirable to place in the Academy's Museum.

The President observed that there could be no hesitation as to the propriety of accepting the offered donation.

It was then resolved that the offer should be accepted, and Mr. Hogan was requested to convey the thanks of the Academy to the gentleman who had so kindly made it.

The Secretary announced a donation from Dr. J. M. Neligan, of four Numbers of the "Correspondenza Scientifica in Roma," of which other Numbers had been already presented by the same donor.

The Ballot was then closed, and the gentlemen proposed for admission as Honorary Members of the Academy were declared by the President to be duly elected.

MONDAY, DECEMBER 13TH, 1852.

THOMAS ROMNEY ROBINSON, D. D., PRESIDENT, in the Chair.

REV. CHARLES GRAVES, D. D., read a paper on the affinities of certain Irish and Latin words.

One of the laws of affinity noticed by Dr. Graves is, that in a number of Irish words derived from, or cognate with, the Latin, the letter *n* disappears. He illustrated this law by the following list of words, which admits of being considerably increased:—

Argentum,	airgiod.	Infernus,	ifrionn.
Cantilena,	ceadal.	Inter,	idir.
Carpentum,	carbad.	Mensa,	mias.
Census,	cios.	Mensis,	mios.
Centum,	cead.	Quinque,	cuig.
Consecro,	coisreacaim.	Tendo,	teud.
Consto,	costus.	Ulna,	uille.
Dens,	dead.	Viginti,	fiċid.

In these instances the *n* disappears generally before a consonant; and most frequently before *d* or *t*. The full establishment of this fact contributes materially to the proof of M. Pictet's assertion, that -aid, the suffix of the 3rd pers. plur. indic. pres. in Irish, corresponds with the Sanskrit *-anti* and the Latin *-ant*, *-ent*, *-unt*.

An initial *n* seems to have been suppressed in the words oidce, *nox*, and uiṁir, *numerus*. But this may, perhaps, be accounted for by supposing that it was confounded with the *n* of the article.

Another law, of which Dr. Graves proved the application, is, that several Irish words beginning with vowels have Latin cognates, beginning with *p*.

The following were adduced as instances :—

Palma,	ailm.	Piscis,	iasg.
Pater,	aṫair.	Porcus,	orc.
Pectus,	uċt.	Purus,	ur.

In such cases the *p* was probably first softened into an *f*, which afterwards disappeared. This view is confirmed by the fact, that the Teutonic cognate in two of the preceding instances, viz., *pater*, and *piscis*, begins with *f*. And the disappearance of an initial *f* is most frequent in Irish.

MONDAY, JANUARY 10TH, 1853.

JOHN ANSTER, LL. D., VICE-PRESIDENT, in the Chair.

GILBERT SANDERS, Esq., was elected a Member of the Academy.

On the recommendation of the Council, it was Resolved,—

"That leave be given to read Papers of which the general nature shall have been approved by Council, but that, unless an Abstract of a Paper shall be delivered to the Secretary of the Council, on or before the night of reading, the title only of it shall be published in the Proceedings of the Academy."

A letter from Mr. Macaulay, returning thanks for his election as an Honorary Member, was read.

The Rev. Professor Graves communicated the following theorem relating to the total curvature of bounded portions of surfaces:—

If a closed curve B *be traced on any surface whatsoever,* S, *the total curvature of the included portion of the surface may be represented by means of the following construction:—Let a developable surface,* D, *be circumscribed along the bounding curve, and let it be opened by cutting it along one of its rectilinear generatrices,* G, *and developed upon a plane; then the angle between $g\ g'$, the two right lines which correspond to that generatrix, will represent the total curvature of the proposed portion of the surface.*

To prove this theorem, let us conceive a sphere whose radius is unity. Let a cone, C, be formed by radii paralel to the rectilinear generatrices of the circumscribed developable

D. Let its intersection with the sphere be the curve c, and let the supplemental cone and corresponding spherical curve be C′ and c'.

Then the total curvature of the proposed portion of the given surface S is equal to the portion of the spherical surface included by the radii drawn parallel to the normals to S along the curve B. But as the plane of two consecutive sides of the cone C is parallel to the plane of two consecutive generatrices of the developable D, and as this latter plane touches the surface S at a point on the bounding curve B, it follows that the area of the curve c' represents the total curvature of the proposed part of the surface S. But the area of c' is equal to 2π, diminished by the perimeter of the curve c. And as the angle between two consecutive sides of the cone C is equal to that between two consecutive generatrices of D, which remains unaltered by development, it follows that the total curvature of the proposed portion of S is equal to four right angles diminished by the angle through which g must turn as it assumes all the positions of tangency to the developed edge of regression of D, until finally it comes into the position of g'. And thus the theorem is proved.

The right lines g and g' being equally inclined to the initial and final elements of the developed curve, the angle between the tangents to these elements is equal to that between g and g'. We may therefore represent the total curvature of the proposed portion of the surface S by the angle between the tangents to the initial and final elements of the developed curve; or, what is the same thing, by four right angles diminished by the entire angle through which the tangent to the developed curve is turned as it passes from its first to its last position.

Many interesting corollaries may be deduced from the preceding theorem.

If the proposed boundary B be a closed geodetic curve returning into itself, the total curvature of the included portion of the surface will be equal to a hemisphere. And hence, if radii of a sphere be drawn parallel to the radii of absolute curvature of any closed curve whatsoever, they will divide the sphere into two equal parts; for the proposed curve may be regarded as a geodetic line upon a surface so described that the tangent plane at any point along the given curve is perpendicular to the radius of absolute curvature at that point.

If the boundary curve be a loop of a geodetic line, the total curvature of the included portion of the surface is equal to a hemisphere diminished by the external angle of the loop.

If the boundary be a polygon whose sides are geodetic lines, the total curvature will be equal to a hemisphere diminished by the sum of the external angles of the figure. This proposition includes Gauss' celebrated theorem respecting the total curvature of a triangle formed on any surface with geodetic lines.

If the surface S be itself a sphere, we can represent the *area* of any closed curve B traced upon it by a plane angle. For this purpose, let a developable surface be circumscribed along the curve B, and let the angle be constructed as in the theorem. In this way we find the area of a small circle of the sphere to be equal to the defect by which the developed angle of the circumscribed cone falls short of four right angles.

The Rev. Professor Haughton communicated the following account of some barometric determinations of height made by him, with the view of examining by direct observation the different formulæ which have been proposed for introducing the hygrometric condition of the air into the calculation of heights:—

The uncorrected barometric formula is the following:—

$$H = 10000^{fath.}\left(1 + \frac{\Theta}{493}\right)\log\frac{p}{p'} \qquad \text{(I.)}$$

in which Θ denotes the mean excess of the temperature of the column of air above 32°; p, p', the corrected barometric heights for the temperature 32°, at the lower and upper stations respectively; and H, the height of the mountain in fathoms.* If aqueous vapour constitute part of the column, and the mixture of dry air and vapour be in a state of equilibrium, then the column of air calculated by (I.) will be too short, and must be increased by the expansion due to the quantity of vapour in the column. If f, f' denote the elastic force of the vapour at the lower and upper stations respectively, it is easy to show that the hygrometric coefficient, by which equation (I.) should be multiplied, is

$$\frac{p+p'}{p+p'-f-f'};$$

This will convert the formula (I.) into the following:—

$$H = 10000^{fath.}\left(1+\frac{\Theta}{493}\right)\left(\frac{p+p'}{p+p'-f-f'}\right)\log\frac{p}{p'} \quad \text{(II.)}$$

This may be considered as the *statical* barometric formula, and in it account is taken of both moisture and temperature. It is certain that if the air be in a state of equilibrium, this formula will represent with accuracy the difference of level between the two stations.

If vapour or any other gas be suddenly introduced into a portion of a vertical column of air, and it requires *time* for the air to expand in consequence, the barometric pressure observed at any such point will be too great by a quantity, which at its maximum will be the elastic force of the vapour introduced. If we suppose therefore that the true barometric pressure at any point is $p-f$, this is equivalent to supposing that the introduced vapour has not yet commenced to expand the column. This supposition may be considered as belonging to the state of incipient motion. If we suppose that the expansion of the air, consequent on the introduction of the vapour, has ceased,

* The exact coefficient for the latitude of Dublin is 10008 fath. 2 ft.

and the air has returned to a state of equilibrium, then the observed barometric pressure is correct, and no deduction is to be made from it in consequence of the pressure of vapour. This is the supposition made in (II.), or the *statical* formula.

In the present state of our knowledge, I fear it is impossible to form a *dynamical* hygrometric correction for the barometric formula, but the principles on which it depends may be thus stated.

Let f denote the observed elastic force of the vapour at any point; this quantity is the sum of two elastic forces

$$f = f_s + f_d \tag{1}$$

f_s denoting that part of f which is doing *statical* work, i. e. bearing the *weight* of the vapour in the column; and f_d denoting that part of f which is doing *dynamical* work, i. e. lifting and expanding the column of air.

The barometric pressure at any point is therefore the sum of three quantities, viz., the pressure of the dry air, the statical pressure of the vapour, and the dynamical pressure of the vapour. Let ϖ denote the pressure of the dry air, then

$$p = \varpi + f_s + f_d \tag{2}$$

If the air be in equilibrium, $f_d = 0$, and $p = \varpi + f_s$, this is the value of p used in formula (II.): but if we suppose $f_s = 0$, i. e. the whole of the vapour at any point to be employed in moving the column, then $p = \varpi + f$, f_d becoming equal to f, the whole force of the vapour; but from (2) it is plain that $\varpi + f_s$ is the pressure to be used in the barometric formula; and in this supposed case $\varpi + f_s = \varpi = p - f$.

This corresponds to the case of incipient motion. Introducing it into (I.) we find

$$H = 10000^{fath.} \left(1 + \frac{\Theta}{493}\right) \log \frac{p - f}{p' - f'}; \tag{III.}$$

and from (II.) we obtain

$$H = 10000^{fath.} \left(1 + \frac{\Theta}{493}\right) \frac{p + p'}{p + p' - f - f'} \log \frac{p - f}{p' - f'}. \tag{IV.}$$

This latter formula (IV.) is the formula proposed by Dr. Apjohn (Proc. Royal Irish Academy, vol. ii. p. 561).

The dynamical formula may be thus written down, although unfortunately it cannot be used:—

$$H = 10000^{fath.}\left(1+\frac{\Theta}{493}\right)\frac{p+p'}{p+p'-f_s-f_s'}\log\frac{p-f_d}{p'-f'_d}. \quad \text{(V.)}$$

The statical part of the elastic force of the vapour appearing in the hygrometric coefficient, and the dynamical part under the logarithm.

If in (V.) we make $f_d = 0$, $f'_d = 0$, then since $f_s = f$, $f'_s = f'$, we obtain the statical formula (II.); if we suppose $f_s = 0$ $f'_s = 0$; then since $f_d = f$, $f'_d = f'$, we find (V.) reduced to (III.), the hygrometric coefficient disappearing, as it ought, for we have implicitly supposed that no expansion has yet taken place in the column of air. Equation (III.) may therefore be considered as the barometric formula corresponding to the state of incipient expansion. The heights calculated from (III.) will be in general smaller than those calculated from (I.) without hygrometric correction, because the elastic force of the vapour diminishes faster than that of the dry air, and therefore* the ratio of p to p' will be greater than of $p-f$ to $p'-f'$; consequently, the heights calculated from (III.) will be smaller than those deduced from (II.). The two corrections used in (IV.) tend to counteract each other, one increasing and the other diminishing the height, so that it sometimes happens that the heights calculated from (I.) and (IV.) are absolutely equal. It frequently occurs, however, from the irregular development of vapour at particular places, that the ratio of f to f' is less than of p to p', and, consequently, that the ratio of $p-f$ to $p'-f'$ is greater than of p to p'. In such cases, formula (III.) will give a greater height than (I.).

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* I $\frac{f}{f'} > \frac{p}{p'}$, then $fp' > pf'$, or $fp' - pf' > 0$, and $pp' - pf' > pp' - fp'$, therefore $\frac{p}{p'} > \frac{p-f}{p'-f'}$; and *vice versâ*, if $\frac{f}{f'} < \frac{p}{p'}$.

In the following observations, the lower station was the N.W. coping-stone of the Barrow lock-gate in the town of Carlow; the upper station, the summit of Clogrenan Hill. Diff. of level by Ordnance Map = 157·00 fath.

TABLE I.

No. of Obs.	Lower Station. p	f	t	Upper Station. p'	f'	t'	Therm. Coeff. $1+\frac{\theta}{493}$	Hygrom. Coeff. $\frac{p+p'}{p+p'-f-f'}$	OBSERVATIONS.
	in.	in.							
1	29·654	0·260	50°	28·646	0·258	4 0	1·034	1·008	Oct. 2, 1849; fine day.
2	29·071	0·320	48	28·054	0·298	45	1·029	1·011	Oct. 3, 1849; wet, cloudy day.
3	29·362	0·234	50	28·355	0·222	44	1·033	1·008	Oct. 4, 1849; fine day.
4	29·555	0·271	47	28·518	0·263	42	1·025	1·009	October 5, 1849; heavy rain.
5	29·880	0·252	49	28·852	0·203	45	1·030	1·008	Oct. 8, 1849; fine day.
6	29·934	0·238	49	28·900	0·249	45	1·030	1·008	Oct. 9, 1849; fine day.
7	29·687	0·281	49	28·665	0·249	45	1·030	1·007	October 10, 1849; fine, cloudy.
8	29·651	0·214	51	28·620	0·217	46	1·033	1·007	October 12, 1849; high wind, fine.
9	29·591	0·430	59	28·581	0·420	54	1·050	1.015	October 19, 1849; wet and cloudy.
10	29·609	0·319	55	28·610	0·308	49	1·040	1·011	October 20, 1849; fine; high wind.

In observations 9 and 10, the lower station was at a point situated 15·06 feet above the lower station of the first eight observations. The barometer employed was made by Mr. Newman, of Regent-street. An observation of this barometer was made on setting out and returning from the Hill, and the exact height, at the time of the observation at the upper station, was found by interpolation, with the aid of observations of a good barometer, recorded by another observer, within a few yards of the lower station. In observations 9 and 10, the observation at the lower station was made simultaneously with a second barometer of Mr. Newman's construction.

In the following Table, I have calculated the heights from the four formulæ; for the reasons already given, the fifth and most correct formulæ cannot be used in practice:—

TABLE II.

No.	I.	II.	III.	IV.	Range of Barom. from 10, A.M., to 4, P.M.
1	155·30	156·54	156·38	157·63	– ·029
2	159·13	160·88	157·39	159·12	+ ·013
3	156·56	157·81	155·93	157·18	+ ·094
4	159·00	160·43	159·22	160·65	+ ·026
5	156·61	157·86	150·30	151·50	+ ·044
6	157·25	157·51	160·25	161·53	– ·092
7	156·70	158·11	153·19	154·57	– ·061
8	158·76	159·87	160·41	161·53	+ ·034
9	160·87	163·28	159·12	161·50	– ·157
10	157·53	159·26	157·49	159 22	– ·069
	157·771	159·155	156·968	158·443	

On examining column I. of these observations, it is plain that they may be divided into two distinct groups, of which Nos. 1, 3, 5, 6, 7 are below the average, and Nos. 2, 4, 8, 9, 10 are above the average. Of the latter, Nos. 2, 4, 9 were made on wet days; Nos. 8, 10, on windy days, and in all, the state of the atmosphere may be considered as unsettled; although, so far as the change in the barometer is considered, Nos. 2, 4, 8 will bear comparison with the fine days.

If we take the mean results of the observations on settled and unsettled days, we obtain the following Table:—

TABLE III.

	I.	II.	III.	IV.
Settled, ...	156·484	157·566	155·210	156·482
Unsettled, ...	159·058	160·744	158·726	160·404

Column III. is less than I. for the reason already given. Comparing columns I. and IV., it is interesting to observe how nearly they agree in settled weather, showing that the effect of the two hygrometric corrections is equal and opposite.

From the preceding observations, it appears that on wet days the barometric formula (II.), corrected statically for the hygrometer, gives too great a value for the height. As this fact does not appear to have attracted the attention of observers, it may be useful to confirm it by other cases which have been observed.

In the following observation of the height of Douce and Sugar Loaf, the lower station was at Kilmacanoge cross roads, at a point marked on the Ordnance Map as 255 feet, or 42·5 fathoms. Simultaneous observations were made with a Newman's barometer, which had been carefully compared with my own.

The lower station at Howth was the foot of the cliff in Balscaddan Bay:—

TABLE IV.

No.	Lower Station.			Upper Station.			Ther. Coeff.	Hygr. Coeff.	OBSERVATIONS.
	p	f	t	p'	f'	t'			
1. Douce, . .	29·663	0·372	58	27·421	0·361	50	1·044	1·014	Aug. 31, 1849; wet and foggy at summit of Douce.
2. Sugar Loaf,	29·635	0·372	58	28·153	0·278	51	1·045	1·011	Aug. 31, 1849; variable.
3. Howth, . .	29·684	0·440	63	29·103	0·419	58	1·058	1·915	June 28, 1852; wet day.

In order to compare the heights calculated from these observations with the trigonometric heights of the Ordnance Survey, we must add 42·5 fathoms for the height of the lower station in Nos. 1 and 2, and two fathoms for the height of the lower station in No. 3 above low water of spring tides. These corrections have been made in the following Table, in which V. denotes the trigonometric heights:—

TABLE V.

	I.	II.	III.	IV.	V.
Douce, ...	398·84	403·83	401·70	406·73	397·33
Sugar Loaf, .	275·32	277·88	263·03	265·45	275·17
Howth, ...	93·24	94·61	90·84	92·17	93·83

Column I., which is only corrected for temperature, is almost the same as V., and the figures in column II. are greater than V.

I shall add to these observations of my own three observations of the same height made by the Rev. Professor Jellett in the neighbourhood of Zermatt. I have calculated the two following Tables from the figures furnished by his note-book:—

The lower station is at Zermatt, the upper at the Schwarzsee:—

TABLE VI.

No.	Lower Station.			Upper Station.			Therm. Coeff.	Hyg. Coeff.	Range.
	p	f	t	p'	f'	t'			
1	24·856	0·379	59·5	22·128	0·294	53	1·049	1·014	+ ·053
2	24·880	0·355	59·5	22·207	0·260	50	1·046	1·013	− ·046
3	24·853	0·263	57	22·158	0·190	58	1·053	1·010	− ·024

The heights calculated by the four formulæ from these figures are—

TABLE VII.

	I.	II.	III.	IV.	
1	529·63	537·04	520·56	527·85	Fine.
2	516·30	523·01	504·52	511.08	Fine.
3	524·90	530·15	515·63	520.78	Fine.
Mean. .	523·61	530·06	513·57	519·903	

In this Table, the reduction of heights by formula III. is very striking; it is also remarkable that No. 3 of column II., on which day there was least moisture in the air, is the mean of the whole three observations.

Sir Robert Kane brought under the notice of the Academy the results of the analysis of the waters of the streams which descend from the side of the Dublin mountains, such as the Three Rock Mountain, with a view to illustrate the process of decomposition of the granite masses of those rocks, and the conversion of the felspathic elements into clays adapted for ceramic manufactures. A great number of springs and wells along the line of hills from Glencullen to Dundrum had been examined, and with similar results; but Sir Robert Kane specially detailed the quantitative analyses of two waters from Ticknock, above Rathfarnham, on the flank of the Three Rock Mountain.

The first of these specimens of water was taken from a rapidly running stream, and it was found that it contained a considerable quantity of soluble silica, combined with alkalies, there being both potash and soda present. This stream passed over a considerable tract of decomposing granite: 148,000 grains of this water left a residue on evaporation of 12·5 grains. This residue was found to contain the ordinary constituents of surface water, but in addition, alkalies and silicates amounting to—

Silica, ...	5,061	100,000.
Potash, ...	2,345	
Soda, ...	13,950	

The presence of alkaline silicates in such quantity in this water induced Sir Robert Kane to have a still more detailed analysis made of the water contained in a cavern excavated in one of the quarries made for obtaining what is called freestone, that is, the coarse powder of decomposed granite used in Dublin for scrubbing floors. This water was stagnant, and was derived from drainage through the adjoining masses of decomposing granite: 88,000 grains of this water gave a solid residue of 10·50 grains; containing organic matter, 2·47 grains.

The complete analysis of this solid material showed it to contain per cent.—

Organic matter (crenic and apocrenic acids),	23·30
Carbonic acid,	7·40
Muriatic acid,	17·99
Sulphuric acid,	6·34
Silica,	3·81
Lime,	3·03
Magnesia,	0.85
Potash,	2·86
Soda,	30·48
Loss,	3·94
	100·00

The large quantity of muriatic acid in this water is of course present as chloride of sodium, derived from the vapours carried over to those mountains from the immediately adjoining sea. This 17·99 of muriatic acid takes, therefore, 15·28 of soda to form common salt. The state of combination in which the sulphuric acid may have been in is not so easily assigned; but even if we allocate to it the strongest alkalies, there will still remain a large quantity, about 12·16 per cent. of soda, which must have been combined with the silica, and with the organic acids.

The characteristic feature of those waters, which may be considered as the types of those flowing down the flanks of the granite hills south of Dublin, is the presence of considerable quantities of alkaline silicates, principally silicate of soda. This might be expected, as it verifies the mode of decomposition of granitic rocks, and the deposition of china clays, suggested by Brogniart and others, but the instances in which the waters of such localities have been accurately examined, and the actual removal therein of the alkalies and silica of the felspathic materials of the granite, verified by analysis, have been so few, that I considered the Academy might not consider the present cases as unworthy of being placed on record in its Proceedings.

The analysis of these waters have placed in view another fact of much interest, in regard to the geognostic character of the granite of the Dublin mountains. In the waters there were found both potash and soda, but the latter in very great excess. This indicates that the felspar of our Dublin granites is upon the whole a soda or albitic felspar granite, although in particular spots orthose or potash felspar may be found. This fact has been also verified by a great number of analyses of specimens of granites from various parts of the great mass which extends from Dublin into the County Wicklow. In all the analyses made, which included both ordinary granites and elvan or granite porphyries, both potash and soda were found present, and the latter almost always so preponderant as to lead to the conclusion that the potash should in most cases be considered to belong to the mica which the granite contained, and that the felspar was almost exclusively an albitic or soda felspar, containing only in some cases a small quantity of replacing potash.

Dr. Apjohn made some remarks on the subject of Sir R. Kane's paper, eliciting some further explanations from the author.

Read, a letter from Mr. James S. Knowles, accompanying a donation of a cast of an inscribed monumental stone found lately in an excavation in St. Paul's Churchyard, London.

The stone, of the monumental portion of which the accompanying cast is a fac-simile, was discovered in the process of excavating for the foundations of a new warehouse for Messrs. Cook, Sons, and Co., on the south side of St. Paul's Churchyard, in the month of August, 1852.

At the depth of rather more than 20 feet from the surface, the natural ground level was attained, consisting of a compact dark yellow gritty sand, overlying gravel. Upon the surface of this sand the sculptured stone slab was found, and to the north of it a rude long hollow was scooped out, dipping from south to north at an angle of from 16° to 20°, containing the skeleton of a human being. The skull, with almost the whole of the bones, were thrown into the new excavation, and re-buried; but the femur and tibia of one leg, with the tibia of the other, fortunately preserved, are in my possession, and at the service of the British Museum.

The stone slab itself is rather of a friable oolite, probably Bath. Its dimensions are, 2 feet $4\frac{3}{4}$ inches long, 1 foot $10\frac{1}{2}$ broad, and 4 inches thick. It is broken into four fragments; a fifth was thrown into one of the concrete trenches, but its loss is unimportant, as all the lower portion of the stone is but roughly hewn, in the very rudest manner, and was evidently inserted in the ground.

The edge of the slab displays by the method of terminating its tooled surface (i. e. *all* of the stone which was not buried) the angle of inclination at which this antique head-stone was pitched. This was of about 30°, the sculptured panel and front face of the stone making an obtuse angle of nearly 60° with the ground surface.

The faces of the sculpture have been coloured with a deep tone of an almost black blue, still very perceptible in the original.

The cast which accompanies this communication may be relied upon as a faithful transcript of so much of the interesting monument as it includes.

It may be remarked, that although the Runic inscription is considered incomplete by several English scholars, yet that no trace whatever of any further writing is to be discerned upon the slab, the finish and entire preservation of which lead to the certain inference that no additional inscription did at any time exist upon it. And as to the missing fragment, as has been already noticed, it must have been entirely rough buried out of sight.

The author would direct attention, moreover, as settling this doubt, to the terminal line (under which the letter **A** has been scratched on the cast) upon the edge of the slab, which, being a continuation of the curved line on the face of the stone, appears to indicate a completion of the writing in that direction.

The following reading, with which the author has been kindly favoured by Mr. Saull (a member of the Society of Antiquaries) agrees with others nearly enough to afford in itself a sufficient example of the translations I have hitherto seen.

Mr. Saull says, that from the research of antiquarian friends "fully understanding the language, the inscription appears to be old Norse," and the characters "almost identical with those of an ancient inscription found in Siæland, and figured in 'Hickes' Thesaurus.' The two lines show the Runes placed foot to foot, the line next the back edge at bottom of the slab being the first, and the inscription reading round. The single Rune on the lower slab" (this refers to the character in the lower line immediately above the channel marked A on the cast) "we did not meddle with, as it is so imperfect . . . ; it may prove to be the first letter of the first word in the inscription, though that seems complete without it.

"The following is the transcript of the inscription, all ranged in one line, as better to read:—

1st Line.		2nd Line.
INA : LET : LEGIA : ST.	|	**IN : THIASI : AUG : TUKI.**

Literally:

Ina let to lay stone this and took. . .

Meaning:

Ina caused this stone to be laid and took. . .

ST at the end of the first line undoubtedly had **EAN** added to it for the word 'stone;' another word followed the letters **TUKI**. It is unfortunate that this portion is lost, because with it probably the whole sentence might have been read. The inscription is probably of the tenth, or early in the eleventh, century."

Such is the information given me by Mr. Saull, as derived from friends of his own competent to give opinion on the subject. As to the non-completion of the inscription, I have myself a strong opinion formed, from a close inspection of the relic now in my possession, that no further writing ever existed upon it. It has been suggested that the imperfect record was completed upon another slab, possibly a foot-stone to the same grave, of which the slab in question formed the head-stone.

A writer to the Illustrated London News, I may add, gives the word **TUKI** as a proper name, but otherwise reads the characters as above described.

MONDAY, JANUARY 24TH, 1853.

THOMAS ROMNEY ROBINSON, D. D., PRESIDENT, in the Chair.

THE seal of a Bishop of Leighlin and Ferns was presented by W. H. Hardinge, Esq.; also, a pewter cast of a bulla of Honorius II., and some fragments of ancient earthenware smoking-pipes, found near Drogheda; presented by J. T. Rowland, Esq.

Dr. Todd made the following communication to the Academy on the notices which occur in various writers, of the power said to be possessed by the Irish hereditary bards, of *rhyming rats to death*, or causing them to migrate by the power of rhyme. Allusions to this curious superstition are very frequent in writers of the Elizabethan age, and the following century. Shakespeare, in *As you like it* (Act iii. sc. 2), puts into the mouth of *Rosalind* the following reference to this Irish legend:

"*Celia.* But didst thou hear, without wondering, how thy name should be hang'd and carved upon these trees?

"*Rosalind.* I was seven of the nine days out of the wonder before you came; for look here what I found on a palm tree; I was never so be-rhymed since Pythagoras' time, that I was an Irish rat, which I can hardly remember."

The commentators on this passage of Shakespeare have collected several parallel passages from writers of the Elizabethan age, in which allusion is made to this superstition. Ben Jonson, for example, in his *Poetaster* (Epil. to the Reader) says:

> "Rhime them to death, as they do Irish rats,
> In drumming tunes."

And Randolph in the *Jealous Lovers:*

> "And my poets
> Shall with a Satire steep'd in vinegar
> Rhime 'em to death, as they do rats in Ireland."

Archdeacon Nares, in his Glossary, quotes the following verses from "*Rhythmes against Martin Mar-Prelate:*"

> "I am a rimer of the Irish race,
> And have already rimde thee staring mad;
> But if thou cease not thy bold jests to spread
> I'll never leave till I have rimde thee dead."

Sir William Temple, in his *Essay on Poetry*, has the following passage:

"The remainders [he is speaking of the old Runic] are woven into our very language. *Mara*, in old Runic, was a goblin that seized upon men asleep in their beds, and took from them all speech and motion. Old *Nicka* was a Sprite that came to strangle people who fell into the water. *Bo* was a fierce Gothick captain, son of Odin, whose name was used by his soldiers when they would fight or surprise their enemies: and the proverb of rhyming rats to death came, I suppose, from the same root."

Reginald Scot, in his *Discoverie of Witchcrafte*, p. 35 (ed. 1665), says: "The Irishmen affirm that not only their children, but their cattel are, as they call it, eye-bitten when they fall suddenly sick, & tearm one sort of their witches eye-biters, only in that respect: yea and they will not stick to affirm that they can rime either man or beast to death."

And Dean Swift, in his witty and ironical "Advice to a Young Poet," (having quoted Sir Philip Sidney), says:—"Our very good friend (the Knight aforesaid), speaking of the force of poetry, mentions rhyming to death, which (adds he) is said to be done in Ireland; and truly, to our honour be it spoken, that power in a great measure continues with us to this day."

The passage to which Swift has alluded occurs in Sir Philip Sidney's *Defence of Poesie*:—"Though I will not wish unto you to be driven by a poet's verses, as Bubonax was, to hang himself, nor to be rhymed to death, as is said to be done in Ireland," &c.

Dr. Todd stated, that having met with these passages, he called the attention of Mr. Eugene Curry to them, and requested him to make search in our ancient Irish manuscripts for such notices of the alleged powers of Irish rhymers as might throw light on this superstition. The following paper contains the substance of what Mr. Curry has collected on the subject.

The antiquity of satire in Ireland is, according to our ancient writings, of a very remote date. In the early ages of Christianity it appears to have been so frequent and so much dreaded, that the "Brehon Laws" contain severe enactments against it, and strict regulations regarding its kind, quality, and justice, something like the law of libel of more modern times.

Several references to ancient satires and satirists will be found in the Preface, by Dr. John O'Donovan, to a low, scurrilous poem on the native and Anglo-Norman noblemen of Ireland, written at the close of Queen Elizabeth's reign, and lately published by John O'Daly, of Dublin. The most interesting in its results, and perhaps the most authentic, of these satires mentioned by Dr. O'Donovan is that composed by the poet Laidginn (not Athairne of Binn Edair, as Dr. O'Donovan by an oversight has stated). The story is preserved in the Book of Ballimote, in the Library of the Royal Irish Academy, and the following is a literal translation of it:

"Eochaidh, the son of Enna, king of Leinster [having been for some time at Tara, as an hostage from his father to Niall of the nine hostages, monarch of all Erinn], absconded and repaired to the south to his own country. He decided on visiting the house of Niall's poet laureat, Laidginn, the son of Barcead, to refresh himself, but on arriving there he was refused entertainment. He proceeded home then, but soon returned with some followers to the poet's house, burned it, and killed his only son. The poet for a full year after that continued to satirize the Leinstermen, and to bring fatalities upon them, so that neither corn, grass, nor foliage grew unto them during the whole year. In the meantime the poet so worked up the feelings of the monarch Niall, that he vowed to march with his army into Leinster and lay it waste, unless the young prince Eochaidh was delivered up to him again, to be dealt with as he should deem fit, in expiation of the double insult and violation which had been offered to the sacred persons of himself and his poet. This vow he immediately carried into effect, and the King of Leinster, being unable to offer any effectual resistance, was compelled to deliver up his son as he was commanded. The young prince was conveyed to Niall's camp, at Ath Fadat (now Ahade), on the river Slaney (about three miles below Tulla), where he was left with an iron chain round his neck, and the end of the chain passed through a hole in a large upright stone, and fastened at the other side. Shortly after, there came to him nine champions of Niall's soldiers, for the purpose of killing him. This is bad indeed (said he) at the same time giving a sudden jerk, by which he broke the chain. He then took up the iron bar which passed through the chain at the other side of the stone, and faced the nine men, and so well did he ply the iron bar against them, that he killed them all. The Leinstermen, who were in large numbers in the neighbourhood, seeing their prince at liberty by his own valour, rushed in, led by him, upon their enemies, and a great battle ensued, in which the monarch was routed, and forced to retreat to Tulla, and ultimately out of Leinster, closely pursued, with great slaughter, by the Leinstermen."

Although this story is doubtless exaggerated, and has the appearance of a legend, it is, nevertheless, in all probability, founded on fact; for Mr. Curry, in 1841, with a copy of the story in his hand, visited the scene of this ancient battle, and found on the field a remarkable confirmation of the fact that a great slaughter had there taken place in very remote times. Not having then seen Ryan's History of the County Carlow, he was quite unaware of the existence at the present time of the "Hole Stone," mentioned by that writer. However, in moving along the road which runs parallel with the river from Tulla to Ahade, and when near to the latter place, he espied the identical flag-stone lying at the north end of a small field of wheat close on the left-hand side of the road, with a large lime-kiln nearly opposite, on the other side of the road. Having thus unexpectedly come upon the neighbourhood of the site of the battle, he proceeded a short distance forwards, to where some men were at work, at the same (left-hand) side of the road, trenching up a small field to a great depth, to get rubble limestone for burning, with which the soil seemed to abound. This appearing to him a fortunate circumstance, he turned into the field, and inquired of the men if they had discovered anything remarkable in their excavations. They answered immediately, that they had found the field full of small graves, at a depth of from eighteen to thirty inches below the surface, and they showed him some which had not been yet closed up. The graves were formed, generally, of six flagstones,—one sometimes at the bottom, four at the sides and ends, and one, sometimes more, to cover them in. They were from three to four feet long, one and a half broad, and about three feet deep. Every grave contained one, two, or more urns, bottom down, covered with small flags, and containing minute fragments of burnt bones and black ashes or mould.

Mr. Curry succeeded in procuring two of the urns in a perfect state. They were made of materials superior to such urns in general, and very neatly manufactured, and are now in the valuable collection of Dr. Petrie. But to return from this digression.

Several instances of this alleged power of the Irish bards of rhyming to death not rats only, but even Lords Lieutenant of Ireland, are collected by Dr. O'Donovan, in the Preface to Angus O'Daly's Satire, already mentioned, p. 17, *seq.*

The following is an instance given by the Four Masters at the year 1414, in which an unpopular Lord Lieutenant was rhymed to death by the Irish bards:—"John Stanley, Deputy of the King of England, arrived in Ireland, a man who gave neither mercy nor protection to clergy, laity, or men of science, but subjected as many of them as he came upon to cold, hardship, and famine." Then, after mentioning some particular instances, especially his having plundered Niall, son of Hugh O'Higgin, the annalists proceed to say:—"The O'Higgins, with Niall, then satirized John Stanley, who lived after this satire but five weeks, for he died from the virulence of their lampoons."

The most ancient story of rhyming rats to death in Ireland is found in an historico-romantic tale, entitled "Imthecht na tTrom Dáimhe;" "The Adventures of the Great Company." The history of the Great Company is this:—On the death of Dallan Forgaill, the chief ollave, or poet of Erinn, about A. D. 600, Senchan Torpest, a distinguished poet of Connacht, was selected to pronounce the defunct bard's funeral oration, and was subsequently elected to his place in the chief ollaveship of the kingdom. Senchan forthwith formed his establishment of bardic officers and of pupils in the art of poetry, &c., on a larger scale than had been known since the revision of the bardic institution at the great meeting of Dromceat, some twenty years previously. As chief poet of Erinn, he was entitled to make his visitation, with his retinue, of any of the provinces, and to be entertained during pleasure at the court of the provincial kings; and the honour of being so visited was sought for with pride and satisfaction by the kings of Ireland.

Seanchan having consulted with his people, they decided on giving the distinguished preference of their first visitation to his own provincial king, Guairè the Hospitable, king of Connacht. They were received hospitably and joyfully at the king's palace, at the place now called Gort, in the county of Galway. During the sojourn of Senchan at Gort, his wife, Bridget, on one occasion sent him from her own table a portion of a certain favourite dish. Senchan was not in his apartment when the servant arrived there; but the dish was left there, and the servant returned to her mistress. On Senchan's return, he found a dish from his wife's table on his own; and, eagerly examining it, he was sadly disappointed at finding that it contained nothing but a few fragments of gnawed bones. Shortly after, the same servant returned for the dish, and Senchan asked what its contents had been. The maid explained it to him, and the angry poet threw an unmistakeable glance of suspicion on her. She, under his glance, at once asserted her own innocence, and stated at the same time, that as no person could have entered the apartment from the time that she left until he returned to it, the dish must have been emptied by *mice*.*

Senchan believed the girl's account, and vowed that he would make the mice pay for their depredations, and then he composed a metrical satire on them. Of this we have but two and an half quatrains, of which the following is a literal translation:—

Mice, though sharp their snouts,
Are not powerful in battles;
I will bring death on the party
For having eaten Bridget's present.

* *Luch* is the generic name, and is qualified by *mor*, big, as *Luch Mhor*, a big mouse, or a rat. The modern *Francach*, literally a Frenchman, now used for a *rat*, is not found in any ancient Irish document known to the writer.

Small was the present she made us,
  Its loss to her was not great,
  Let her have payment from us in a poem,
  Let her not refuse the poet's gratitude !

You mice, which are in the roof of the house,
  Arise all of you, and fall down.

* * * * *

" And thereupon ten mice fell dead on the floor from the roof of the house, in Senchan's presence. And Senchan said to them : It was not you that should have been satirized, but the race of cats, and I will satirize them. And Senchan then pronounced a satire, but not a deadly one, on the chief of the cats of Erinn, who kept his princely residence in the cave of Knowth, near Slane, in the county of Meath."

To enumerate the various instances of the power of satire to be met with in the ancient records of Ireland would extend this communication to an inconvenient length. The power was very generally supposed to be most efficacious in its application to rats ; and the following story, which Mr. Curry relates from his own knowledge of some of the circumstances, shows that the superstition has existed down to our own times.

" About the year 1776 a priest of the Roman Catholic Church, named John O'Mulconry, became a convert to the Established Church, and was appointed curate of Kilrush, in the county of Clare. He was descended from the branch of the O'Mulconry family, who were hereditary satirists and poets ; and, notwithstanding his apostacy, was still much respected by the Roman Catholic inhabitants of Kilrush and Kilferagh, in the latter of which parishes, near Kilkee, he was in the habit of officiating on all Sundays. The burying ground of Kilferagh Church was at this time so infested with rats that serious accidents occurred there at interments, from the anxiety of men to kill them, and of the women to fly from them, as it was said that of bodies newly interred nothing but the bones remained after one day. It was generally believed and whispered about, that Father John O'Mulconry, as the people still called him, was endued with the hereditary bardic power of banishing the rats by satire. In the meantime an interment took place, at which the Rev. gentleman himself officiated, and seemed horror-stricken at what he saw. This was in the autumn of the year; and in a few days after, an honest respectable farmer, named John Foley, who lived at Querin, about four miles to the east of the Church of Kilferagh—the end of a large bog intervening—was out on an early morning to look after his cattle and his corn-fields, which skirted the same bog. While thus engaged, he noticed a rather thick and low fog or mist, confined to a narrow breadth, but extending in length almost across the bog. Surprised at such a phenomenon, he stood to observe it more closely; but his surprise was soon increased when he perceived it moving directly towards him, and with remarkable velocity. He immediately thought of his hitherto invisible neighbours, the fairies; and, thinking it would be as well not to stand in their way, he ran as fast as he could to get out of their line of march, which, having succeeded in doing, he turned to have a view of them. But his surprise was much greater at seeing in this mist a long compact train of rats, numbering hundreds of thousands, and crushing to the ground everything in the way of plant or shrub that opposed their progress. They quickly climbed over the walls or ditches of John Foley's corn-field, which was nearest to the bog, and passed straight through it, entering another and another of his fields in direct succession, and trampling to the ground the corn to the full breadth of their front, which was several yards. They passed on then through Querin, directly to the flat, low accumulation of sand which is called Querin Head, and which forms within it the handsome fishing-cove of Querin, about six miles below Kilrush, on the Clare side of the Shannon, and about five miles from Kilferagh Church. Having reached the 'Head,' they immediately buried themselves deep beneath the dry sand; there they remained some time without molestation; but the green sandy surface above them being the usual place for the herring fishermen of the Cove to spread their nets out to dry, the vermin soon began to gnaw and tear their nets to such an extent as to force the boatmen to abandon the place altogether, though at a great inconvenience. The sudden disappearance of the rats from Kilferagh, and their equally sudden appearance at Querin Head, soon became the talk of the country far and wide, and it was then remembered by several persons, who were present at the funeral at which Father John O'Mulconry officiated, that he had said on that occasion, that the rats should soon depart from Kilferagh; nor did he deny, when talked to on the matter, that they had been satirized and banished by him. In the meantime men crowded from all parts of the country to see the extraordinary rat-burrows at Querin Head. But the vermin soon took it into their heads to try their teeth on the bottoms of the boats in the creek, and their depredations of this kind became so serious that there was a meeting of the men of the parish held on the chapel-green of Dunaha on a Sunday evening, to consider what means should be taken to get rid of the nuisance. Here it was determined, that after mass on the Sunday following, all the young and able men of the congregation should go in a body to Querin Head, with spades, sticks, hurlies, &c., dig up the 'Head,' and kill and totally extirpate the colony of rats. The day came, and about one hundred active men, with a large crowd of spectators, repaired to the 'Head' and forthwith commenced operations. It was some time before they started the *game*, but suddenly, as if by concert, the enemy made their appearance amidst such a suffocating, blinding cloud of sand and sea-fowl feathers as stunned the besiegers for a moment. Soon, however, sticks, hurlies, spades, and feet were at work, and thousands of the vermin were left sprawling and crushed on the field of battle. Still their numbers appeared to suffer no diminution, and after their first surprise was over, they began to crawl and climb up the legs, thighs, and bodies of their assailants in such numbers, and with such pertinacity, as to force them to give way and retreat ingloriously from the battle-field, fully convinced that the action of the rats was governed by an influence against which human force was unavailing. What became of the rats after this day, or how long they remained at Querin Head, I cannot say; but I have often heard my father, Owen Mor O'Curry, William Macguire, and Denis Macgrath, three of the most expert rat-killers with the stick in the parish, and who were at Querin Head on the occasion, talk with wonder and fright of the scene in which they were engaged. And these were not men who were frightened at seeing their own precious blood copiously following the application of well-balanced, well-directed 'shillelaghs' to their own living skulls. No, they were men well accustomed to give and take in that agreeable way.

"It is a common tradition in Limerick, and not older than my own boyish days, that when ships were found dangerously infested with rats, there were men to be found then who came and placed an open razor in a fixed position on the ship's deck, and compelled all the rats in her to come in succession—I do not know by what agency—and rub their throats to the razor's edge so as to kill themselves.

"There are people still in the west of the county of Clare who pretend to possess a form of satire for the *banishment* of rats. One man, Thomas Keane, land surveyor, now living near Kilkee, told me, about the year 1820, that he had thus banished one or more destructive rats from his mill and house at Belahaglass, near Dunlicky Castle, on the Kilkee coast. It must be remembered, that the rat satire was always composed in rhyme, and in the most obscure and occult phraseology of the Irish language. Having myself a small inkling of the rhyming propensity, I tried my hand at a satire on rats, in the house of a friend at Kilkee, in the year 1820, but I fear the words I made use of were too *hard* for the vermin to understand, or that I had not the true inspiration, as, certainly, they paid not the slightest regard to the notice to quit which I then gave them.

"Martin, in his Tour to the Western Isles, says, that the ancient race of the Island of Rona was, about the year 1700, all destroyed in the following manner:—First, a swarm of rats, none knows how, came into the island and eat up all the corn. In the next place, some seamen landed and robbed them (the people) of what provisions they had left, and all died before the usual time of the arrival of the boat from Lewis."

The President read a paper on the probable errors of the eye and ear in transit observations.

"Among the important applications of the Electric Telegraph which every day is producing, none is more interesting to those who pursue physical inquiries than its power of making time-determinations with a precision and facility which promise ere long to supersede the existing processes. In its very first application to determine longitudes by making the clock of each station beat its time at the other, its immeasurable superiority was at once revealed; and though it has not been as completely established in the more ordinary operations of the Observatory, yet that is only an affair of a few years. One of these seems specially to invite it,—the determination of right ascension; and already Mitchel and, I believe, others have obtained results which appear to surpass those hitherto obtained by the transit instrument.

"The principle is this: the clock, by a well-known apparatus, prints on some fit surface a series of equidistant dots by the successive vibrations of its pendulum. Between any pair of these the observer can interpose a dot at the instant of a phenomenon, and its place, with respect to them, gives the time. This reduction can be made at leisure, as the record is permanent, and a scale of any reasonable magnitude can be given to the second. The American astronomers have compared the results of this method with the Greenwich transit observations, and have found, in the words of Mr. Airy, that 'the measure of its irregularities is only about one-fourth of that of the other.' He, however, very truly remarks that 'a portion of these differences may be owing to the difference in the state of the atmosphere, that of England being perhaps comparatively unfavourable to accurate observations.'

"In making a comparison of this kind it must be remembered that the two systems not merely employ different senses to co-operate with sight, but that the sight itself is used in two different ways. In the 'Electric Register' the eye catches the moment when the star crosses a wire, and the touch is to synchronize with it in giving a signal. In the common modes the ear counts the clock's beats; the eye notes the distances of the star from the wire at the beats which precede and follow its passage, and thus the mind estimates the fraction of the second from the relative position of three points; all existing *in memory alone* when that estimation is made. Now this is rather a complicated operation; and it is evident that the optical part of it must be much more liable to uncertainty than the mere noting the occurrence of the transit. Of this latter, as well as of the relative promptitude of hearing and touch, it is desirable to have careful determinations; but if any such have been made during the five years that have elapsed since this new principle of observation was discovered, they have not reached me. In hopes, therefore, of drawing attention to the subject, I offer to the Academy the results of a similar examination, applied to the Armagh Transit Observations, for the purpose of ascertaining how far they could be improved, and what probable weights should be given to certain elements of reduction.

"The error which may be caused by uncertainty in catching the precise part of the beat which shall be taken for the origin of the second, is the same for every star (at least if we suppose the clock equally audible in every position of the telescope, and the observer able to observe in all with equal convenience, for personal discomfort will interfere with the attention). That arising from uncertainty in estimating the star's place will vary inversely as the cosine of its declination.

"But there is yet another, arising from the actual displacement of the star's image, by irregular changes in the refractive density of the atmosphere; the effect will, as the preceding, be inversely as the cosine of declination, but also directly as the magnitude of these changes. This depends, in the first place, on the heterogeneity of the air as to heat and moisture; and in the second, on the quantity of disturbed medium through which the line of sight passes. The former scarcely admits of expression in terms of our present meteorological data, and we must be content to assume for it an average value. In respect to the other, as the disturbance takes place chiefly within a small distance of the earth's surface, it will easily be seen that its amount is as the secant of zenith distance. If then we denote by u the probable error of the ear, by y that of the eye, and by z the atmospheric tremor at the zenith, we have, by the theory of these errors, for a star whose declination is δ,

$$\varepsilon^2 = u^2 + \frac{y^2}{\cos^2 . \delta} + \frac{z^2}{\cos^2 \delta . \cos^2 (l - \delta)}.$$

It is evident that z admits of a minimum in respect of δ: let x be the tangent of $l - \delta$, λ that of latitude, and $r = \frac{z}{y}$, differentiating and equating to 0, we derive

$$x^4 + \frac{2}{\lambda} x^3 + \frac{2r^2 + 1}{\lambda r^2} - \frac{r^2 + 1}{r^2} = 0.$$

"If then we select three stars, properly differing in zenith distance, we can determine the three errors u, y, and z. We find ε in the usual way, by comparing each wire of a set of n

with its mean; but as this mean is itself affected with an error $= \frac{\varepsilon}{\sqrt{n}}$, the value thus computed must be multiplied by

$$\sqrt{\left(\frac{n}{n+1}\right)}.$$

"My first examination was made in 1830. The instrument had then seven wires, and its eye-piece gave a power of 130. It was, however, far inferior in sharpness of definition to the one which it replaced; that was 104, and was removed because it was unprovided with means of attaching a dark glass for sun observations.

"The stars chosen, observed almost in every case on the same nights, except the excess of the second, were

α Lyræ,	$\delta = +\ 38^\circ.\ 38'$ . . .	No. wires, 120
β Aquilæ,	$+\ 5^\circ.\ 59'$ . . .	„ „ 167
α^2 ♑	$-\ 13^\circ.\ 4'$ . . .	„ „ 122

Giving the equations

$$(0^s{\cdot}1041)^2 = u^2 + y^2 \times 1{\cdot}63878 + z^2 \times 1{\cdot}76856$$
$$(0^s{\cdot}0959)^2 = u^2 + y^2 \times 1{\cdot}01097 + z^2 \times 2{\cdot}29065$$
$$(0^s{\cdot}1281)^2 = u^2 + y^2 \times 1{\cdot}05385 + z^2 \times 7{\cdot}14595$$

These give

$$u = \pm\ 0^s{\cdot}\ 0445; \quad y = \pm\ 0^s{\cdot}0619; \quad z = \pm\ 0^s{\cdot}0381.$$

In my case, therefore, the ear could estimate the twenty-third part of a second, and its precision was to that of the eye as 7 : 5.

"With this ratio of y to z, the two real roots of the equation of minimum are, the positive = tang. 37°. 55′; and the negative (belonging to a sub-polar transit) = tang. 66°. 47′. Therefore, stars passing at those zenith distances should be used at Armagh to obtain the exactest determination of time. In such an examination we must be careful to use observations made under conditions as nearly the same as possible. For instance, they must be all day or all night ones, as the errors are very different in these cases; the first being at this Observatory to the second as 4 to 5; and I even think the stars ought not to differ in magnitude or colour: but if these precautions be attended to, I am satisfied that very exact conclusions may be attained. Perhaps no stronger evidence of this can be given than the result of a second examination, instituted several years after certain alterations had been made in consequence of the first one.

"As the value of y was not very much less than the whole ε that I had obtained with the former eye-piece, notwithstanding its low power, a new one was obtained from the late Mr. Dollond, of 240, and very good. Nine lines were inserted by Mr. Grubb, finer and more uniform than the previous seven; the clock, whose arc of repose had been four times that of escape, had its weight changed from 4 lbs. to 1·75; and a multitude of trees and shrubs were removed from the south of the transit-room, as their evaporation was a manifest cause of unsteadiness. All these, except the alteration of the clock, tended to lessen the error; that improved the rate, but it made the beat less audible in high winds, and therefore would increase u.

"In this instance stars all of the first magnitude were selected; one of them, Fomalhout, I had formerly been unable to use on account of its excessive fluctuations. They were

α Lyra,	$\delta = +38°. 39'$ . . .	No. wires,	279
α Aquilæ,	$+\ 8°. 29'$ . . .	,, ,,	251
Fomalhout,	$-30°. 27'$ . . .	,, ,,	278

Giving

$$(0^s{\cdot}1022)^2 = u^2 + y^2 \times 1{\cdot}63955 + z^2 \times 1{\cdot}76909$$
$$(0^s{\cdot}0925)^2 = u^2 + y^2 \times 1{\cdot}02225 + z^2 \times 2{\cdot}10826$$
$$(0^s{\cdot}1162)^2 = u^2 + y^2 \times 1{\cdot}34559 + z^2 \times 163{\cdot}81153$$

Whence

$$u = \pm\, 0^s{\cdot}0732; \quad y = \pm\, 0^s{\cdot}0554; \quad z = \pm\, 0^s{\cdot}0049.$$

The error of hearing is considerably increased; that of sight a little lessened, but the tremor is only a seventh part of its original amount.

"It is evident that the same equations apply to the new mode of observation if u represent the error of touch; and it is to be hoped that a similar discussion of its probable errors may be soon instituted, for there are a number of inquiries which must be answered before its superiority will be fully appreciated. Independent of the possibility that the means employed to close and break the voltaic circuit may disturb the clock's pendulum, and that the promptness of the register may vary with the intensity of the battery, it is certain that in the obedience of the finger to the will there must be a personal equation, and it is possible that this, unlike that of the ordinary transit observer, may be variable. For any regular succession it will probably be insensible, as I infer from some observations given by Mr. Mallet in the report of his valuable experiments on the propagation of Earthquake Waves, p. 306. Starting a chronograph at a given beat of a clock, and stopping it at another, he gives the differences from the mean, whence I compute ε, for himself $= \pm 0^s{\cdot}0449$, and for his son $\pm 0^s{\cdot}0592$. Each of these involves two errors of ear and two of finger, so that the measure of one of each is $0^s{\cdot}0318$ and $0^s{\cdot}0419$. These come so near my u, that any error of touch is scarcely possible; the case is, however, a special one, and may be compared to the counting seconds without a clock, which a practised observer will do with surprising accuracy. Phenomena not regularly recurring could scarcely be taken so accurately.

"The error of sight will, for the reason already given, be less in the case of stars; as to the sun and moon, it is more doubtful. In the transit they have larger probable errors than the stars. For the sun I obtained in 1830 the first limb $\pm 0^s{\cdot}116$, the second $\pm 0^s{\cdot}087$; the moon gave $\pm 0^s{\cdot}149$; while stars observed at the same hour, and near the same parallel, had but $\pm 0^{s}\cdot097$. This greater uncertainty arises from the strong contrast between the bright and dark surfaces whose boundary we take; and a similar one may be expected in attempting to note the precise instant of its passage.

"As to tremor, it will act here precisely as in transit observations, and it may, moreover, perhaps nullify one of the proposed advantages, that of making many observations in a few seconds. The undulations of the air are twofold, those of short period, which cause the flutter that produces z, and those of much longer duration, which, without blurring the star, displace it, and sometimes cause the pole-star, after crossing a wire, to go back, and after ten or even fifteen seconds make a second transit. In the present mode such waves affect only a single wire, and may be neutralized by others; but in the other they would vitiate the whole set.

"I mention these doubts in the hope that some of our own astronomers may take up the subject, and examine it fully. If there be practical objections to it they may be remedied; but if it really possess the advantages which it seems to have, it should be decidedly adopted. At all events it is a step in the right direction, for we have now carried the existing processes and instruments of astronomical research nearly as far as they can go, and new powers must be invoked, if we wish to make further progress."

MONDAY, FEBRUARY 14TH, 1853.

THOMAS ROMNEY ROBINSON, D.D., PRESIDENT, in the Chair.

The Secretary announced the following donation:

A Pamphlet on "The Maynooth Grant," by Philip D. Hardy; presented by the author.

The Rev. Alexander Leeper; William Dargan, Esq.; David Brereton, M.D.; Alfred H. M'Clintock, M.D.; were elected Members of the Academy.

The following Address was read and approved of by the Academy:—

"*To His Excellency Edward Granville, Earl St. Germans, Lord Lieutenant General and General Governor of Ireland.*

"MAY IT PLEASE YOUR EXCELLENCY,

"We, the President and Members of the Royal Irish Academy, beg to offer you our respectful congratulations on your arrival in this country, as the Representative of our Most Gracious Sovereign.

"By this high office, your Excellency is constituted the Visitor of the Academy under our Charter; and we venture to hope, that the knowledge of our history and character, which your former connexion with Ireland has given you, will justify us in the expectation that we shall obtain your patronage and aid in carrying out the great object for which we were founded—the promotion of Science, Polite Literature, and Antiquities in Ireland.

"We are emboldened, therefore, to look to your Excellency for encouragement, not only as an accomplished gentleman, but as an enlightened statesman, who needs not to be informed, that the cultivation of the studies in which the Academy is engaged must exercise a great and rapidly increasing influence on the progress of civilization and social life.

"Abstract and practical sciences are the foundation of the marvellous wealth and power that crown the British Empire: the lighter treasures of literature are not the less necessary to prevent the human mind from becoming enslaved by the preponderance of material interests: and the study of the remaining records and monuments of antiquity is of no less practical importance, because the past, which they make known to us, has left traces in the national character which cannot be fully understood whilst they are unknown.

"To the interest which was taken in the progress of the Academy by your noble predecessor, the Earl of Clarendon, we owe the very convenient premises we now occupy, as well as the means of adding to them suitable rooms for our Museum and Library. As these buildings are as yet unfinished, our Museum of Irish Antiquities is not at present displayed to advantage; but we hope before long to have it so arranged, as to render it worthy of your Excellency's inspection.

"We beg leave to express our heartfelt wish, that your Excellency's Government may prove a source of improvement to Ireland, and happiness to its people."

On the recommendation of the Council, it was Resolved:—

I. That £50 be placed at the disposal of the Committee of Antiquities for the purchase of articles for the Museum.

II. That the Museum of the Academy be exhibited in the Great Dublin Exhibition of 1853, on the conditions agreed to between the Council and the Committee of the Great Exhibition; and that the Council be empowered to take such further steps, from time to time, for the security of the Collection, as they may deem necessary.

Monday, February 28th, 1853.

HUMPHREY LLOYD, D.D., President, in the Chair.

The Secretary announced the following donations:—

A Treatise on Syphilitic Diseases, by J. C. Egan, M.D., M.R.I.A.; presented by the author. A very rare form of ancient stone battle-axe, found in the county of Galway; presented by A. B. Cane, Esq., M.R.I.A.

The following Answer to the Address to the Lord Lieutenant, adopted at the last Meeting, was read, and ordered to be printed in the Proceedings:—

"Gentlemen,—I accept with pleasure your congratulations on my arrival in this country as the Representative of our Most Gracious Sovereign.

"The study of ancient records, and of the remaining documents of antiquity, is a useful and important, as well as an interesting, one.

"Fully to understand the present, it is, indeed, necessary to have some insight into the past. If this be true when said generally, and of any country, it is especially true when said of Ireland, on the character of whose people the past has left so many traces.

"As the official Visitor of your Academy, I shall willingly co-operate with you in carrying into full effect the intentions of its founder, and in thus promoting Science, Polite Literature, and the study of Antiquities in Ireland."

Dr. Allman read a note on the development of the ferment-cells, and on some other vital phenomena of fermentation.

In this communication the author first brought before the notice of the Academy the occurrence of a certain peculiar organism which is developed in company with the ferment-cells in fluids undergoing the alcoholic fermentation, and whose presence in the alcoholic fermentation of wort appears to be as universal a phenomenon as that of the ferment-cells themselves.

It consists of rigid filaments, apparently destitute of spontaneous motion, except a slight vibration, manifestly molecular; these filaments are at first straight, but afterwards become, for the most part, abruptly bent at an obtuse angle, generally at about a third of their length. They correspond nearly with the genus *Bacterium*, as defined by Ehrenberg, and though Ehrenberg's definition may, perhaps, not strictly apply to them, it would seem more advisable to place them in the genus Bacterium than to construct for them a new one. The bodies in question possess considerable resemblance to the *Bacterium termo* of Dujardin: from this animalcule, however, they differ in their greater length in proportion to their breadth; in their entirely uniform diameter; in the angular bend presented by the full-grown filament; in the total absence of all trace of transverse divisions in the mature individuals; and in being entirely deprived of locomotion. The peculiar circumstances under which the Bacterium of the alcoholic fermentation is developed, suggested the specific name of *cerevisiæ*, under which the author proposed to designate it.

Bacterium cerevisiæ is one of the first distinct organisms that shows itself in the fermentable fluid; it appears anterior to the ferment-cell, and precedes all sensible fermentation. It is itself, however, preceded by excessively minute, spherical corpuscles, and its formation was distinctly traced to the union in a rectilineal series of several of these corpuscles, originally quite distinct from one another. Ehrenberg explains the formation of the chain-like filaments of the Vibrionidæ by the supposition of the imperfect self-division of an original monadic element. The origin of Bacterium cerevisiæ, however, is certainly such as is here described, and this organism is, therefore, truly compound. The excessive minuteness of the monadic element of the Bacterium renders it impossible to form a satisfactory conclusion as to its real structure; the microscope shows nothing but a simple granule, presenting active molecular motion. It is only during the very early age of Bacterium cerevisiæ that the composition of the filament is apparent, a little later all trace of transverse division disappears, and the filament appears perfectly smooth and homogeneous.

The author has examined many examples of distillers' wort during the progress of fermentation, both experimentally, on a small scale, and in large masses in the fermenting-backs, and he has universally observed the presence of the Bacterium; in instances where, for the sake of experiment, fermentation was prevented, the ferment-cells were never developed, and the Bacterium very imperfectly.

The author then proceeded to detail the results of some careful observations he had made on the progress of development of the ferment-cells and Bacterium filaments during the alcoholic fermentation of wort.

A specimen of distillers' wort, prepared from mixed grain, was introduced into a flask, and set to ferment at a temperature of about 90°, without the addition of yeast. It was then carefully examined by the microscope, at intervals of twelve hours, and the results noted. The fluid, when first set to ferment, contained some untransformed starch granules suspended in it, with amorphous granular matter and a few minute oil-globules. No trace of ferment-cells or of Bacterium could be detected by the most careful microscopical examination.

After twelve hours.—No appearance of fermentation. The microscope reveals numerous filaments of Bacterium, but no ferment-cells are yet visible.

After twenty-four hours.—A few small air-bubbles are collected round the edge of the fluid, but otherwise there is no decided appearance of fermentation.

Under the microscope a few very small cells may be seen, some single, and some in groups of two. Filaments of Bacterium numerous.

After thirty-six hours.—Fermentation decidedly established, a thin layer of froth on the surface. Ferment-cells much more numerous, and, for the most part, larger; some solitary, others in groups of two or three. Filaments of Bacterium as on preceding observation.

After forty-eight hours.—Fermentation very active, a copious frothy head, strong vinous odour.

Ferment-cells have much increased, and may be seen in various stages of germination; some are solitary, others form groups of two, three, four, or, occasionally, five; and some of the groups have begun to exhibit a disposition to branch; some of the cells have considerably increased in size. *Bacterium* filaments abundant.

After sixty hours.—Fermentation very active; a copious dense yeast has been deposited at the bottom of the flask; the fluid continues to exhale a strong vinous odour.

Under the microscope the ferment-cells are seen to have still multiplied, and branched groups, of from three to six cells, are frequent. There is an evident general increase in the size of the cells. Bacterium filaments abundant.

After seventy-two hours.—Fermentation still very active, but the fluid presents no change of importance since last observation.

After eighty-four hours.—Fermentation has greatly subsided. Cells still numerous throughout the fluid, but much more so at the bottom, where they have collected into a copious yeast. The cells of this yeast are mostly solitary, and larger than the majority of the floating cells; a great number of the latter continue united in simple linear or branched groups. Bacterium filaments are very abundant all through the fluid.

A few hours after this the fermentation appeared to have entirely ceased. The ferment-cells had almost all subsided to the bottom. The Bacterium filaments continued abundant, suspended at all depths through the fluid.

The ferment-cells, when mature, are nearly spherical, and present an eccentric spherical cavity; this cavity, however, is not the true cell-cavity, but a mere vacuole in the protoplasmic contents. Its size is very various; it is sometimes barely visible under the highest powers, while, in other instances, it occupies nearly the whole of the cell. By the action of iodine the protoplasm is turned dark-brown, and the cell-membrane is then rendered apparent. There is no distinct indication of a nucleus; and authors who have described a manifest nucleus have evidently mistaken for this body the vacuole, already described, in the protoplasm. If a nucleus exist, it is probably concealed in the thick opaque protoplasm. In some instances the contents of the cell appeared broken down into a multitude of detached granules; the cell-wall was then very visible without the aid of iodine; this condition was probably confined to dead cells.

In an example of "spent wash," the residuum which remains after the distillation of the fermented wort, the microscope showed that the solid matter was almost exclusively composed of ferment-cells and Bacterium filaments; the cells retained their spherical figure, but their contents presented the granular condition just described. The filaments appeared unaltered.

Dr. Apjohn read a paper on the nature and relative proportion of the alkalies occurring in the granite of the vicinity of Dublin.

A paper was read at a recent meeting of the Academy, by Sir Robert Kane, which communicated the results of some analyses, made under his direction, of waters from Ticknock, on the slope of the Dublin mountains. From this communication it appeared, that these waters included a large amount of alkaline silicates, but that the proportion of potash present was very small compared to that of the soda, their relative quantities being very nearly represented by the numbers 1 and 13.

From these results, and the assumption that the alkalies are derived exclusively from the disintegration of the adjacent granite, Sir Robert Kane went on to infer "that the felspar of our Dublin granite is, on the whole, a soda or albitic felspar, although, in particular spots, orthose or potash felspar may be found." And in the succeeding paragraph of his paper he observes, that he found this conclusion corroborated by the results of numerous analyses of the granitic rocks of the same locality.

Having been present when this paper was read, I certainly felt, relying merely on my memory at the time, that the statement, alleging potash to be absent from the Dublin felspar, or to be but casually present, and only in insignificant quantity, was not in accordance with my experience. I have had this mineral frequently analyzed as an exercise for pupils in my laboratory, and, while recollecting that soda was invariably found in it, I had also very distinctly on my mind that the potash often preponderated, and was never present in very small relative quantity. Upon referring to my notes, and instituting some fresh analyses for the express purpose of throwing light on this question, I find that the impressions I previously entertained are in accordance with my experiments; and as the point under consideration is one of some practical and scientific interest, I am anxious to be permitted to put on record, through the Academy, the evidence in reference to it which I have obtained. The following Table includes two complete analyses of felspar, for some time in my possession, and three partial analyses, made within the last fortnight, for the sole purpose of determining the relative quantities of the potash and soda. The composition of the Mourne felspar has no immediate bearing upon the question under discussion, and is given merely for the purpose of showing that a variety of this mineral, generally considered as a true albite, includes a large relative amount of potash.

	Mourne Mountains. (Mr. Cairnes.)	Killiney. (Mr. Keightley.)	Kingstown. (Mr. England.)	Three Rock. (Mr. Foster.)	Three Rock. (Mr. England.)
Silex,	65·17	65·03			
Alumina,	19·37	18·60			
Lime,	0·67	0·02			
Magnesia,		0·02			
Potash,	5·99	12·73	9·65	4·15	5·72
Soda,	8·80	1·14	1·64	4·34	6·89
Loss,		2·46			
	100·00	100·00			

According, then, to these experiments, in the felspar of Killiney and Kingstown the potash greatly predominates. In that of the Three Rock Mountain the two alkalies are present in nearly equal quantities; while even in that of the Mourne range, long considered as an albite, the ratio of the quantity of the vegetable to that of the mineral alkalies is that of 2 to 3.

These results are so different from those announced by Sir Robert Kane, that the discrepancy can scarcely be due to errors of experiment, while it is, at the same time, difficult to suggest any other probable explanation of it. It may, indeed, be suggested, that the felspar of the Dublin granite is subject to variation as respects the relative proportions of its alkaline constituents; and it is just possible that, by some singular chance, while the specimens he operated upon contained no alkali but soda, those which were employed in my experiments contained potash also, and in large relative quantity. Upon this explanation, however, I do not feel disposed to lay much stress, when I recollect that Sir Robert Kane's researches on this subject have been, as he informs us, very extensive, and that he considers the conclusion at which he has arrived as "verified by a great number of analyses of specimens of granites from various parts of the great mass which extends from Dublin into the county of Wicklow." His analyses, however, it should be recollected, were analyses, not of felspar, but of granite, that is, of a mechanical and very variable mixture of quartz, felspar, and mica; and he admits that potash always appeared amongst his results. But its quantity, relatively to the soda, is, he contends, so small, that he is of opinion it should be referred exclusively to the mica, and that the felspar containing no alkali but soda must be viewed as an albite. This argument I cannot but consider as somewhat too circuitous to be altogether satisfactory. The investigation may be conducted in a much more simple manner, and it appears to me that mineralogists will probably not feel themselves safe in adopting the conclusion which Sir Robert Kane has drawn until it is supported by the results of experiments made directly on the felspars themselves.

Sir Robert Kane explained, in reference to Dr. Apjohn's observations, that he had never denied that orthose or potash felspars were found in certain localities of the Dublin and Wicklow range, and that Killiney was certainly one of those, as was sufficiently well known and indicated by the presence of other minerals rich in potash as the Killinite itself, of which portions were actually attached, as Dr. Apjohn admitted, to the specimen of felspar selected by Professor Apjohn for examination. But from Dr. Apjohn's own analyses of the other specimens, it was evident that as they were taken more in the granitic mass, the soda element first equalled the potash, and then preponderated in the granite of the Three Rock Mountain. Hence Dr. Apjohn's analyses did not impugn the truth or accuracy of Sir Robert Kane's idea,—that the predominant character of the granitic district of Dublin and Wicklow was the presence of soda felspars. This idea was founded not merely on the results of the analysis of the waters, read at the last meeting of the Academy, and which in itself Sir Robert Kane did not consider very important, but was the result of a widely-spread series of observations which, on another occasion, Sir Robert Kane hoped to be able to bring before the Academy.

The analyses of felspars from the North of Ireland, quoted by Dr. Apjohn, could not, Sir Robert Kane remarked, have any reference to a question as to the nature of the felspars in the south-east, nor could the crystallographic or analytical details into which Dr. Apjohn had entered. The real question was, the average constitution on the great scale of the granitic district lying to the south of Dublin, and on this Sir Robert Kane considered the conclusions suggested in his former notice to be perfectly unimpeached, although in special localities deposits of true potash felspars (orthoses) may occur, a fact of which Sir Robert Kane was, of course, perfectly aware, and never could have contemplated to deny.

The Rev. Dr. Lloyd read a paper on the magnetic influence of the moon.

"The influence of the moon upon the position and movements of the magnetic needle seems to have been first recognised by Professor Kreil. From the discussion of the magnetical observations made at the Prague Observatory, in 1839 and 1840, he has inferred that there existed a small periodical variation in the position of the freely suspended horizontal magnet, dependent upon the position of the moon with respect to the meridian. The question has been again examined, in this and in other bearings, by Mr. Broun, the able Director of Sir Thomas Brisbane's Observatory at Makerstoun, in Scotland, and the action of the moon has been apparently traced in a variety of periodical laws, dependent not only upon her hour-angle, but also upon her declination and distance from the earth.

"Notwithstanding the very remarkable nature of the phenomenon thus announced, the question has since remained unexamined, and the conclusions unconfirmed, by other observers. Whether the small changes deduced by Professor Kreil and Mr. Broun were thought to be within the limits of the errors of observation, or the apparent improbability of the effect announced was supposed to outweigh the positive evidence adduced in proof of it, it has so happened that none of the numerous staff of magnetical observers, now scattered over the globe, have since resumed the question.

"I confess myself to have been one of those who doubted the conclusion announced on both the grounds alluded to. I did not think that variations so small as those inferred could be fairly construed into a physical law, unless they were found systematically consistent with themselves for a greater number of periods than those hitherto examined; and the antecedent improbability of the action combined with the nature of the evidence to deter me from the labour of the inquiry. The periodical laws in terrestrial magnetism, hitherto discovered, point to the sun as their physical cause; and many circumstances appear to indicate that the sun in this case acts mainly, if not entirely, through the medium of changes of temperature. Thus I have shown that a very remarkable relation exists between the diurnal ranges of the declination and horizontal intensity, and the diurnal ranges of temperature; and the annual variations of the same elements present a similar correspondence.* Now, the thermal effect of the moon is so small as to be incapable of being detected by the most delicate instrumental means; and I inferred that its thermo-magnetic properties must be likewise insensible. But, having now satisfied myself of the *fact* of the lunar action, it is plain that there was an error somewhere in this reasoning; and I believe the erroneous premiss to be, the assumption that the lunar action, if it existed, must be analogous to the solar.

"The most hopeful mode of inquiry into the fact of the lunar magnetic action appears to be an analysis of the diurnal range of the magnetic declination in reference to the moon's

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* Results of Observations made at the Magnetical Observatory of Dublin, Transactions Royal Irish Academy, vol. xxii. pp. 85 and 91; and Proceedings, vol. iv. p. 379.

age. The diurnal range is the phenomenon in which the solar magnetic action is most conspicuously displayed; and in it, if anywhere, we should expect to find evidences of the periodical action of another luminary. In fact, if the moon co-operates with the sun, in the course of the day, in its effect upon the position of the free magnet, we should expect the range to be greater in certain portions of the moon's age than in others, the separate actions of the two luminaries, as in the analogous case of the tides, at one time conspiring, and at another being opposed. We have, therefore, only to analyze the diurnal range, in reference to the moon's age, and such joint action, if it exists, will be manifested by a variation in the magnitude of the range, whose period is the synodic month.

"I have, accordingly, calculated the daily range of the declination for eleven years, viz., from 1840 to 1850 inclusive, and arranged the resulting numbers according to the moon's age. As there are two periods of greatest easterly deviation of the magnet in each day, the range is double, viz., from 7 A.M. to 1 P.M., and from 1 P.M. to 10 P.M.; the mean of these is here taken. When the twelve lunations of each year are combined, and the means of the ranges corresponding to the same day of the moon's age taken, the resulting numbers exhibit a periodical variation, the range being greatest in the first and third quarters, and least in the second and fourth. But as the law is not exhibited with distinctness for each year, even in these numbers which are the means of 24 separate results, I have again combined them in groups of 7 and 8 alternately, corresponding to the four quarterly periods. The following Table gives the results. The numbers are the differences between the mean ranges in each of the four quarters and in the entire month, for each of the eleven years :—

Year.	I.	II.	III.	IV.
1840	+0′·06	−0′·30	+0′·43	−0′·19
1841	+ 0·04	− 0·01	+ 0·33	− 0·35
1842	+ 0·71	− 0·27	+ 0·25	− 0·70
1843	+ 0·65	− 0·48	+ 0·29	− 0·45
1844	+ 0·47	− 0·12	+ 0·43	− 0·78
1845	+ 0·32	− 0·48	+ 0·68	− 0·54
1846	+ 0·38	− 0·14	+ 0·60	− 0·84
1847	+ 1·12	− 0·29	− 0·62	− 0·22
1848	+ 1·14	− 0·49	+ 0·24	− 0·88
1849	+ 0·59	− 0·44	+ 0·66	− 0·81
1850	+ 0·59	− 0·91	+ 0·29	+ 0·04
Means	+ 0′·55	− 0′·36	+ 0′·33	− 0′·52

" These results leave no doubt of the existence of a lunar period. In fact, there are but two instances, out of forty-four, in which the rule announced does not hold. The mean difference of the first and second quarters is 0′·91, and that of the third and fourth 0′·85.

" It has been stated, that the law of the variation is not exhibited distinctly, from day to day, in the separate years. But when we combine the results of the eleven years, we obtain a series of numbers, in which the law of the change from day to day is evident. The following are the results:

Day.	Range.	Day.	Range.	Day.	Range.	Day.	Range.
0	9′·78	7	9′·66	15	9′·59	22	8′·79
1	10·27	8	8·91	16	10·07	23	9·02
2	10·15	9	8·94	17	9·94	24	9·16
3	10·77	10	8·87	18	10·23	25	9·14
4	10·27	11	9·12	19	10·10	26	8·83
5	10·24	12	8·92	20	10·00	27	9·38
6	9·55	13	9·33	21	9·52	28	9·60
		14	10·14			29	8·71

We see here, as before, that the range is greatest in the first and third quarters, and least in the second and fourth. The maxima occur about the 3rd and 18th days of the moon's age, and the minima about the 10th and 24th days.* The mean amount of the variation is 1'·5, which is consequently double of the effect due to the lunar action. The mean magnitude of the range itself, from which the lunar variation is eliminated, is 9'·6; so that the effect of the moon is to that of the sun as 1 to 13 nearly.

"It is obvious that the numbers above given are the resultants of two oscillations, whose periods are different, and which therefore combine in every variety of phase, namely, the diurnal changes produced by the two luminaries; and, on account of the doubling of the lunar change, they are well fitted to establish its existence. The next step in our inquiry will be to ascertain the law of the variation, whose total amount has been here deduced. This can be done only by an analysis of the hourly observations in reference to the moon's hour-angle, which will form the subject of another communication."

The author concluded by some remarks upon the supposed ten-year periodical variation of the mean yearly range, indicated by Professor Lamont, and upon the corresponding variation of the mean disturbance noticed by Colonel Sabine. Although quite prepared for a correspondence between these phenomena, upon grounds stated in a paper formerly read to the Academy,† he doubted the existence of a true period in either.

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* It would seem as if there were two minima, with a small intervening maximum, in the fourth quarter. These results differ altogether from those of Mr. Broun, by whom the effect of the moon's age upon the range of the magnetical declination has been also examined. According to him, the diurnal range of the magnetic declination has but one maximum and one minimum during the month, the maximum occurring two or three days after full moon, and the minimum about three days before new moon.

† Transactions of the Royal Irish Academy, vol. xxii. p. 94.

Sir William R. Hamilton, LL. D., gave an account of the geometrical interpretation of some results obtained by calculation with biquaternions.

In this communication *bivectors* were employed, and were shown to conduct to interesting conclusions. The conception of such bivectors,

$$\rho + \sqrt{-1}\,\rho',$$

where ρ and ρ' denote two geometrically real vectors, and $\sqrt{-1}$ is the *old* and ordinary (or commutative) imaginary of common algebra, and generally of *biquaternions* such as

$$q + \sqrt{-1}\,q',$$

where q and q' are real quaternions, interpretable geometrically on the author's principles, had occurred to him many years ago; and the remark which he made to the Academy in November, 1844 (see the Proceedings of that date), respecting the representations, in his Calculus, of the geometrically *unreal* tangents to a sphere from an internal point, as having *positive squares*, belonged essentially to this theory of bivectors. In the same year, the more general theory of biquaternions had occurred to him, in connexion with what in his theory presented themselves as the *imaginary roots*, or purely symbolical solutions, of a certain quadratic equation in quaternions. Notices on the subject have since appeared in his subsequent papers, in the Proceedings of the Academy, and in the Philosophical Magazine: and a fuller statement of the theory will be found in his (as yet unpublished) Lectures on Quaternions, of which many sheets have long since been distributed among his friends and others in the University. On the present occasion he has employed *bivectors with null squares*, such as

$$i + hj, \text{ or } j + hk,$$

where i, j, k are the *peculiar* symbols of the quaternion calculus, observing the laws communicated by him to the Academy in November, 1843, while h is used as a temporary and abridged symbol for the *old* imaginary $\sqrt{-1}$. In fact the rules of this calculus give

$$(j+hk)^2 = j^2 + h(jk+kj) + h^2k^2,$$
$$= -1 + 0h + (-1)(-1) = 0,$$

h being a *free* (or commutative) factor in any multiplication, as in algebra, but jk being $= i = -kj$, while

$$h^2 = i^2 = j^2 = k^2 = -1.$$

Thus, at least for any numerical exponent x, we have the simplification,

$$(1+j+hk)^x = 1 + x(j+hk),$$

which Sir W. R. H. states that he has found useful in a part of a geometrical investigation, respecting the interpretation of certain continued fractions in quaternions, of the form

$$u_x = \left(\frac{b}{a+}\right)^x u_0,$$

already mentioned by him to the Academy on a former occasion, and specially for the case when $\alpha^4 + 4\beta^2 = 0$, in the fraction

$$\rho_x = \left(\frac{\beta}{\alpha+}\right)^x \rho_0,$$

where the vector β is supposed to be perpendicular to α and ρ_0, and therefore also to ρ_x.

By the investigation referred to, he has found, among others, the following results. Let C and D be two given points, and P an assumed point. Perpendicular to DP draw CQ, towards a given hand, and such that the rectangle $CQ \cdot DP$ may be equal to a given rectangle $CC'D'D$. From Q derive R, as Q has been derived from P, and conceive the process repeated without end. Then, I., the locus of the alternate points $P, R, T, \ldots$ is one circle, and the locus of the other alternate points $Q, S, U, \ldots$ is another circle. II. These two circular loci have the top $C'D'$ of the given rectangle for the common radical axis, of themselves and of the given circle described on CD as diameter. III. The centres of the two alternate loci are harmonic conjugates with respect to the given circle. IV. If from two fixed summits of the two loci chords be drawn to the successive points, and prolonged (if necessary) till they meet the radical axis in other points P', Q', &c.; if also a summit F of the given circle be suitably chosen (on the line of the three centres), then the two lines FP', CQ' will cross in one point on the given circle, the two lines FQ', CR' in another point thereon, and so on for ever: and the same thing holds for the lines DP', FQ', or DQ', FR', &c. Particular forms of these theorems have been published in the Phil. Mag. for this month (February, 1853), but only for the case when the top of the rectangle, or the radical axis, meets the given circle in two *real points*, A, B, in which case the derived points Q, R, .. *converge* towards the point B nearer to C. In the contrary case there can be *no convergence*, but there may be *circulation in a period*. For if we then denote by V one of the two common points of the system of common orthogonals, and by W the point of contact of the given circle with a tangent drawn from the middle point between them, the angle $P'VQ'$ or $Q'VR'$ will be constant, and equal to VFW; so that if this latter angle be commensurable with a right angle, the points $P'Q'R'\ldots$, and therefore also the points $PQR\ldots$ will recur in a certain periodical order. These conclusions have been by Sir W. R. Hamilton obtained as results of his quaternion analysis; but he believes that it will not be found difficult to confirm them by a purely geometrical process, founded on the known theory of homographic divisions.

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* Note, *added during printing*.—Since the foregoing communication was made, the author has seen how to obtain such *geometrical* proofs, or confirmations, of all the foregoing results.

WEDNESDAY, MARCH 16TH, 1853. (Stated Meeting.)

THOMAS ROMNEY ROBINSON, D.D., PRESIDENT, in the Chair.

The Secretary read the following Report:—

The circumstances of the tenure under which the House in Grafton-street was held by the Academy were fully detailed in last year's Report. It is unnecessary, therefore, to allude to the subject now, except to say, that the Academy, by a vote passed at the General Meeting, held Monday, 12th April, 1852, having empowered the Council to dispose of their interest in the lease, several applications were received; but some legal difficulties having been raised, in consequence of a life named in the original lease which was not clearly proved to have dropped, the Council was obliged to wait until the Decree of the Master in Chancery was made known.

On the 3rd of May last, the Secretary of Council was directed to write to the Law Agent of the Academy, urging him to expedite the necessary legal proceedings as much as possible, as the Academy was liable to the rent of the House in Grafton-street as long as it remained in their hands. To this letter the following answer was received:

"26, *Molesworth-street*,
"*8th May*, 1852.

"SIR,—We beg to acknowledge your favour of 6th instant, and regret to say, in reply, that there is no course at present open to the Royal Irish Academy, or those acting on their behalf, by which the arrangements respecting the House, 114, Grafton-street, can be expedited; but as it would naturally be satisfactory to the Council to be informed of the exact state of the matter, we may perhaps as well mention it upon this opportunity.

"The Academy holds the House under Mr. Truell, who again holds under Mr. John Wisdom, the latter being himself a tenant to the Corporation of the City of Dublin.

" The lives in being are those of Mr. and Mrs. Wisdom, both far advanced in years; but Mr. Wisdom—being entitled to renewal for one additional life, should any of the *cestui que vies* die before Easter, 1851, and believing that that contingency had arisen, Mr. Joseph Wilson, one of the lives, not having been heard of for many years—applied for a renewal for the life of a young gentleman now about ten or eleven years old, son of Mr. Brunel, the celebrated engineer. This, however, the Corporation refused to comply with, and Mr. Wisdom was forced to institute proceedings in Chancery, the result of which was, that by a Decree of 18th December, 1851, Mr. Wisdom was declared entitled to a renewal; but with a proviso, that in case Joseph Wilson should be proved to have been living at Easter, 1851, such renewal should be declared null and void. Since then, we are informed, Mr. Wisdom's Solicitors have made every exertion to have the renewal perfected, but with every possible delay and obstacle opposed to them, so that, at length, they have been forced to proceed upon the reference granted to the Master in the matter, to have a draft renewal settled by him, and ground compulsory proceedings against the Corporation; and which reference is, we understand, pending now before Master Litton, whose adjudication may be expected before long. Under these circumstances, the Council will perceive, that the Academy cannot stir until Mr. Truell shall have obtained his renewal from Mr. Wisdom, and which the latter will not be competent to execute until he shall have enforced his from the Corporation of Dublin; and that in the meantime all that we can do is, to watch the course of proceedings of the different parties.

" We have the honour to be, Sir,
" Your most obedient servant,
" (Signed) W. B. Wallace and Sons.

" *To Rev. Dr. Graves,*
" *Secretary of Council, R. I. A.*"

On the 14th of August, the Decree of the Master in Chancery having been made, directing a renewal of the head lease, a Special Meeting of Council was held, at which it was resolved, that the interest of the Academy in the lease of the House, 114, Grafton-street, should be disposed of by public auction on the 23rd of August, instant, and that the Treasurer be empowered to carry this Resolution into effect.

The following is the Report made to the Council by the Treasurer, in pursuance of this Resolution:—

"*4th October*, 1852.

"The Treasurer reports, that in obedience to the directions of Council, he caused the House, 114, Grafton-street, to be set up by public auction: terms of sale being, one-quarter of the purchase-money to be paid on the announcement of the purchaser, the remainder on possession being given. The House sold for £620, the gas-fittings for £10. The fourth of the purchase-money was at once paid. Shortly after, an application was made to the Treasurer, requesting that the purchaser may be at once put into possession, in order that he may commence repairs; to this he consented, on the condition that a Letter of Guarantee should be given to him; that the conditions as to insurance, &c., mentioned at the time of sale, should be given to him; and also on the understanding, that the balance of purchase-money should be immediately paid. However, Mr. Clibborn took upon himself to give posesssion without intimating to the Treasurer his intention of so doing; the Letter was subsequently furnished, and the legal adviser of the Academy has intimated, that no difficulty can arise in regard to the payment of the money in question."

The following is a copy of the Letter of guarantee, alluded to in this Report, which was given by Mr. John Stevenson, Secretary to the Alliance and Consumers' Gas Company:—

"*Consumers' Gas Company*,
"*Dublin*, 26*th Aug.*, 1852.

"Sir,—The Royal Irish Academy having this day permitted the Alliance and Dublin Consumers' Gas Company to go into possession of the House and Premises, 114, Grafton-street, for the purpose of saving time in fitting them up,—I hereby, on the part of said Company, undertake that such possession shall be without prejudice to their completing their purchase thereof, according to the

Conditions of Sale; and that same shall be completed as soon as possible after the return of the Company's Solicitor, who is at present in England.

"I am, Sir, your obedient Servant,
"(Signed) John Stevenson,
"*Secretary.*

"*To Robert Ball, LL.D.,*
"*Treasurer, R.I.A.*"

The additions to the present House, to be erected by the Board of Works, were begun in August last, and although the weather during a great part of the winter has been very unfavourable for building, they are now far advanced. The Library has been roofed in; and the roof of the Museum, which is to be chiefly of glass, is now nearly ready for the glazier. Still, it is impossible that these buildings can be finished and dry enough for occupation, until the end of the summer; and the Academy must therefore submit for several months to the inconvenience we have suffered since our removal to the present House, of having our Museum and Library in disorder.

These circumstances induced the Council to listen the more readily to the liberal proposal made by the Committee of the Great Industrial Exhibition, to be held this year in Dublin, to receive our Museum as a whole, and appropriate to it a separate apartment in the building now in progress for the reception of the Exhibition. After some negotiations with the Committee, for the purpose of obtaining such security for the safety of the Museum as the Committee had it in their power to give, the Council agreed to recommend this important measure to the Academy; and it was resolved, on the 14th ult., that the Museum of the Academy be exhibited in the Great Dublin Exhibition of 1853, on the conditions agreed to between the Council and the Committee of the Exhibition: and that the Council be empowered to take such further steps, from time to time, for the security of the Museum, as to them may seem necessary.

The conditions finally agreed upon between the Council and the Committee of the Great Exhibition, are in substance these:— That the Committee shall give to the Academy an undertaking in writing, that all such precautions for the safety of the Museum shall be taken as the Council shall deem necessary; that full access to the Museum at all times shall be given to such parties as shall be authorized by the Council to watch over its arrangement and safe keeping; and that the expenses of all such necessary precautions, as well as of the insurance of the Museum against fire, shall be borne by the Committee of the Exhibition. To carry out these arrangements, the Council have appointed a Committee, consisting of the Treasurer and Secretaries, with Dr. Petrie and Dr. Aquilla Smith, who are empowered to direct the necessary measures for the exhibition, arrangement, and safe keeping of the Academy's Museum, in the Building of the Great Exhibition. They have also authorized the Assistant Secretary to co-operate with this Committee in carrying their orders into effect, and to take such steps as may be necessary for the removal of the Museum into the Exhibition Building.

By these concessions on the part of the Academy, it is hoped that our Museum will form a striking and attractive feature in the approaching Exhibition, and that the disadvantage under which we would otherwise have laboured, from the unfinished state of our present House, will be more than counterbalanced. The Committee of the Exhibition have caused casts of several ancient ecclesiastical crosses, and other objects of architectural interest, to be taken, with a view to their exhibition. All these they have kindly signified their intention of ultimately depositing in the Museum of the Academy. They have also procured the loan, for exhibition, of some valuable Irish antiquities, now in the hands of private individuals. These, with our Museum, will constitute the largest and most important collection of national antiquities that has ever, perhaps, been presented to the study and examination of antiquaries in this country. The Council would, therefore, anticipate a very important movement in favour of antiquarian science from the approaching Exhibition; which will afford an opportunity of examining in juxta-position a collection of antiquities such as has never before been brought together: and it cannot be doubted, that if this peculiar feature of the Dublin Exhibition is made generally known, it will attract to this city, during the approaching summer, not only the antiquaries of London and

Edinburgh, but also those of the Continent of Europe, to whom our Irish antiquities are so deeply interesting.

In the Report of last year, allusion was made to the subject of a Catalogue of our Museum; and it has since been ascertained from Dr. Petrie, to whom the task had been committed, that he was unable to complete the Catalogue within the limits fixed by the Resolution of Council of 7th January, 1850: the Council, therefore, appointed a Museum Committee, to carry out the plan already agreed upon by the Academy for the preparation and publication of the Catalogue.

This Committee presented to the Council, on the 14th of April last, the following Report:—

"The Resolution of the Council, directing a Catalogue of the Museum to be prepared, distinctly specifies three objects to be kept in view:—

"1. An accurate list of everything in the Museum.

"2. Such a list as to be a guarantee for the safety of the articles.

"3. A descriptive Catalogue for the use of visitors.

"It is the opinion of the Committee, that the first of these objects would be attained by continuing the Register commenced some years ago, in connexion with the Pictorial Catalogue, which was, however, discontinued about two years since.

"They would, therefore, recommend, that this list be continued; and that the Pictorial Catalogue be also completed up to the present time, by which the second of the foregoing objects would be in a great measure attained, especially if weights and measurements were added to each object portrayed.

"For this purpose it will be necessary that a sum, not exceeding £50, be placed at the disposal of the Committee.

"Whilst the Register and Pictorial Catalogue are in course of completion, as above recommended, the Committee will take the necessary steps for a permanent classification of the Museum, with a view to the preparation of the Descriptive Catalogue."

In accordance with this Report, it was recommended by the Council, and voted by the Academy, that £50 should be placed at the disposal of the Museum Committee, for the purpose of continuing the Register of the Museum, and of completing the Pictorial Catalogue.

This sum, however, has not been as yet expended. The Committee have ordered, that the Register of the Museum, commenced some years ago, shall be completed, as a necessary preliminary step to the formation of a Catalogue. In accordance with this order, Dr. Aquilla Smith has kindly assisted in weighing all the gold articles, entering their dimensions and weights in the Register; and Mr. Clibborn is now engaged in filling up the column of the Register headed "*How procured*," which will tell whether the article has been obtained by donation or by purchase. He is adding also a reference to the sheet of the Pictorial Catalogue (so far as it has been hitherto completed), in which each article is portrayed, with such other notices as can now be added, tending to complete its history and identification.

With a view to the continuation of the Pictorial Catalogue, the Committee procured specimens of drawings from three artists, which they did not, however, find quite satisfactory. They have it, therefore, under consideration, whether the recent improvements in photography may not afford the means of attaining this object, more economically, as well as more effectually, than by ordinary drawings. The Calotype process, for example, appears to offer many advantages, as its results may be multiplied *ad libitum*, and Members, or foreign scientific bodies, supplied with copies of our Pictorial Catalogue at a very reasonable cost. It is to be observed also, that the pictures thus obtained will bear microscopic examination, and will thus record what no human hand or eye could otherwise portray. The season of the year, however, has hitherto been unfavourable to experiments on the practicability or expediency of this suggestion; but the Committee hope very soon to arrive at a satisfactory conclusion. They are now engaged in considering the most economical means of producing the Calotype pictures, as it seems probable, so far as they can now form an opinion, that the cost of the process is probably the only objection to its adoption.

The following is a list of the antiquities purchased by the Committee of Antiquities during the past year:—

William Donoghoe, sundry articles from Strokestown, .	£0	10	0
George Kelly, a brass pot, ...	1	5	0
Michael Geraghty, gold brooch, ...	0	10	6
John Donegan, gold bar, 2oz. 16dwts. 21grs., 90*s.*, . .	12	15	11
Ditto, gold fibula, 1oz. 8dwts. 20grs., 90*s.*, .	6	9	9
Ditto, gold collar, 1oz. 7dwts. 12grs., 90*s.*, . .	6	3	9
Ditto, broken gold, 10dwts. 8grs., 80*s.*, ...	2	1	4
Ditto, gold ornaments, 1oz. 8dwts., 90*s.*, ...	6	6	0
Ditto, silver signet, ...	1	0	0
Thomas Mason, bronze cow's head, ...	0	10	0
Mary Conroy, Strokestown, sundry antiquities, ...	3	1	6
M. Carey, sundries from Wexford, ...	7	10	0
W. Edwards, brass figure of crucifixion, ...	3	0	0
M. Donoghoe, sundries from Strokestown, ...	1	7	6
James Underwood, sundry antiquities found in Dublin, .	10	0	0

The Proceedings of the Academy have been published during the past year with great regularity: and the thanks of the Academy are due to Mr. Jellett, who has so zealously and efficiently undertaken the task of putting them through the Press.

It was represented to the Council, that the stringency of a rule hitherto in force was practically inconvenient to Members desirous of reading Papers to the Academy. This rule required an abstract of every Paper, in a form fitted for publication, to be lodged with the Editor of the Proceedings, before the leave of the Council for reading such Paper to the Academy could be obtained. It was found, however, that the Authors of Papers were frequently desirous of obtaining the leave of the Council, before they had so far written out their Papers as to be able to put an accurate abstract of what they intended to say in a shape fit for publication. It was, therefore, deemed advisable to modify this rule, and the Academy, on the recommendation of Council, adopted the following Resolution on the 10th of January last:—

"That leave be given to read Papers of which the general nature shall have been approved by Council; but that, unless an abstract of a Paper shall be delivered to the Secretary of the Council, on or before the night of reading, the title only of it shall be published in the Proceedings of the Academy."

During the past year, the Council have consented to exchange Transactions with the Imperial Society of Antiquaries of France.

The Academy, on the recommendation of Council, have elected the following Honorary Members :—

In the Section of Science.

Elie De Beaumont, Paris.
M. V. Regnault, Paris.
Augustin-Louis Cauchy, Paris.

In the Section of Polite Literature.

William H. Prescott, Esq., United States.
Right Hon. Thomas B. Macaulay, London.

[No vacancy in the Section of Antiquities.]

The following have been elected Ordinary Members of the Academy during the past year :—

Henry H. Head, M. D.
William Nelson Irwin, Esq.
James Sheridan Muspratt, Esq.
Henry John Porter, Esq.
Arthur Leared, M. B.
Lundy E. Foot, Esq.
Gilbert Sanders, Esq.
Rev. Alexander Leeper.
William Dargan, Esq.
David Brereton, M. D.
Alfred H. M'Clintock, M. D.

The following Members have been removed by death :—

Honorary Members.

Thomas Thomson, Esq., M. D. Elected 25th January, 1836; died 2nd July, 1852.

Ordinary Members.

Abraham Whyte Baker, Esq. Elected 13th April, 1846; died 21st October, 1852.

Richard Cane, Esq. Elected 9th February, 1846; died — February, 1853.

John Carly, Esq. Elected 8th January, 1849; died October 1852.

James S. Close, Esq. Elected 23rd June, 1845; died 22nd May, 1852.

Pierce Mahony, Esq. Elected 27th October, 1834; died 19th February, 1853.

Major-General Colby, R. E. Elected February, 1825; died 10th October, 1852.

W. B. Wallace, Esq. Elected 26th April, 1830; died 12th October, 1852.

Rev. John Magrath. Elected 12th February, 1849; time of death not known.

The Report having been read by the Secretary,

It was resolved,—That the Report of the Council be adopted, and printed in the Proceedings.

The Ballot for the annual election having closed, the Scrutineers reported that the following gentlemen were elected Officers and Council for the ensuing year:—

President.—Rev. Thomas R. Robinson, D.D.

Treasurer.—Robert Ball, LL. D.

Secretary to the Academy.—Rev. James H. Todd, D. D.

Secretary to the Council.—Rev. Charles Graves, D. D.

Secretary of Foreign Correspondence.—Rev. Samuel Butcher, D. D.

Librarian.—Rev. William H. Drummond, D.D.

Clerk and Assistant Librarian.—Mr. Edward Clibborn.

Committee of Science.

Sir Wm. R. Hamilton, LL. D.; Rev. Humphrey Lloyd, D. D.; James Apjohn, M. D.; Robert Ball, LL. D.; Sir Robert Kane, M. D.; George J. Allman, M. D.; Rev. Samuel Haughton, A. M.

Committee of Polite Literature.

Rev. William H. Drummond, D. D.; Rev. Charles W. Wall, D. D.; John Anster, LL. D.; Rev. Charles Graves, D. D.; Rev. Samuel Butcher, D. D.; Digby P. Starkey, Esq.; Rev. John H. Jellett, A. M.

Committee of Antiquities.

George Petrie, LL. D.; Rev. James H. Todd, D. D.; J. Huband Smith, Esq., A. M.; Aquilla Smith, M. D.; Earl of Dunraven; Major Larcom, R. E.; Lord Talbot de Malahide.

The President, under his hand and seal, nominated the following Vice-Presidents for the current year:—

James Apjohn, M. D.; Rev. Humphrey Lloyd, D. D.; Major Larcom, R. E.; George Petrie, LL. D.

Rev. Dr. Graves said, it was his duty, on the part of Mr. Richard Hitchcock, to present to the Museum of the Academy two inscribed Ogham monuments, and a portion of an ancient quern. Mr. Hitchcock had described the articles in a letter, from which the following was an extract:—

"The stone which I have marked No. 1 (my new discovery last autumn) is believed to have been originally brought from the same rath in which was found another fine Ogham monument, now preserved at Lougher. It is a good specimen of these inscriptions. No. 2 was the lintel over the doorway of a little building of this ground form (Ω), the flat side showing where the doorway was, in a rath at Gortnagullanagh. Outside this building was another circle, running round it. This stone bears a remarkably well-preserved Ogham inscription, and exhibits two deeply cut crosses, one on either side of the stone. In order to prevent mistake, it may be necessary to state clearly, that this stone was not found in the *souterrain* of the rath, the little building above referred to having been on the surface of the ground but within the enclosure of the rath. An ancient quern was also found near the Ogham stone in this fort, and as I thought it an interesting addition, I procured one stone of it, which accompanies the Ogham inscription."

Dr. Graves observed, that these stones formed a valuable donation to their Museum. Mr. Hitchcock had before presented monuments of the same kind, but in the present case he was a discoverer as well as a donor. Both these stones had been found in the county of Kerry, and were well preserved.

The inscription on the first of the monuments appeared to contain two proper names. It commenced with the word Curci, which Dr. Graves took to be the genitive case of the proper name Corc. It also bore a name beginning with Mucoi (which appeared on a great number of these monuments,—he should say, speaking from recollection, on as many as six or eight of them), and which he took to be the name of a tribe. The inscription was not altogether perfect, the very end being broken off; but all the characters are exceedingly distinct. Corc was a very well-known Irish name; and although the other name had not as yet been identified, he hoped to ascertain what it was, by examining the pedigrees of the ancient tribes occupying the district in which the stone was found. This stone, from its rudeness, might be supposed to be a pagan monument; but the other had two crosses upon it, one at either side, thus supporting the opinion of those who referred these inscriptions to the Christian period; and in particular he would notice in this monument the fact, that so far from there being any ground for saying that the cross could be more recent than the inscription, an unprejudiced person, carefully examining the stone, might be disposed to arrive at an exactly opposite conclusion. The inscription is, on the whole, sharper than the cross; but Dr. Graves explained this by supposing, that while they were cut on the stone at the same time, the cross has been worse preserved than the Ogham strokes, because it was upon that face of the stone which was in the direction of the cleavage—the effect of the action of the weather being to cause the surface of the stone to scale off; while the strokes which were cut across the grain were almost as distinctly preserved as if they had been recently executed. There were two inscriptions on the stone which contained the crosses. One exhibited the name "Decedda," which was as plainly written as it could possibly be. It struck him as worthy of notice, that this identical name occurred upon one of the seven stones in the cave of Dunloe, which had been taken to be a pagan sepulchre. Upon the other edge of the stone was almost the whole of another name, which belonged to the Christian time. The letters formed the word Catufi, and he found that Cathubius was the name of an abbot, whose death was recorded in the Annals of the Four Masters as having occurred in the year 554.

The following communication from the Rev. Dr. Hincks, dated 7th March, 1853, was read by the Secretary:—

"My dear Sir,—I have discovered at my recent visit to the British Museum:—

"1. Two fragments of syllabariums of a similar nature to that which I described in a note to my recent Paper (Transactions, vol. xxii. P. L., p. 342). One of these is in excellent preservation.

"2. I obtained the following complete list of the monograms, in their proper order, representing the twelve Assyrian months of thirty days and the Epagomenæ. These monograms I would read provisionally by the Egyptian names of the corresponding months.

I.	Thoth,	(or)	
II.	Paophi,	do.	
III.	Athyr,	do.	
IV.	Chæac,	do.	
V.	Tybi,	do.	
VI.	Mechir,	do.	
VII.	Phamenoth,	do.	
VIII.	Pharmuthi,	do.	(or)
IX.	Pachon,	do.	
X.	Payni,	do.	
XI.	Epiphi,	do.	
XII.	Mesore,	do.	
Epagomenæ,		do.	

"3. I determined the points represented by each of the four names, which Colonel Rawlinson recognised on the Khorsabad Bulls, as representing the four cardinal points. I am not aware that the point denoted by any one name had been previously determined, any more than the place in the Calendar of any one month. I have succeeded in determining them all, upon evidence that precludes further controversy.

East,	
North,	do.
West,	do.
South,	do.

"4. I have determined the division of the Manah, which was used by the Assyrians. It was sexagesimal. The Manah, itself the sixtieth of the Talent, contained sixty Shekels. The Shekel, the Double Shekel, and the Quadruple Shekel, were all represented by monograms.

The Manah, , = 16.14 oz. Troy.

$\frac{1}{15}$ = 4 Shekels, 

$\frac{1}{30}$ = 2 Shekels, 

$\frac{1}{60}$ = 1 Shekel, 

"I remain, my dear Sir,
"Yours very truly,
"EDWARD HINCKS."

The Secretary, on the part of Dr. Lentaigne, exhibited an ancient Irish reliquary, supposed to contain the hand of St. Patrick, procured at Downpatrick, and now in the possession of the Right Rev. Dr. Denvir.

Dr. Aquilla Smith presented a Manuscript Catalogue of the British Coins and Medals in the collection of the late Very Rev. H. R. Dawson, Dean of St. Patrick's.

A special vote of thanks was given to Dr. Smith for his donation.

MONDAY, APRIL 11TH, 1853.

THOMAS ROMNEY ROBINSON, D. D., PRESIDENT, in the Chair.

THE Rev. Beaver H. Blacker; Major Bonner; John E. Butler, Esq., C. E.; Francis R. Davies, Esq.; Rev. William Fitzgerald, D. D.; John Lentaigne, M. D.; James J. Mac Carthy, Esq.; Alexander Read, M. D.; and Henry H. Stewart, M. D.; were elected Members of the Academy.

The Secretary of the Academy presented, from F. W. Barton, Esq., two bronze ladles and a large bronze sword, of great beauty, and in perfect preservation; from the Dean of Kilmacduagh, several fragments of the upper stone of a quern, handsomely ornamented; from Mr. Gillespie, the bronze ring of a fibula, found at Highfield, Rathfarnham. The Proceedings of the Society of Antiquaries of Scotland, vol. I. part i.; presented by the Society.

The Secretary read a paper by Mr. William Mallet, on the results of his chemical examination of the metallic articles in the Museum of the Academy.

The President made some remarks on Mr. Mallet's communication.

Rev. Dr. Drummond read the first part of a paper on the achievements of Magnus Barefoot, king of Norway, and on his defeat and death in the battle of Magh Cobha, in Ireland, A. D. 1103.

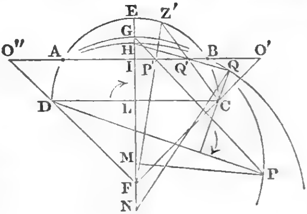
Professor Sir William Rowan Hamilton, LL.D., communicated a few remarks on the geometrical demonstration of some theorems lately obtained by means of the quaternion analysis.

1. (*Rule of Derivation.*)—Let CD be a given right line, bisected in L, and LI a given perpendicular thereto. Assume at pleasure any point P in the same plane, and *derive* from it another point Q, by the conditions that

$$CQ \perp DP, \qquad CQ \,.\, DP = CD \,.\, LI,$$

and that the rotation from the direction of CQ to the direction of DP shall be towards the same hand as that from LD to LI. From Q derive R, and from R derive S, &c., as Q has been derived from P. It is required to investigate geometrically the chief properties of the resulting arrangement.

2. (*First Case: $LI < LD$*).—If the given line LI be less than LD, then, parallel to the latter line, there can be drawn, through the extremity I of the former, a chord AB of the circle (L), described on CD as diameter: and we may suppose that the point B is nearer than A to C. Then,



$$CQ \,.\, DP = CA \,.\, DA = CB \,.\, DB,$$

and $$ACQ = ADP, \qquad BCQ = BDP,$$

even if *signs of angles* (or directions of rotation) be attended to. Thus the two triangles ACQ, PDA, and in like manner the two triangles BCQ, PDB, are equiangular, but oppositely turned, like a figure and its reflexion in a plane mirror, or like the two triangles ABC, BAD: which relations we may perhaps not inconveniently express, by saying that in each of these three pairs the two triangles are *inversely similar*, or by writing,

$$ABC \propto' BAD, \quad ACQ \propto' PDA, \quad BCQ \propto' PDB; \qquad (1)$$

and then either of these two latter formulæ of inverse similarity of triangles is sufficient to express the *rule of derivation* of the point Q from P.

3. Hence, attending still to signs of angles, we may see (even without referring to the figure) that

$$CQA = PAD, \quad CQB = PBD;$$

and that therefore

$$\begin{aligned} AQB &= CQB - CQA = PBD - PAD \\ &= (ADP + DPA) - (BDP + DPB) \\ &= ADB - APB = ACB - APB; \end{aligned}$$

or that

$$APB + AQB = ACB. \tag{2}$$

The *sum of the two angles subtended by the fixed chord* AB, at the assumed point P and at the derived point Q, is therefore *constant*, and equal to the angle which the same chord subtends at the point C (or D); these angles being supposed to change their signs when their vertices cross that fixed chord. (This result was given in the Philosophical Magazine for February, 1853, as one of several which had been obtained by applying quaternions to the question.)

4. In like manner if we continue to derive successively other points, R, S, T, U, ... we shall have

$$AQB + ARB = ACB, \text{ \&c.},$$

and therefore

$$\left. \begin{aligned} APB &= ARB = ATB = \ldots, \\ AQB &= ASB = AUB = \ldots; \end{aligned} \right\} \tag{3}$$

the *alternate points*, P, R, T, ... are therefore situated on *one circular locus* (M), and the *other* alternate and derived points Q, S, U, ... are on *another circular locus* (N); or rather these two sets of alternate points are contained on two circular *segments*, both resting on the fixed chord AB as their *common base* (as stated in the Phil. Mag. just cited).

5. It is evident also that if E, F be (as in fig. 1) the summits of the two semicircles on CD, of which the former con-

tains the chord, and if M, N be the centres of the two loci, then

$$APB = AMI, \quad AQB = ANI, \quad ACB = ALI = 2AFI;$$

so that, by (2),

$$AFI - ANI = AMI - AFI, \text{ or } FAN = MAF: \tag{4}$$

wherefore the centres M, N are *harmonic conjugates* with respect to the given circle (L), or its diameter EF, and we may write

$$LM \,.\, LN = LF^2. \tag{5}$$

6. The similar triangles (1) give

$$\frac{QA}{PA} = \frac{QC}{DA}, \quad \frac{QB}{PB} = \frac{QC}{DB},$$

and therefore

$$\frac{QB \,.\, PA}{QA \,.\, PB} = \frac{DA}{DB} = \frac{CB}{CA} = \text{const.}, \tag{6}$$

(as stated in the same number of the Magazine). Hence (as there stated) the successively and *directly derived points* Q, R, S, ... must *tend indefinitely to coincide with the fixed point* B, and in like manner the *inversely derived points* R, Q, P, ... must tend indefinitely to coincidence with the *other fixed point* A, as the limits of their positions, on account of the geometrical progressions of the quotients of distances from those two fixed points, *wherever the first point* P or S of the direct or inverse derivation may be: unless it happen to be exactly *at* either of those two fixed points A and B, in which case the derivation will produce no change of place. (It might therefore be not too fanciful to say that A and B are respectively positions of *unstable* and *stable* equilibrium for the *direct* mode of derivation, but of stable and unstable for the inverse mode.)

7. Let G and H be summits of the loci (M) and (N), so chosen that the lines PG and QH, crossing the fixed chord AB in the points P' and Q', are both internal or both external

bisectors of the angles APB, AQB; and prolong FC, FD, or the external bisectors of ACB, ADB, to meet the same fixed chord prolonged in O' and O''. Then the formula (6) will still hold good, even with attention to the *signs of the segments*, after changing P, Q, C, D, to P', Q', O', O''; we have therefore the two following equations between *anharmonic ratios*,

$$(ABP'\infty) = (ABQ'O'), \quad (ABP'O'') = (ABQ'\infty), \tag{7}$$

which give

$$\frac{Q'O'}{AO'} = \frac{Q'B}{P'B} = \frac{O''A}{O''P'}, \tag{8}$$

and consequently,

$$Q'O' \,.\, O''P' = AO' \,.\, O''A = IO'^2 - IA^2 = \text{const.}, \tag{9}$$

where the constant may be variously transformed: for instance we may write,

$$Q'O' \,.\, O''P' = 2FI \,.\, LI. \tag{10}$$

8. The equations (7) shew that we have the *two involutions*,

$$(AB,\ P'O',\ Q'\infty) \text{ and } (AB,\ P'\infty,\ Q'O''); \tag{11}$$

if then from *any point* Z, assumed at pleasure *on any one of the three circles*, we draw three successive chords of that circle, ZZ' through P', $Z'Z''$ through Q', and $Z''Z'''$ through O', or else ZZ' through Q', $Z'Z''$ through P', and $Z''Z'''$ through O'', the fourth or *closing chord* $Z'''Z$ will in each case pass through infinity; or in other words, this closing chord will be *parallel to the fixed chord* AB. In particular, by placing Z, and therefore also Z''' at F, which will oblige Z'' to be at C or at D, we see that the lines FP', CQ' (or FQ', CR', &c.) must intersect each other (at an angle of 45°) in some point Z' of the given circle (L); and that the same thing holds for the lines FQ', DP' (or FR', DQ', &c.), as stated to the Academy at the

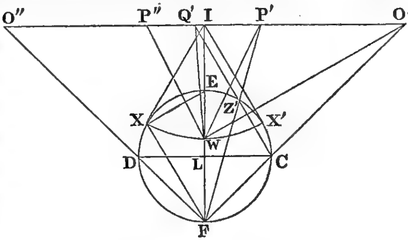
Meeting of February 28th, 1853 (see the Proceedings of that date). And thus we might prove in a new way the indefinite *tendency* of the points Q', R', . . on the fixed chord, and therefore also the corresponding tendency of the points Q, R, . . in the plane, to ***coincidence with the fixed point B*** (that point being still supposed to be ***real***).

9. By placing Z alternately at G and at H, it may be shewn, in like manner, that the alternate lines PQ', RS', TU', . . all pass through one fixed point, namely, the point where GO' intersects (M) again, after meeting it in the summit G; the other alternate lines QR', ST, . . all pass through another fixed point, namely, the second intersection of HO' with (N); again, RQ', TS', . . pass through the analogous intersection of GO'' with (M); and QP', SR', . . through that of HO'' with (N). The opposite summits E, G', H' might be employed in the same way to furnish other theorems, which would not, however, be essentially different from these.

10. (*Second Case*: $LI > LD$).—When the given line LI is greater than LD, or than the radius of the circle (L), that circle is no longer met by the line $O''IO'$ in any *real points*, A, B; but it is obvious, from the known principles of modern geometry, that this latter line is *still* the *common radical axis* of three circles $(L)(M)(N)$, whereof the two latter have still their centres M and N *harmonic conjugates* with respect to the given circle (L), and are still the loci of the two systems of alternate points, P, R, T, . . and Q, S, U, . . . namely, the assumed point and those derived from it by the rule stated in Art. 1, taken alternately: because that rule did not involve any reference to the points of intersection A and B. These circular loci will still have real summits G, H, which will still serve to determine real points, P', Q', R', . . . upon the radical axis, by the alternate lines GP, HQ, GR, . . .; and the same relations of *homography* and *involution* will still hold good, conducting to the same theorems of *real intersections of lines* as before, although the points A and B on the *circle* (L)

have now become *imaginary*. For example, the lines FP', CQ', or the lines FQ', DP', still cross at an angle of 45° in some point Z' on that given circle (L): but because the radical axis is now *beyond* that circle, there is now ***no tendency to any convergence*** of the points $Q'R'S'$ . . , nor of $R'Q'P'$ . . , nor consequently of the points QRS . . , nor of RQP . . , *to any fixed position*.

11. There *may* however be, in this second case, when A and B are imaginary, a constant *circulation in a period*, among the derived points in the plane, or on the axis. For we have now, in the formula (9) (compare fig. 2).



$$-IA^2 = IL^2 - LA^2 = IL^2 - LX^2 = IX^2 = IW^2, \qquad (12)$$

if IX be a tangent (now real) from I to (L), and if W be one of the two fixed points in which the common orthogonals to the three circles (now really) intersect each other: thus (9) becomes, in the present case,

$$O'Q' \,.\, O'P'' = Q'O' \,.\, O''P' = IO'^2 + IW^2 = O'W^2, \qquad (13)$$

if P'' be so taken on the radical axis that I shall bisect $P'P''$ hence $O'WQ' = (WP''Q' =)\ IP'W$; subtracting therefore $O'WP'$ from each, and observing that the triangles $WO'I$, EFX are equiangular, we obtain the formula,

$$P'WQ' = IO'W = EFX = \text{const.} \qquad (14)$$

If then the constant angle thus subtended by $P'Q'$ at W be commensurable with a right angle, or in other words if EX be a *side* or a *diagonal* of a *regular polygon* with n sides inscribed in (L), n derivations of Q' from P' will answer to one or more complete revolutions of the line WP', and will conduct from P' to P' again, and therefore also from P to P, if the number n be *even:* in this case, then, there will be a *period of n points PQR . .*, arranged half on one locus, and half upon the other. For example, if $LI = FE = 2LD$, the chord EX will be the side of an inscribed *hexagon*; and wherever P may be assumed, we shall have a period of *six* points, $PQRSTU$, three (PRT) on one locus, and three (QSU) on the other. But if n be *odd* (for instance, if EX be the side of a regular *pentagon*), then the result of n derivations gives indeed the initial position P' *on the axis*, but this position now answers *in the plane* not to the first assumed point P on (M), but to a certain other point on (N): and the period therefore now consists of $2n$ points in the plane, whereof n are on the circle (M), and the n others on the alternate circle (N). An outline of these results respecting *periods of points* was lately submitted to the Academy, in the communication of last February.

12. (*Third Case:* $LI = LD$).—In the intermediate case, where the given line LI is equal to LD, the radical axis becomes a common tangent at E to the three circles, the centres M, N being harmonic conjugates as before; and because all former theorems respecting intersections of lines hold good, the lines FP', CQ' still cross on (L); and therefore the points Q', R', S', . . . and in like manner R', Q', P', . . . and consequently also the points Q, R, S, . . . and R, Q, P, . . . (the lines GPP', HQQ', &c. being now obtained by lines drawn from the summits G and H remote from the common summit E), must all indefinitely tend to that fixed position E as a limit. As regards the law of this tendency, it may be expressed by either of the formulæ

$$Q'O'.\ O''P' = EO'^2; \quad EP'.EQ' = EO'.\ Q'P'; \qquad (15)$$

or more clearly by the following,

$$\frac{1}{EQ'} - \frac{1}{EP'} = \frac{1}{EO'} = \text{const.} \qquad (16)$$

And instead of treating (as has here been done) this third case, or the case of *contact* at E, of the line $O'O''$ with the circle (L), as a *limit* of the first case, or of the case of *intersection* of that line with that circle in two real and distinct points A, B, we might have treated it *directly*, by a shorter but less general method.*

13. The readers of the excellent *Traité de Géometrie de Position*, by M. Chasles (Paris, 1852), with which the author of the present paper does not pretend to be more than partially acquainted, will not fail to recognise the *double homographic division* of the radical axis (whence such divisions on the circular loci can easily be obtained), with the *double points* A, B, and with O', O'' as *homologues of infinity*. That theory of homographic division may also be employed in the treatment of the case where A and B become imaginary, without any previous reference to the case where those two points are real. It was, however, almost entirely through the quaternion method, including, indeed (as lately stated to the Academy), some use of *biquaternions*, or combining the employment of the old imaginary of algebra with that of his peculiar symbols ijk, that Sir W. R. H. was led, not merely to the *results*, but even to the chief *constructions* of the present paper. In particular, he was led to perceive the theorem of *circulation* in Art. 11, and to make out the geometrical construction given in that article for exhibiting it, by endeavouring to interpret formulæ which presented themselves to him, in investigating the integral of an equation in finite differences of quaternions, which integral was found to contain a *periodical term*.

* Some remarks on this case have appeared in the number of the Philosophical Magazine for the present month (April, 1853).

Monday, April 25th, 1853.

THOMAS ROMNEY ROBINSON, D. D., President, in the Chair.

The Secretary of the Council read the correspondence between the Council and the General Committee of the Great Industrial Exhibition in Dublin, since the last meeting of the Academy, together with the amended conditions agreed to between the Sub-Committee of the Council and the Fine Arts Committee of the Exhibition, and the following Resolution of the General Committee, viz.:—"That this Committee, having had before them the conditions on which the Royal Irish Academy propose to lend the Museum of Antiquities for Exhibition, agree to accept the Academy's offer, with the understanding that the inspection of the Collection of Antiquities in the Exhibition Building be confined to the Treasurer, Dr. Ball, and the Assistant Librarian, Mr. Clibborn, who shall have access at all times for that purpose."

Read,—The following recommendation of the Council:

"That the Academy approve of the articles of agreement on which it is now proposed to exhibit the Academy's Museum." To which the following addition, as an amendment, was moved by John F. Waller, LL. D., seconded by the Rev. Samuel Haughton:—"That the articles of agreement, &c. be agreed to, provided, that in case either of the persons having the right of visiting the Collection of the Academy be unavoidably absent, the Council of the Academy shall have the right of nominating his substitute." A division having been called for, there were—

For the amendment, . . .	29
Against it, ...	12

Whereupon the President declared the recommendation of the

Council, together with the amendment thereto, to have been adopted by the Academy.

The following donations were presented:—

1. Meteorological Observations made at Newport, Tipperary, from 1st July to 31st December, 1852; presented by the Rev. J. W. Heffernan.

2. An iron finger ring found at Cong; presented by S. C. Hall, Esq.

3. The following antiquities were presented, on behalf of the Board of Works, by W. T. Mulvany, Esq.:

Four bronze swords, one hatchet, and three spear-heads; an iron pike-head and hatchet, and three hardwood caltraps: found at Cutts, near Coleraine. Six stone and two bronze celts, an iron spear-head and bayonet, three fibulæ, one bridle-bit, and two cheek-plates, made of bronze: found at Loughran's Island. A short bronze dagger, with highly ornamented blade; an iron sword, with basket hilt, and two oak paddles: found at Toome, from the lower Bann River.

Also, a two-edged iron sword, a sword-hilt, an iron cannon-ball, a bronze spear-head, and a very long and peculiarly shaped stone celt; a bronze cooking-pan, with a handle: collected in the Blackwater River, by Charles C. Ottley, Esq., District Engineer.

Bronze sword and iron skein, found in the Barony of Tullyhunco and County Cavan; an iron tobacco-pipe, found near Killeshandra; a bronze dagger, found in Armagh Drain, County Leitrim; a bronze celt, found in the Woodford River, townland of Cormun, County Cavan: collected by Thomas J. Mulvany, Esq., District Engineer.

A stone pestle, an armlet made of black stone, and a flat circular stone, found near Ballyhoe Lake, County Louth: collected by R. Manning, Esq., District Engineer.

A curious bronze capsule, found in the railway gripe at

Cloomone, near Templemore: collected by A. O. Lyons, Esq., District Engineer.

A bronze flat celt, found in the bed of River Clare, at Lehid, barony of Dunmore, County Galway; two papal medals of Leo II. and Theodorus II.: discovered in a cave at Shandon, near Dungarvan, County Waterford.

The special thanks of the Academy were voted to Mr. Mulvany and the Board of Works for their untiring efforts to preserve our antiquities, and to deposit their collections in the Academy's Museum.

A selection from a large collection of Etruscan vases, &c., from the Marquis of Sligo, was presented by W. C. Hogan, Esq.

The special thanks of the Academy were voted to the Marquis of Sligo for his donation of Etruscan antiquities.

The Caah, or Shrine of the Psalter of St. Columbkill, was again deposited in the Academy Museum, by Sir Richard O'Donnell, Bart., on the condition that it be returned to him on demand.

The special thanks of the Academy were voted to Sir Richard O'Donnell, Bart., for his kindness in again entrusting to the Academy the guardianship of the Caah.

The Secretary to the Academy announced donations of Transactions and other Publications of the Royal Society of Brussels, the Royal University of Christiania, and of the Government of the United States.

Dr. Apjohn read some remarks, in explanation of his paper read 28th February last.

"On Monday, the 28th of February, I had the honour of communicating to the Academy a brief notice of some researches which I had made in relation to 'the nature and relative proportion of the alkalies of the felspars occurring in the vicinity of Dublin.' In this notice I gave the results of my examination of four different specimens of felspar from different localities near this city, and stated that my experiments rendered it impossible for me to adopt the views submitted to the Academy at its previous meeting by Sir Robert Kane, viz., that the potash found by him in numerous analyses of specimens of granites from various parts of 'the great mass which extends from Dublin into the county of Wicklow, should in most cases be considered to belong to the mica which the granite contained; and that the felspar was almost exclusively an albitic, or soda felspar, containing only, in some cases, a small quantity of replacing potash.'

"Upon this paper Sir Robert Kane made some remarks, which are, no doubt, in the recollection of several members of the Academy; and to these, particularly such of them as I considered to have a relation to the subject under discussion, I took an opportunity of replying to the best of my ability. These matters I recapitulate here, not for the purpose of reviving the discussion which took place,—though I, of course, feel no indisposition to discuss in a suitable spirit any scientific question to which I have paid attention,—but with the view of enabling the Academy to understand why I am now trespassing on its indulgence.

"An abstract of my notice first referred to appeared shortly after in the Proceedings (see pages 379–82), and in turning to it, and throwing my eye over the observations attributed to Sir Robert Kane (see page 382), I was, I confess, not a little surprised to find the following passage:

"'Sir Robert Kane explained, in reference to Dr. Apjohn's observations, that he had never denied that orthose or potash felspars were found in certain localities of the Dublin and Wicklow range, and that Killiney was certainly one of those, as was sufficiently well known and indicated by the presence of other minerals, rich in potash as the Killinite itself, of which portions were actually attached, as Dr. Apjohn admitted, to the specimen of felspar selected by Professor Apjohn for examination.'

"In this extract it will be seen I am represented as *admitting* that Killinite, a mineral rich in potash, was *actually attached* to the specimen of felspar which I had *selected* for examination. When this passage first attracted my attention, it certainly appeared to me and others well calculated to convey to the unwary reader the impression that, with the view of making potash figure largely amongst my results, I had purposely operated on a mixture of felspar and Killinite. Now this is a charge which, if untrue, no one can be expected to submit to. I therefore brought the matter under the notice of the Council, but was glad to find, from the observations of Sir Robert Kane on the occasion, that it was not his intention to cast any such imputation upon me. I do not, however, come before the Academy for the purpose of announcing the interpretation which Sir Robert Kane puts—or rather declines to put—on this passage, but to deny, in the most distinct and emphatic manner, that there existed any grounds for representing me as *admitting* that I had selected for examination a specimen of felspar with Killinite attached to it. I never made any such admission, for the simple reason that I could not have done so without being guilty of a deviation from the truth. What I did say was, that one of the felspars on which I had operated, and which was described in my paper as being from Killiney, was concluded to be from this locality from the circumstance of its having been taken from a lump of granite in my laboratory having some particles of Killinite attached to it.

"This correction of what I am willing to consider as a mere misconception by Sir Robert Kane of the words which I did use, I intended to make through the Proceedings, but some formal objections to such a course having been found to exist, I have had the permission of the Council to make my explanation here,—a permission, of which, under existing circumstances, I readily avail myself, though feeling very strongly the general inexpediency of bringing questions partaking of a personal character under the notice of a scientific body."

Sir Robert Kane made some remarks.

Rev. Dr. Drummond read the second part of his paper on Magnus Barefoot.

MONDAY, MAY 9TH, 1853.

THOMAS ROMNEY ROBINSON, D. D., PRESIDENT, in the Chair.

THE Rev. Dr. Todd presented the following donations to the Museum:

1. From William Acheson, Esq., copies of two ancient brooches,—one, Irish, found at Roscrea, and now in the cabinet of George Petrie, LL. D.; the other, Scotch, found in the parish of West Kilbride, Ayrshire.

2. From the Very Rev. Richard Butler, a steel arrowhead, found on Cromwell's Hill, close to Towneley, on the Boyne.

The Secretary reported that the conditions upon which the Academy's consent to exhibit their Museum, as amended by the vote of the Academy at its last meeting, having been communicated to the General Executive Committee of the Exhibition, were approved of, and signed by their Chairman.

The Rev. Dr. Graves read a paper on the properties of the functions of two variables employed by him in the interpretation of his theory of triplets.

"In interpreting my theory of algebraic triplets I was led to the conception of a calculus, whose formulæ bear a close resemblance to those of trigonometry. In this latter calculus there are two *primitive* functions of a single variable, named its *sine* and *cosine*, between which the equation

$$\sin^2\theta + \cos^2\theta = 1$$

holds good, whatever be the value of the variable θ. Besides these primitive functions, there are other *derived* ones, such as the tangent, secant, cotangent, cosecant, &c., which may be expressed by means of the primitive ones; and a number of useful and elegant formulæ may be established, connecting the different trigonometric functions of the same variable, or of variables related to each other in particular ways.

"In the new calculus we have to consider three primitive functions, each of two variables, ϕ and χ, to which I have ventured to give the names of cotresine (ϕ, χ), tresine (ϕ, χ), and tresine (χ, ϕ); and I have found that the two functions obtained by dividing the two latter by the first possess properties analogous to those of the trigonometric tangent, and are sufficiently remarkable to entitle them to a particular designation. I therefore propose to call them *tritangents*.

"In the present paper I mean to give a few of the formulæ which result from a comparison of the functions already noticed.

"Employing the exponential development, putting a for $\frac{-1 \pm \sqrt{(-3)}}{2}$, the cube root of $+1$, and writing $n!$ for the product $1.2.3 \ldots n$, we find

$$e^{a\phi} = \lambda + a\mu + a^2\nu;$$

where

$$\lambda = 1 + \frac{\phi^3}{3!} + \frac{\phi^6}{6!} + \&c.$$

$$\mu = \phi + \frac{\phi^4}{4!} + \frac{\phi^7}{7!} + \&c.$$

$$\nu = \frac{\phi^2}{2!} + \frac{\phi^5}{5!} + \frac{\phi^8}{8!} + \&c.$$

Again,

$$e^{a^2\chi} = \lambda_1 + a^2\mu_1 + a\nu_1,$$

where λ_1, μ_1, ν_1 are the same functions of χ that λ, μ, ν are of ϕ. Hence $e^{a\phi + a^2\chi} = \text{cotr}(\phi, \chi) + a \text{ tres}(\phi, \chi) + a^2 \text{ tres}(\chi, \phi)$ if we agree to put as definitions,

$$\begin{aligned} \text{cotr}(\phi, \chi) &= \lambda\lambda_1 + \mu\mu_1 + \nu\nu_1, \\ \text{tres}(\phi, \chi) &= \lambda\nu_1 + \mu\lambda_1 + \nu\mu_1, \\ \text{tres}(\chi, \phi) &= \lambda\mu_1 + \mu\nu_1 + \nu\lambda_1. \end{aligned} \qquad (1)$$

" The exponential values of the sine and cosine are most useful in all parts of analysis. Analogous values may be assigned to the cotresine or tresine of two variables. Since

$$\begin{aligned} e^{a\phi+a^2\chi} &= \operatorname{cotr}(\phi,\chi) + a \operatorname{tres}(\phi,\chi) + a^2 \operatorname{tres}(\chi,\phi), \\ e^{a^2\phi+a\chi} &= \operatorname{cotr}(\phi,\chi) + a^2 \operatorname{tres}(\phi,\chi) + a \operatorname{tres}(\chi,\phi), \\ e^{\phi+\chi} &= \operatorname{cotr}(\phi,\chi) + \operatorname{tres}(\phi,\chi) + \operatorname{tres}(\chi,\phi), \end{aligned} \qquad (2)$$

Adding these equations, and dividing by 3, we get

$$\operatorname{cotr}(\phi,\chi) = \tfrac{1}{3}\{e^{a\phi+a^2\chi} + e^{a^2\phi+a\chi} + e^{\phi+\chi}\}.$$

In like manner we should find

$$\operatorname{tres}(\phi,\chi) = \tfrac{1}{3}\{a^2e^{a\phi+a^2\chi} + ae^{a^2\phi+a\chi} + e^{\phi+\chi}\}, \qquad (3)$$

and $$\operatorname{tres}(\chi,\phi) = \tfrac{1}{3}\{ae^{a\phi+a^2\phi} + a^2e^{a^2\phi+a\chi} + e^{\phi+\chi}\}.$$

Multiplying together the first and second of equations (2), we get

$$\begin{aligned} e^{-\phi-\chi} = \operatorname{cotr}^2(\phi,\chi) + \operatorname{tres}^2(\phi,\chi) + \operatorname{tres}^2(\chi,\phi) - \operatorname{tres}(\phi,\chi)\operatorname{tres}(\chi,\phi) \\ - \operatorname{tres}(\chi,\phi)\operatorname{cotr}(\phi,\chi) - \operatorname{cotr}(\phi,\chi)\operatorname{tres}(\phi,\chi); \end{aligned}$$

and multiplying this again by the third, we find

$$\begin{aligned} \operatorname{cotr}^3(\phi,\chi) + \operatorname{tres}^3(\phi,\chi) + \operatorname{tres}^3(\chi,\phi) \\ - 3\operatorname{cotr}(\phi,\chi)\operatorname{tres}(\phi,\chi)\operatorname{tres}(\chi,\phi) = 1. \end{aligned}$$

This equation, which holds good whatever be the values of the variables ϕ and χ, corresponds in this calculus to the well-known relation between the sine and cosine.

" In trigonometry we have

$$\cos(-\theta) = \cos\theta, \text{ and } \sin(-\theta) = -\sin\theta.$$

The corresponding formulæ in this calculus are the following:

$$\begin{aligned} \operatorname{cotr}(a\phi, a^2\chi) &= \operatorname{cotr}(\phi,\chi), \\ \operatorname{tres}(a\phi, a^2\chi) &= a\operatorname{tres}(\phi,\chi), \\ \operatorname{tres}(a^2\chi, a\phi) &= a^2\operatorname{tres}(\chi,\phi). \end{aligned} \qquad (4)$$

" The relations between the cotresine or tresine of two variables, and the same functions of these variables with their signs changed, are not quite so simple. They are, however, easily established; and instances frequently arise in which it is necessary to avail ourselves of them.

"Changing the signs of ϕ and χ in the first of formulæ (3), we have

$$3 \text{ cotres}(-\phi, -\chi) = \frac{1}{\{\text{cotr}(\phi, \chi) + a \text{ tres}(\phi, \chi) + a^2 \text{ tres}(\chi, \phi)\}}$$

$$+ \frac{1}{\text{cotr}(\phi, \chi) + a^2 \text{ tres}(\phi, \chi) + a \text{ tres}(\chi, \phi)}$$

$$+ \frac{1}{\text{cotr}(\phi, \chi) + \text{tres}(\phi, \chi) + \text{tres}(\chi, \phi)}$$

and on adding these fractions, we get

$$\text{cotr}(-\phi, -\chi) = \text{cotr}^2(\phi, \chi) - \text{tres}(\phi, \chi) \text{ tres}(\chi, \phi).$$

By a similar process we should obtain

$$\text{tres}(-\phi, -\chi) = \text{tres}^2(\chi, \phi) - \text{cotr}(\phi, \chi) \text{ tres}(\phi, \chi),$$
$$\text{tres}(-\chi, -\phi) = \text{tres}^2(\phi, \chi) - \text{cotr}(\phi, \chi) \text{ tres}(\chi, \phi).$$

These last expressions are particularly useful in geometrical applications of this theory.

"The known formulæ for the sine and cosine of the sum of two arcs may be most readily derived from the equation

$$e^{\theta\sqrt{-1}} = \cos\theta + \sin\theta \cdot \sqrt{-1}.$$

In like manner we may obtain formulæ for the tresines and cotresine of $\phi + h$ and $\chi + k$ from the equations (2). Thus, if ι denote a symbol of distributive operation such that $\iota^3 = 1$, whilst ι, ι^2, and 1 are absolutely heterogeneous, we shall have

$$e^{\iota\phi} = \lambda + \iota\mu + \iota^2\nu,$$
$$e^{\iota^2\chi} = \lambda' + \iota^2\mu' + \iota\nu';$$

whence

$$e^{\iota\phi + \iota^2\chi} = \text{cotr}(\phi, \chi) + \iota \text{ tres}(\phi, \chi) + \iota^2 \text{ tres}(\chi, \phi).$$

In like manner,

$$e^{\iota h + \iota^2 k} = \text{cotr}(h, k) + \iota \text{ tres}(h, k) + \iota^2 \text{ tres}(k, h).$$

Multiplying the two latter equations together, we have

$$e^{\iota(\phi+h)+\iota^2(\chi+k)} = \text{cotr}\,(\phi, \chi)\,\text{cotr}\,(h, k) + \text{tres}\,(\phi, \chi)\,\text{tres}\,(k, h) + \text{tres}\,(\chi, \phi)\,\text{tres}\,(h, k)$$
$$+ \iota\,\{\text{tres}\,(\chi, \phi)\,\text{tres}\,(k, h) + \text{cotr}\,(\phi, \chi)\,\text{tres}\,(h, k) + \text{tres}\,(\phi, \chi)\,\text{cotr}\,(h, k)\}$$
$$+ \iota^2\,\{\text{tres}\,(\phi, \chi)\,\text{tres}\,(h, k) + \text{tres}\,(\chi, \phi)\,\text{cotr}\,(h, k) + \text{cotr}\,(\phi, \chi)\,\text{tres}\,(k, h)\}.$$

Now the left-hand member in this equation being also equal to

$$\text{cotr}\,(\phi + h,\ \chi + k) + \iota\,\text{tres}\,(\phi + h,\ \chi + k) + \iota^2\,\text{tres}\,(\chi + k,\ \phi + h),$$

we may compare the *similar* parts of the two expressions, and thus get at once the three formulæ of which we were in search, viz.:

$$\text{cotr}\,(\phi + h,\ \chi + k) = \text{cotr}\,(\phi, \chi)\,\text{cotr}\,(h, k) + \text{tres}\,(\phi, \chi)\,\text{tres}\,(k, h) + \text{tres}\,(\chi, \phi)\,\text{tres}\,(h, k),$$

$$\text{tres}\,(\phi + h,\ \chi + k) = \text{tres}\,(\chi, \phi)\,\text{tres}\,(k, h) + \text{cotr}\,(\phi, \chi)\,\text{tres}\,(h, k) + \text{tres}\,(\phi, \chi)\,\text{cotr}\,(h, k),$$

$$\text{tres}\,(\chi + k,\ \phi + h) = \text{tres}\,(\phi, \chi)\,\text{tres}\,(h, k) + \text{tres}\,(\chi, \phi)\,\text{cotr}\,(h, k) + \text{cotr}\,(\phi, \chi)\,\text{tres}\,(k, h).$$

From these equations, combined with (4), we obtain

$$\text{cotr}\,(\phi + h,\ \chi + k) + \text{cotr}\,(\phi + ah,\ \chi + a^2k) + \text{cotr}\,(\phi + a^2h,\ \chi + ak) = 3\,\text{cotr}\,(\phi, \chi)\,\text{cotr}\,(h, k),$$

which is obviously analogous to the formula

$$\cos(\theta + h) + \cos(\theta - h) = 2\cos\theta\cos h;$$

and we might obtain similar formulæ for the tresines.

"In many investigations great convenience arises from the peculiar way in which the functions of our new calculus are affected by differentiation.

"From formulæ (1) or (3) we obtain the following:

$$\frac{d\,\text{cotr}(\phi, \chi)}{d\phi} = \text{tres}\,(\chi, \phi), \qquad \frac{d\,\text{cotr}\,(\phi, \chi)}{d\chi} = \text{tres}\,(\phi, \chi),$$

$$\frac{d\,\text{tres}\,(\phi, \chi)}{d\phi} = \text{cotr}\,(\phi, \chi), \qquad \frac{d\,\text{tres}\,(\phi, \chi)}{d\chi} = \text{tres}\,(\chi, \phi),$$

$$\frac{d\,\text{tres}\,(\chi, \phi)}{d\phi} = \text{tres}\,(\phi, \chi), \qquad \frac{d\,\text{tres}\,(\chi, \phi)}{d\chi} = \text{cotr}\,(\phi, \chi).$$

It appears, then, that the symbol $\frac{d}{d\phi}$ operating upon any one of the functions cotr (ϕ, χ), tres (ϕ, χ), tres (χ, ϕ), changes it into the preceding function in that cycle; whilst the symbol $\frac{d}{d\phi}$ changes any one of these functions into the succeeding one in the same cycle. It follows, therefore, that $\frac{d^2}{d\phi d\theta}$ is inoperative upon each of these three functions. These results are analogous to those which we are familiar with in trigonometry, where we find sines and cosines reproduced by differentiation.

"In discussing the properties of the surface whose equation in rectangular co-ordinates is

$$x^3 + y^3 + z^3 - 3\,xyz = 1,$$

as the co-ordinates x, y, z are equal respectively to cotr (ϕ, χ), tres (ϕ, χ), tres (χ, ϕ), it will be convenient to denote

cotr $(-\phi, -\chi)$, tres $(-\phi, -\chi)$, tres $(-\chi, -\phi)$ by $\bar{x}, \bar{y}, \bar{z}$.

Then, as

$$x^2 - yz = \bar{x}, \quad y^2 - zx = \bar{z}, \quad z^2 - xy = \bar{y},$$

the equation of the tangent plane at the point (x', y', z') will be

$$\bar{x}'x + \bar{z}'y + \bar{y}'z = 1.$$

Hence dS, the element of the surface, is expressed by

$$\frac{(\bar{x}^2 + \bar{y} + \bar{z}^2)^{\frac{1}{2}}\,dydz}{\bar{x}};$$

and as the perpendicular from the origin upon the tangent plane is equal to

$$(\bar{x}^2 + \bar{y}^2 + \bar{z}^2)^{-\frac{1}{2}},$$

we find the volume of the small pyramid, which has the origin for its vertex and dS for its base, to be equal to

$$\tfrac{1}{3}\frac{dydz}{\bar{x}}.$$

But again, as

$$\begin{aligned} dx &= zd\phi + yd\chi, \\ dy &= xd\phi + zd\chi, \\ dz &= yd\phi + xd\chi, \end{aligned}$$

the element $dydz$ must be replaced by $(x^2 - yz)\, d\phi d\chi$ under the double sign of integration. Hence

$$\tfrac{1}{3}\iint \frac{dydz}{\bar{x}} = \tfrac{1}{3}\iint d\phi d\chi.$$

Thus it appears that the sector, generated by a radius vector drawn from the origin, and having for its base the portion of the surface bounded by the lines $\phi = 0$, $\chi = 0$, $\phi = \phi'$, $\chi = \chi'$, may be represented by the product $\frac{1}{3}\phi'\chi'$.

"It has been observed that the functions obtained by dividing the two tresines by the cotresine possess properties analogous to those of the trigonometric *tangent*. A remarkable instance to this effect may be adduced in connexion with the preceding theorem.

"Let us put

$$\text{trit}\,(\phi, \chi) = \frac{y}{x} = \eta, \text{ and trit}\,(\chi, \phi) = \frac{z}{x} = \zeta;$$

then

$$d\eta = \frac{xdy - ydx}{x^2}, \text{ and } d\zeta = \frac{xdz - zdx}{x^2};$$

or

$$d\eta = \frac{(x^2 - yz)\, d\phi - (y^2 - zx)\, d\chi}{x^2} = \frac{\bar{x}d\phi - \bar{z}d\chi}{x^3},$$

and

$$d\zeta = \frac{(x^2 - yz)\, d\chi - (z^2 - xy)\, d\phi}{x^2} = \frac{\overline{x}d\chi - \overline{y}d\phi.}{x^2}$$

Hence the element $d\eta d\zeta$, under a double sign of integration, must be replaced by $\frac{\overline{x^2} - \overline{yz}}{x^4}\, d\phi d\chi$, which is equal to $\frac{d\phi d\chi}{x^3}$, since

$$\overline{x^2} - \overline{yz} = x.$$

And as

$$x^3 + y^3 + z^3 - 3\, xyz = 1,$$

$$1 + \eta^3 + \zeta^3 - 3\, \eta\zeta = \frac{1}{x^3},$$

consequently

$$\iint \frac{d\eta d\zeta}{1 + \eta^3 + \zeta^3 - 3\eta\zeta} = \iint d\phi d\chi.$$

This result is plainly analogous to the formula

$$\int \frac{dx}{1 + x^2} = \tan^{-1} x,$$

and might be expressed by putting

$$\iint \frac{d\eta d\zeta}{1 + \eta^3 + \zeta^3 - 3\eta\zeta} = \mathrm{trit}^{-1}(\eta, \zeta).$$

The Rev. Orlando Dobbin read a paper on his collation of the Codex Montfortianus.

As it has been the controversy about the Three Heavenly Witnesses which has given such notoriety to this particular manuscript, Dr. Dobbin commenced his paper with an account of that celebrated passage of arms, in which as much critical skill and polemic acerbity have been displayed, as in any religious or literary controversy of any age. Expressing his entire concurrence in the decision of such men as Porson, Bishop Marsh, and Bishop Turton, on the spuriousness of the passage, Dr. Dobbin, nevertheless, undertook the vindication of the manuscript from three distinct charges, seriously affecting its value and trust-worthiness, which he announced in the following terms:—

"It has become a kind of fashion to decry the Codex Montfortii—

"I. As a modern forgery.

"II. As a Latinizing Codex.

"III. As a Cursive, and therefore not so valuable as an Uncial, manuscript.

"Porson, the wit and the scholar (in his immortal letters to Travis), will stand at the head of the first class.

"Erasmus and Wetstein at the head of the second.

"While the host of superficial readers, and second-hand critics, will constitute the third."

With Dr. Adam Clarke's judgment, he being by far the most favourable of modern critics to the value and antiquity of the manuscript, the author differed on most important points, while the specific object of his paper was to impugn the correctness of the conclusions of those maintaining the views numbered I., II., III.

Dr. Clarke was shown to be certainly wrong in the date he assigned to the style of handwriting in the manuscript, and wrong, on the evidence of fact, in the date thence assigned to the paper on which it was written.

In reply to the first charge, it was alleged, that the manuscript was in the hands of at least three possessors before the year 1520, the year in which its reading of 1 John, v. 7, was given to the world; that it was then cited as authoritative, not as modern, and possibly manufactured, evidence; that the opinion of Usher and Walton, men of the first rank as Christian men and critics, was in favour of its genuineness;—and again, that it agrees in no respect, specially, with Erasmus's printed text, even in points orthodox and essential, where in all likelihood it would have agreed with it, had it been fraudulent in its origin, and shaped for a purpose.

In reply to the second charge, Dr. Dobbin showed, by a collation of the chapters whose divisions were said to be Latinizing, that they followed the Greek, and not the Roman type; and that the two passages cited by Wetslein, as well as his description of asserted kindred manuscripts, were inconsistent with each other, and flatly contradictory of his own preamble and the statement of Erasmus.

In reply to the third charge, the author made certain observations to the effect that the age of uncial manuscripts was greatly exaggerated in his opinion; and that their value was, by consequence, extremely overrated. He urged, that there always had been a current or cursive hand during the predominance of the uncials; and again, that there always had been, during the prevalence of the cursive manuscript, occasion for large, costly, uncial volumes for ecclesiastical purposes. That this rendered it difficult to assign a *primâ facie* greater antiquity to the uncial over the cursive manuscript; while the perishable nature of the materials on which every book was written, if exposed to the external air and the chapter of accidents, rendered it improbable in the highest degree that any Codex of any portion of the Scriptures was as old as 1000 years. That thus, not only in accordance with the canon of criticism might a cursive copy have all the value of the uncial from which it was transcribed, but an older cursive would have a positive value superior to that of an uncial of more modern date: that, in fact, the character of the writing was not an infallible guide to a right decision as to the date of a manuscript, but that that decision must be guided by other no less weighty considerations. Nevertheless, forming his opinion from the sundry aspects of the manuscript, its history, its readings, its character, its paper, Dr. Dobbin declared his conviction to be, that the Codex Montfortianus was written, from first to last, within the last fifty years of the fifteenth century, and that by some half-learned scribe,—not by any one "bold critic," as had been averred, nor by an unprincipled forger.

Dr. Dobbin is engaged in a course of investigation as to the manufacture of the paper, which cannot fail to issue in ascertaining, for the first time upon indisputable grounds, the approximate date of the manuscript.

The author closed his paper in the following terms:—

"For the reasons, then, presented before the Academy, I cannot refrain the expression of my decided belief, that those parties are entirely in the wrong who endeavour to fix a charge of forgery upon our Codex. A charge so dishonourable to literature and to religion, one rises instinctively to repel where not based upon the most incontrovertible ground. We vindicate our common nature and our common Christianity when we refute by anything like satisfactory reasons the disgraceful imputation, that men were to be found base enough, somewhere about the beginning of the sixteenth century, to attempt a paltry forgery either to overwhelm a hated rival, or to establish what they deemed God's truth. I do not think any candid mind, acquainted with the laws of evidence bearing on such cases, can fail to acquiesce, in the main, in the views we have advanced on the testimony supplied. We have taken nothing at second hand, but, through the courtesy of the custodiers, have gone to the *ipsissima verba* of the documents themselves; and while we have corrected the mistakes of previous writers, believe we have established the four following points:—

"I. That the Codex Montfortianus, however faulty, is genuine.

"II. That it has been written at different times by four different writers, the very last being before A. D. 1520. This is a perfectly new contribution to the criticism of the manuscript, as well as the two statements which follow.

"III. That a different exemplar was employed for, at least, the Acts of the Apostles, and possibly others elsewhere; but this is urged on grounds too various and subtle for presentation in a short paper:—and

"IV. That the Latinizing tendency of the manuscript has not been sustained on the grounds alleged."

Mr. J. H. Smith read a paper on the Cross of Kilnasagart.

The Rev. Dr. Lloyd read the concluding part of a paper "on the influence of the moon upon the position of the freely-suspended horizontal magnet."

In a former communication upon this subject the author had analyzed the diurnal range of the magnetic declination in reference to the moon's age, and shown that its magnitude was subject to a periodical variation, being greatest in the first and third quarters of the lunation, and least in the second and fourth. The moon, therefore, conspires with the sun in its effect upon the diurnal range in the former portions of the lunation, and opposes it in the latter.

The preceding method of examination, however, only determines the *total amount* of the effect produced by the moon's action upon the freely-suspended magnet in the course of the day. In order to investigate its *law*, we must examine the varying position of the magnet at the several hours of observation in reference to the moon's hour-angle. To this question the author now proceeded.

The observations discussed are those of the years 1841, 1842, and 1843, during which they were made at intervals of two hours. The results are tabulated according to the moon's hour-angle in the following manner:

The scale-readings of the instrument nearest to the moon's upper meridian passage, on each day, are entered in the first column of the Table; the next following in the second; and so on to the twelfth. This is continued until the lunation is completed; so that the same solar hour falls on each of the lunar hours in succession, and thus the diurnal variation due to the sun is completely eliminated in the monthly means.

As the lunar day exceeds the solar by $0^{h}\cdot8$, or by four hours in five days, there will be thirteen observations in two out of every five lunar days. In all such cases the observation at 1 A. M., being the first of the solar day, is omitted. There are thus twelve observations omitted in each lunation, one between each pair of successive lunar hours in the Table; and it will be easily seen that the effect of such omission is to alter the mean interval from 2^{h} to $2^{h}\ 4^{m}$, corresponding to $30°$ of the lunar hour-angle.

On account of the smallness of the periodical variation sought, it is indispensably necessary in this investigation to diminish, as far as possible, the effect of magnetic disturbances, the presence of which would altogether mask the regular change. This has been done, as in the corresponding investigation of the ordinary diurnal variation, by omitting altogether days of disturbance, such days being defined to be those in which the sum of the differences between the several scale-readings, and the monthly means of the corresponding hours, exceeds a certain assumed limit.

The monthly means of the scale-readings, in each lunation of the three years, having been calculated in the manner above described, the results of the twelve lunations in each year are again combined, and their means taken. The following Table contains the differences between the yearly means corresponding to each hour, and the mean yearly mean, reduced to angular value, one division of the scale of the instrument being equal to $0'\cdot7205$. The *positive* numbers correspond to *easterly* deviations, and the *negative* to *westerly*. The numbers in the first column are the lunar hours reckoned from the upper meridian passage, each lunar hour being $1^{h}\ 2^{m}$.

TABLE I.—*Diurnal Variation of the Declination, related to the Moon's Hour-Angle. Yearly Means.*

Hours.	1841.	1842.	1843.	Mean.
0	− 0′·36	− 0′·20	− 0′·23	− 0′·26
2	− 0·26	− 0·15	− 0·14	− 0·18
4	− 0·05	+ 0·04	+ 0·14	+ 0·04
6	+ 0·57	+ 0·43	+ 0·27	+ 0·42
8	+ 0·36	+ 0·32	+ 0·02	+ 0·23
10	+ 0·43	− 0·25	− 0·43	− 0·08
12	− 0·45	− 0·50	− 0·48	− 0·48
14	− 0·72	− 0·38	− 0·43	− 0·51
16	− 0·01	− 0·27	+ 0·06	− 0·07
18	+ 0·06	+ 0·32	+ 0·56	+ 0·31
20	+ 0·52	+ 0·42	+ 0·37	+ 0·44
22	− 0·09	+ 0·19	+ 0·23	+ 0·11

It will be seen from the foregoing Table that the position of the freely-suspended horizontal magnet varies with the moon's hour-angle, the north pole deviating twice to the east, and twice to the west, in the course of the lunar day. The extreme westerly deviations occur about 0 and 13 (lunar) hours, or soon after the moon's meridian passage, above and below; and the extreme easterly about $6\frac{1}{2}$ and 20 hours, or soon after the moon's rising and setting. The mean range, measured from the mean of the two greatest westerly elongations to the intervening easterly, is 0′·82, when the moon is to the east of the meridian, and 0′·80 when the moon is west. The mean range due to the sun's action being 9′·6, the lunar range is to the solar as 1 to 12,—a result which accords very nearly with that before derived from a different analysis of the phenomenon.

A marked difference having been elsewhere obtained between the laws of this phenomenon in summer and in winter, it has been thought necessary to separate the results of the summer and winter lunations: they are given in the two following Tables, of which Table II. contains the mean results for summer, and Table III. those for winter.

Table II.—*Diurnal Variation of the Declination related to the Moon's Hour-Angle. Summer Lunations.*

Hours.	1841.	1842.	1843.	Mean.
0	−0′·30	+0′·02	−0′·36	−0′·21
2	−0·10	−0·14	−0·17	−0·14
4	+0·22	+0·20	+0·09	+0·17
6	+0·99	+0·63	+0·08	+0·57
8	+0·55	+0·18	−0·08	+0·22
10	+0·53	−0·22	−0·31	+0·00
12	−0·67	−0·85	−0·40	−0·64
14	−1·18	−0·81	−0·20	−0·73
16	−0·50	−0·38	+0·23	−0·22
18	+0·06	+0·24	+0·64	+0·31
20	+0·40	+0·50	+0·36	+0·42
22	−0·01	+0·66	+0·13	+0·26

Table III.—*Diurnal Variation of the Declination related to the Moon's Hour-Angle. Winter Lunations.*

Hours.	1841.	1842.	1843.	Mean.
0	−0′·44	−0′·42	−0′·09	−0′·32
2	−0·43	−0·17	−0·09	−0·23
4	−0·32	−0·12	+0·21	−0·08
6	+0·15	+0·22	+0·46	+0·28
8	+0·17	+0·46	+0·13	+0·25
10	+0·32	−0·27	−0·54	−0·16
12	−0·25	−0·13	−0·54	−0·31
14	−0·27	+0·06	−0·63	−0·28
16	+0·48	−0·15	−0·09	+0·08
18	+0·06	+0·41	+0·48	+0·32
20	+0·64	+0·35	+0·38	+0·46
22	−0.18	−0·27	+0·33	−0·04

It appears from these Tables that the summer and winter lunations exhibit the same law, there being in both cases two maxima and two minima, and their epochs coinciding nearly with those already given for the entire year. There is, indeed, an apparent difference in the magnitude of the range; that of the summer lunations being 0′·89 when the moon is eastward of the meridian, and 1′·04 when westward, while for the winter lunations the corresponding ranges are 0′·78 and 0′60.

The foregoing results agree in their main features with those obtained by Professor Kreil* and Mr. Broun, from the discussion of the Prague and Makerstoun observations. The chief difference is in the winter lunations. In the Prague observations the lunar variation is extremely small in winter, and its law is apparently masked by irregular changes; while at Makerstoun there is but one maximum and one minimum in the winter months, and the magnet deviates but once to the east and once to the west in the course of the day. It seems difficult to reconcile such influences of season with any physical cause.

It now remains to examine the consistency of the foregoing results with those already obtained, on the dependence of the diurnal range of the declination upon the moon's age.

It is obvious that as the periods of the oscillations caused by the sun and moon respectively, in the position of the freely suspended magnet, are different, they will combine in every variety of phase; so that the resultant oscillation will vary with the moon's age in the course of the month. Let the variation of the declination at any hour, caused by the sun and moon respectively, be denoted by Δu and δu; then m and n being the solar hours of greatest and least declination, and p the interval (in hours) between the sun and moon's meridian passage, $m-p$ and $n-p$ will be the corresponding lunar hours, and the resultant range will be

$$\Delta_m u - \Delta_n u + \delta_{m-p} u - \delta_{n-p} u.$$

The values of this quantity are given in the following Table, —in the first column of which are the days of the moon's age; in the second the corresponding hours (p) of the moon's retardation; in the third and fifth the calculated values of

* The author takes this opportunity of stating that, in referring to Professor Kreil's labours on this question in his former communication, he omitted to notice the elaborate memoir, " On the Influence of the Moon on the Magnetic Declination," read to the Imperial Academy of Sciences in Vienna, in 1850, and published within the last year. Had he read that paper before he had written his own, he could not have questioned the sufficiency of the evidence for the lunar action which it contains.

$\delta_{m-p}\,u - \delta_{n-p}\,u$, the variable part of the morning and evening ranges due to the lunar action; and in the fourth and sixth, the total ranges. The seventh column contains the mean of the two latter. The value of $\Delta_m u - \Delta_n u$ is 9′·81, for the range between 7 A. M. and 1 P. M; and 9′·33 for the range between 1 P. M. and 10 P. M.

TABLE IV.—*Diurnal Range of the Magnetic Declination dependent on Moon's Age.*

Moon's Age.	Retardation.	Morning Range.		Evening Range.		Mean Range.
		Lunar Variation.	Absolute Range.	Lunar Variation.	Absolute Range.	
0^d	0^h	+0′·67	10′·48	+0′·15	9′·48	9′·98
1	1	+0·68	10·49	+0·33	9·66	10·08
2	2	+0·46	10·27	+0·38	9·71	9·99
3	2	+0·30	10·11	+0·38	9·71	9·92
4	3	+0·04	9·85	+0·31	9·64	9·75
5	4	−0·40	9·41	+0·09	9·42	9·42
6	5	−0·77	9·04	−0·17	9·16	9·10
7	6	−0·93	8·88	−0·38	8·95	8·92
8	6	−0·95	8·86	−0·38	8·95	8·90
9	7	−0·84	8·97	−0·39	8·94	8·96
10	8	−0·63	9·18	−0·33	9·00	9·09
11	9	−0·26	9·55	−0·16	9·17	9·36
12	10	+0·25	10·06	+0·07	9·40	9·73
13	10	+0·40	10·21	+0·07	9·40	9·80
14	11	+0·58	10·39	+0·36	9·69	10·04
15	12	+0·76	10·57	+0·64	9·97	10·27
16	13	+0·90	10·71	+0·81	10·14	10·42
17	14	+0·75	10·56	+0·77	10·10	10·33
18	14	+0·60	10·41	+0·77	10·10	10·26
19	15	+0·35	10·16	+0·50	9·83	10·00
20	16	−0·03	9·78	+0·24	9·57	9·68
21	17	−0·31	9·50	−0·08	9·25	9·38
22	18	−0·60	9·21	−0·49	8·84	9·02
23	18	−0·65	9·16	−0·49	8·84	9·00
24	19	−0·65	9·16	−0·75	8·58	8·87
25	20	−0·53	9·28	−0·78	8·55	8·92
26	21	−0·19	9·62	−0·57	8·76	9·19
27	22	+0·19	10·00	−0·40	8·93	9·47
28	22	+0·41	10·22	−0·40	8·93	9·57
29	23	+0·51	10·32	−0·15	9·18	9·75

It will be seen from this Table that the calculated range has two maxima and two minima in the month, the maxima occurring one or two days after syzigies, and the minima one or two days after quadratures. This result agrees very closely with that deduced from a direct examination of the mean ranges, as given in the former communication.

The morning range varies within wider limits than the evening one, the extreme variation of the former being 1'·85, and that of the latter 1'·60; their mean variations are 1'·60 and 1'·20 respectively. This difference is due to the circumstance that the interval between the epochs of greatest and least declination in the former case is six hours, which is also the interval between the maxima and minima of the lunar change; and consequently the lunar variation is doubled in its effect upon the range. In the case of the evening range, on the other hand, the interval of greatest and least declination is nine hours, and they cannot, therefore, both coincide with the extremes of the lunar variation.

MONDAY, MAY 23RD, 1853.

THOMAS ROMNEY ROBINSON, D. D., PRESIDENT, in the Chair.

SIR WILLIAM BETHAM read a letter from W. D. Haggard, Esq., accompanying two thin discs of silver, used for overlaying modern forgeries of Spanish dollars, in illustration of the forgeries of the old Scottish coins exhibited to the Academy by Dr. A. Smith (see Proceedings, vol. v. p. 324).

Rev. Professor Jellett read a paper on the properties of inextensible surfaces.

Adopting Gauss's definition of an inextensible surface, namely, "A surface in which the length of any curve arbitrarily traced upon it is invariable," the author has proceeded to consider the conditions which the displacements of the several points of any such surface must fulfil. Denoting by x, y, z, the co-ordinates of any point on the surface, and by δx, δy, δz, the displacements of this point parallel respectively to the three axes of co-ordinates, he finds that these quantities are connected by a system of three partial differential equations of the first order, and of a very simple form. He finds also, that any one of these displacements may be determined by a single partial differential equation of the second order. Some interesting results follow at once from these general equations. Thus, for example, it is easily shown that if the displacements be all parallel to the same plane, the surface will move as a rigid body.

Having established these fundamental equations, the author has proceeded to deduce general expressions for the variations which the differential coefficients

$$\frac{dz}{dx}, \frac{dz}{dy}, \frac{d^2z}{dx^2}, \frac{d^2z}{dxdy}, \frac{d^2z}{dy^2},$$

undergo in consequence of the displacement of the surface. From these expressions Gauss's celebrated theorem as to the product of the principal radii of curvature follows at once.

The author has next proceeded to consider the effect of *fixing* any curve, or portion of a curve, upon the surface. In this investigation it is necessary to consider severally the three classes into which surfaces are divided with respect to their curvature, namely—

1. Oval surfaces, or those in which the principal curvatures have the same sign.

2. Developable surfaces, in which one of the principal curvatures vanishes.

3. Concavo-convex surfaces, in which the principal curvatures have opposite signs.

The author has obtained the following remarkable results:

1. Oval Surfaces.

If a curve, or portion of a curve, traced upon an oval surface composed of an inextensible membrane, be rendered immovable, the entire surface becomes immovable also.

2. Developable Surfaces.

I. *If an arc of a curve (which is neither the* arête de rebroussement, *nor one of the rectilinear generatrices) traced upon a developable surface, be rendered immovable, all that part of the surface which lies between the rectilinear generatrices, drawn through the extreme points of the fixed curve, and on the same side of the* arête de rebroussement *with the fixed curve, will become immovable also. Beyond these limits the surface will have the power of motion.*

II. *The* arête de rebroussement, *or a rectilinear generatrix, may in general be fixed without rendering any finite part of the surface immovable.*

III. *The rectilinear generatrices of a developable inextensible surface are rigid.*

3. Concavo-convex Surfaces.

In surfaces of this class there exist (as is well known) at each point of the surface two directions, such that the normal sections which pass through them respectively have at that point infinite radii of curvature. We may, therefore, conceive the entire surface to be crossed by two series of curves, such that if at any point a tangent be drawn to either of the curves which pass through it, the normal section passing through this tangent will have at that point an infinite radius of curvature. These curves we shall denominate (for a reason which will appear subsequently) *curves of flexure*. Preserving this definition, we shall have the following theorems:

I. *If an arc of a curve (which is not a curve of flexure), traced upon an inextensible surface of the third class, be rendered immovable, and if we conceive the two curves of flexure corresponding to the extreme points of the fixed arc to be drawn, the whole of the quadrilateral formed by these four curves will become immovable also.* (In forming this quadrilateral it is to be remembered that each of its angular points is formed by the intersection of two curves belonging to *different* series.)

II. *A curve of flexure may be fixed, without rendering any finite portion of the surface immovable.*

III. *If two arcs of curves of flexure, commencing from the same point, be fixed, the immovable portion of the surface will be the quadrilateral formed by these two arcs, and the two other curves of flexure drawn through their other extremities.*

The preceding theorem (II.) gives the reason for the name "curves of flexure." In fact, we see that if one of these curves be fixed, the surface has the power of *bending* round it. This would be impossible with any other curve.

The author has next proceeded to consider the case of surfaces which may be denominated *partially extensible*. These surfaces have at each of their points one or more inextensible directions. In other words, it is possible to draw through each point of the surface one or more inextensible curves. Respecting these surfaces, the author has arrived at the following results:

I. *Any surface may* (without being wholly inextensible) *have at each point one or two inextensible directions.*

II. *If a surface have at each point three or more inextensible directions, the surface is wholly inextensible.*

III. *If the curves of flexure be inextensible, the extension of an indefinitely small arc of a curve, divided by the arc itself, will at each point, and for a given law of displacement, vary inversely as the radius of curvature of the normal section passing through the tangent to the curve.*

Professor Allman read a paper on the structure of hydra.

The substance of *hydra* consists of two perfectly distinct strata,—an external, which may be called the *ectoderm;* and an internal, to which the name of *endoderm* may be given. The ectoderm is composed of cells of a more or less spherical figure; the greater number of these cells possess the power of developing, in their interior, *thread-cells.* Only one thread-cell is generally developed in each cell of the ectoderm.

The endoderm is composed of elongated pyriform or clavate cells, with their long axes perpendicular to the surface, and developing free, spherical, distinctly nucleated cells within them; several of these free cells being developed in each cell of the endoderm. Of the free cells thus developed in the interior of the endodermal cells, some are filled with colourless and transparent contents, while others contain a deep-brown granular matter. In this structure we cannot avoid recognising a true glandular system; the free cells being true secreting cells developed in the interior of mother-cells, and producing, by a process of genuine secretion, the brown granular matter, which may be viewed as representing the biliary secretion of the higher animals.

The endoderm and ectoderm are closely united to one another immediately round the mouth; in other parts of the body they are very easily separable. The cavity of each tentacle is lined by a direct continuation of the endoderm of the body, and communicates by a distinct orifice with the stomach.

Between the ectoderm and endoderm may occasionally be witnessed the appearance of longitudinal fibres, which would indicate the existence here of a true muscular apparatus. This, however, has not been made out so satisfactorily as to remove all doubts of its presence.

The thread-cells of *hydra* are of two kinds, namely, the hastigerous and tactile organs of Corda. They are both developed in the interior of cells, which, as secondary cells, originate free, and almost always solitary, in the interior of the ectodermal cells. The author's examination of the structure of the hastigerous organs confirms the description given by Hancock.* The so-called tactile organs have not been correctly described; each consists of a capsule, having a filament coiled up spirally within it, and uncoiling in the act of projection.

The observations contained in the present communication were made on *Hydra fusca*.

Dr. Lyons read the following notice of Researches on the primary stages of Histogenesis and Histolysis.

Much yet remains to be achieved by chemical and microscopic researches, before we shall be in a position to understand thoroughly the laws, in obedience to which the elementary bodies combine to form organic compounds, and the processes by which these latter assume the determinate forms and distinctive characters of the various vegetable and animal tissues.

The term HISTOGENESIS is employed to designate the origin, development, and growth of animal and vegetable tissues, and under this head are included several of the most obscure and difficult problems in the entire domain of physiological science. Thus we have still to inquire what it is that determines the formation of plastic fluids; what are the forces

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* Annals Nat. Hist., 1850.

brought into play to determine the growth of a tissue from an amorphous blastema, and, moreover, to give the elements of that tissue peculiar and characteristic properties; and, lastly, we have to inquire how various tissues combine to form organs. Each of these problems requires for its solution a greater amount of chemical and physico-physiological knowledge than we yet possess.

The researches of Turpin and Dumortier, Schleiden, Schwann, Henle, Valentin, Reichert, and others, have thrown considerable light on the manner of growth of tissues, and no reasonable doubt can be now entertained that the Cell-theory, as elaborated by these and other observers, and specially applied to the development of animal structures by Schwann, fully and satisfactorily explains the mode of formation and development of several tissues and organs. Notwithstanding, however, the reception of this theory, even in its extreme and exclusive application, as insisted on by Schwann, in most schools, soon after its promulgation, it has been found defective in many points, and has been and is still questioned by several observers of authority. Having devoted much attention to this subject, I have become convinced by repeated observations that there are several tissues which at no period of their development exhibit any evidence of formation by cells, and consequently that cells cannot be considered as the only plastic germs or formative elements of organic life.

The following researches and observations appear to me to support the opinion now stated.

As the common hen's egg offers great facilities for the study of the formation of structures, I have made some careful observations of the microscopic elements, which it presents both before incubation and at certain periods after the commencement of that process.

1. A portion taken from the mass of the yolk, and submitted to a power of 420 D., exhibited the following elements:

a. An abundance of minute granules, covering the greater part of the field, of a light-yellowish colour, with a dark border and semi-opaque centre, moving freely on each other, and presenting the Brownian movement.

b. Bodies of larger size, strongly refractive, varying in diameter, and evidently oil-globules.

c. Vesicles of various sizes, round, oval, and elliptical, some presenting coarsely granular contents, others extremely fine, almost homogeneous, contents, their borders uniformly clear, dark, but fine, and readily seen; these vesicles were, some as large as ordinary cells, others as small as nuclei. In none could I detect anything like a nucleus or nucleolus.

2. A portion of the germinal membrane was found to present—

a. Numerous granules, but in much less quantity than in the body of the yolk; they were also clearer and more transparent.

b. Vesicles of various sizes, with fine pale contents, and clear but well-defined border, occasional oil-globules, granular corpuscles, with large, dark, spherical contents, and well-defined dark border. These corpuscles varied much in size; aggregated masses of granules existed here and there, both of the light and dark variety of granules, and with corpuscles imbedded in them.

In no case did I see a distinctly nucleated cell in this preparation, many vesicles contained a central mass of spherules, but no distinct nucleus. The superposition of granules or vesicles is very likely to be mistaken for nuclei or nucleoli; occasionally a motion in the fluid disturbs the granules, and they may then be seen to float freely away. I have often observed this.

3. In a preparation from near the germinal centre, after about twenty-four hours' incubation, the vesicles were much larger, more clearly seen, and very finely granular for the greater part; a few presented central spherules, with or without granules, but I am doubtful, for the reasons just assigned, whether they are to be regarded as nuclei; a few coarsely granular vesicles were to be seen; also, isolated and aggregated granules.

4. From one of the halones, about a quarter of an inch external to the germinal centre, I took a fragment, which, when submitted to a power of 900 D., presented the following elements:

a. Large flat masses of a finely granular base or stroma, with superposed free granules, small vesicles, and oil-globules.

b. A considerable number of long flat bands or fibres, with a very fine, clear, double outline, and minutely granular centre, and occasional superposed and adjacent small vesicles and granules; here and there a small vesicle was to be found lying partly within and partly without the fibre. In some places the fibres appeared to me to terminate by tapering, indistinct granular ends, and I am much disposed to think that this indicates the true mode of their formation, viz., by the linear aggregation of granules. On the addition of acetic acid, I could get no indication of nuclei, or of the outlines of cells of any kind.

c. The large vesicles still exist in abundance, but I cannot see them anywhere to be distinctly engaged in forming any structure; I have looked in vain for nuclei in them; there appear to be two varieties of them—one finely granular, the other containing numerous large, dark globules. I think they become larger and more numerous for a certain time, and then break up; I look upon them as a-plastic, and consider their most probable use to be that of forming loci for the chemico-molecular elaboration of or change of combination of the chemical elements. The fibres above alluded to were found in the vicinity of granules, granular masses, and a small variety of cells.

5. In a preparation from near a blood islet I obtained a number of reddish-coloured elliptical corpuscles, some with nuclei, others without, also large finely granular vesicles, and a smaller kind of hyaline clearness, which burst on the addition of water.

6. In the plasma from a cut in my finger, five minutes after

blood ceased to flow, I found not only granules, but granular corpuscles, hyaline vesicles, and granular masses. In another instance, one hour after the receipt of a wound in the hand, I examined the exudation, and found a well-marked granular base of considerable extent, abundance of granules, and a few examples of nucleated cells.

7. The observations of Robin and Handfield Jones, on the development of fat, likewise prove a mode of growth not reconcilable with the nucleo-cellular doctrine.

8. Another class of proofs may be deduced from the results of experimental or artificial Histogenesis, which go to prove the direct formation of tissues, without the intervention of cells.

Thus, in the well-known experiment of Ascherson, the contact of oil and albumen, two homogeneous fluids, gives rise to the formation of granules, granular base or stroma, vesicles, and simple membrane (hyaline membrane).

The experiments of Panum show the possibility of artificially forming granules, vesicles, and granular corpuscles.

The results obtained by Melsens, and fully confirmed by microscopic examination of his "tissu cellulaire artificiel" both by M. Gluge and myself, give us instances of the direct formation of at least three elements of organic bodies, independently of cells, viz., granules and granular base, fibres, and corpuscles.* Similar results have been obtained by Parkes.

I am able to furnish another and valuable class of proofs from the results of my researches in Histolysis, which show, as will be fully detailed further on, that structures can originate under conditions when we cannot suppose any vital organic influence to be present, but when such forces as attraction, cohesion, fusion, endosmose and exosmose, and the mutual

* For an account of Melsens' experiments, see Dublin Quarterly Journal of Medical Science, February, 1852. For Panum's experiments, see Lyons' Annals of Micrology, British and Foreign Medico-Chirurgical Review, April, 1853.

re-actions of elements differing in physical and chemical characters, are in full operation.

From the foregoing observations, and especially from the results of researches in Histolysis, I am induced to believe that in the formation of organic structures we may detect two quite distinct modes of growth and development, the one physical, the other organic (properly so called) or vital, the former taking place in obedience to certain physical laws alone; the latter, though operating by physical laws, yet guided and directed by a force which, for the want of a better name, we are compelled to call vital.

The elements which result from these modes of growth differ widely in function and destination (the latter alone possessing the "gestältungsfähigkeit"). There is reason, I think, to believe that the primary phases of Histogenesis are in a considerable measure similar to some of the artificial processes which have been above alluded to, and that in the history of development the following is the order of appearance of the elementary parts:

I. An amorphous organic fluid, which in time exhibits the formation of—

II. Primary organic granules, granular corpuscles, granular base or stroma, hyaline membrane, hyaline base or stroma, and hyaline vesicles.

Here we have an assemblage of elements of a simple kind which are to be met with, some or all variously combined in the examination of animal tissues and fluids: they are, in fact, the rubble work of the organic edifice, but have themselves no share in determining its development, being a-plastic, or incapable of generating higher tissues, though they may serve as pabulum for the more active plastic elements. But in the living organism we have elements of a still higher order, possessed of wonderful vitality, which we may suppose to be of later origin, and of whose mode of genesis we have still but very imperfect conceptions. These elements I will denominate Histo-plasts, or Histo-plastic Germs, and I conceive them to be of three kinds, Granules, Fibres, and Cells. The accompanying Table will exhibit more clearly my views of the order of precedence of the elementary parts of the organic fabric:

AMORPHOUS ORGANIC FLUID.

From which become developed—

I.

A-PLASTIC ELEMENTS.

1. Primary Organic Granules:
   (*a*) Isolated;
   (*b*) Aggregated; and thus forming—
2. Granular Corpuscles; or,
3. Granular Stroma or Base.
4. Hyaline Membrane (Cell Membrane, &c.)
5. Hyaline Stroma or Base.
6. Hyaline Vesicles.

II.

HISTO-PLASTS OR TRUE HISTO-PLASTIC GERMS.

7. Plastic Corpuscles, Granules, Nucleoli, Nuclei, and other Germs, if any.
8. Fibres (themselves formative elements).
9. Cells.
10. Definite Tissues.

It is unnecessary here to go farther into the study of these individual elements, the forms of which must be familiar to all experienced microscopic observers; to the class of hyaline structures evidently belongs the membrane alluded to by Schwann, and whose formation even he found it difficult to reconcile with the exclusive adoption of his cell theory. He observes in reference to it: "In many glands, as for instance the kidneys of a young mammalian fœtus, the stratum of cells surrounding the cavity of the duct is enclosed by an exceedingly delicate membrane, which appears to be an elementary structure, and not to be composed of areolar tissue; the origin of this membrane is not at all clear, although we may imagine various ways of reconciling it with the formative process of cells." Various cell walls are examples of hyaline membrane.

It is further to be remarked, that crystalline forms, whether organic or inorganic, have no place in this arrangement.

Several instances having come under my notice in which structures submitted to microscopic examination appeared to have undergone considerable alteration, by reason of a more or less advanced condition of decomposition, I was led to institute a series of observations for the purpose of discovering the order (if any) of the morphic changes which take place in the passage of organized bodies through the several stages of putrefaction to their final dissolution and decay, until they return, "ashes to ashes," and "dust to dust." As I believe that the researches I have already made warrant me in stating that a certain order of morphic changes is brought about, I have introduced the term Histolysis, to designate the morphic changes of putrefying tissues, the use of a single word being convenient for the purposes of description and reference.

Not only will the study of Histolysis be found interesting in itself, as a portion of scientific inquiry, presenting, as it does, several beautiful and unexpected phenomena; but, moreover, the knowledge thereby acquired admits of several valuable and practical applications. Thus, it affords most favourable opportunities for the study of the intimate structure of complicated normal textures, which are thus, as it were, unfolded to our view by a process of natural dissection, in which the least possible violence is done to the most delicate parts. Furthermore, as I have already stated, I believe it furnishes us with means of elucidating some of the early and obscure phases of Histogenesis. Lastly, I feel confident that when the histolytic process will have been carefully and successfully studied in the chief tissues, fluids, and organs, the knowledge thus acquired will prove eminently useful in medico-legal inquiries, and will give a precision and accuracy to investigations of this nature which they are now incapable of. In pathological research, likewise, it will be highly useful. To study the morphic changes of putrefaction, under what may be termed its normal phases, it will be necessary to have the subjects of our intended examinations submitted to conditions of an equable mean temperature, with access of air and moisture. If none of these be in excess, the process is a sufficiently slow one; excess of any of them, if slight, will be found to rather hasten the putrefactive changes, while, if considerable, a condition may be produced in which the tissue will remain for a long time without farther change.

Extremes of heat, as is well known, will produce almost immediate dissolution, while, at a freezing temperature, structures will remain unaltered for almost an indefinite period. I now proceed to detail some of the observations which I have already made; they relate to cutaneous structures and fat, some varieties of human and animal blood, and muscular fibre. I omit for the present any notice of the general physical or chemical characters, though both are extremely important.

1. *Integument.*—This specimen had undergone change for four months. The epithelium of the cuticle was entirely destroyed, its place being supplied by a soft, pulpy mass, which presented an amorpho-granular mass under the microscope.

2. *Subcutaneous Structures after* 6½ *Months.*—They had the appearances of what is known as cadaveric fat; under the microscope, D. 900, there was seen an abundance of minute but well-defined granules, with fine, dark, well-marked border, and clear, transparent centre; they were arranged in masses, isolated, and in groups; small granular corpuscles of different sizes, and a few oil-globules; very large oval, pale, semi-opaque cells or vesicles; they had no nuclei; their borders were clear and well defined, but the most of them presented fissures, some as many as seven or eight, which extended inwards for about a sixth of

the smaller axis; a very remarkable linear or moniliform arrangement of granules presented itself in certain parts of the field, sets or rows of granules being arranged longitudinally parallel or convergent, and apparently in connexion with very faint subjacent striations in the same direction—I am inclined to regard this as an instance of granular disintegration of a band of fibre;—lastly, numerous stellate crystals, apparently of the fatty acids, lay scattered over the field, some also being included in cells, and appearing to be the stage of lysis of their previously granular contents, preparatory to the final rupture and dissolution of the including membrane.

3. *Blood.*—I have met with specimens of blood in which changes took place with great rapidity; I do not now allude to the corrugation and stellate appearance of the corpuscles, which is familiar to every one. In one specimen, after twenty-six hours, I found the hæmatine had escaped from numerous corpuscles, and had assumed the shape of granular masses, heaps, and crystals (hæmatoid crystals of Virchow). What pathological significance to give to this rapid change I do not know; but I am inclined to think that this, as well as other isolated facts which we now possess in reference to the blood, will be one day utilized.

4. *Blood Stains.*—This question is so important that I purpose making it the subject of a special inquiry. At present I will only add, that from specimens three months old, I have been able to figure the corpuscles, though much changed in form; also, a red granular base studded with corpuscles, and hæmatoid granules more or less aggregated.

2. *Histolysis in Fluid Blood.*—Blood of duck after two years (kept in a bottle). Here was presented an assemblage of forms widely different from those of the natural blood; none of the characteristic elliptical corpuscles of this animal's blood was to be found. There existed, firstly, abundance of granules, granular corpuscles, spherical vesicles of moderate size; square and oblong, apparently vesicular, bodies; large cells or vesicles,

including one or more smaller ones: these several bodies were evidently the result of a process of secondary growth, taking place while the general process of dissolution was going on around, and constituting a kind of generation in death which may be termed thanato-genesis; in addition, there were numerous prisms and needles of hæmatine, and large irregular hæmatine masses.

6. *Blood of Salmon.*—Of same date as last, and presenting nearly the same appearances; the granular bodies were, however, much larger; there existed also very large cells, including vesicles, and masses of granular base. Cells, including stellate crystals, were also visible. I am disposed to think that these forms resulted from the greater quantity of oil in the blood of fish, which, with the albuminous element, gave abundant means for these formations.

7. *Histolytic Changes in Muscle.*—The specimens examined had undergone the process of putrefaction for a considerable time; yet, by the aid of the microscope, the nature of the structures admitted of demonstration in the most clear and positive manner, though, I am satisfied, that by the unaided sight no amount of careful study would have sufficed for their recognition and identification. Under a power of 900 D., the following appearances were presented:—A semi-fluid granular mass, tinged of a light brown colour, in which granules, granular corpuscles, and spherules, were visible; here and there lay larger and smaller masses of elementary fibres, many of which retained, either in whole or part, their characteristic striæ, but presented internally more or less change.

There were seen several examples of elementary fibres. On more minutely examining these elementary fibres, it was found that some presented the transverse striation complete and perfect for a certain portion of their length; in others, the lines ceased at about half the transverse diameter; in other portions the edges only indicated the commencement of the striæ, which, however, were very clearly and well defined;

almost all the elementary fibres which I was enabled to trace throughout their extent appeared to terminate indistinctly, a few only showed jagged and broken ends. A small number of the fibres continued clear and transparent throughout their entire extent, but, in the majority, the interior presented more or less change. Lastly, in a few instances I observed a number of corpuscles of very peculiar and definite characters. These appeared to be perfectly spherical, were of a reddish-brown colour, and presented a well-marked edge sharply defined; in their interior lay another ring, having a diameter of about two-thirds of that of the outer, this enclosed a body or space which had the appearance of being depressed, and within which lay a dark central spot. These bodies varied somewhat in size, and lay, some mixed with other histolytic elements, some free and isolated on the field, and others again aggregated into masses, but showing no trace of any investing membrane. I am quite at a loss to understand the nature and origin of these peculiar corpuscles.

Scattered through the field lay granular masses, granular corpuscles, and cells; cells including numerous large corpuscles, formed, as it were, by endogenous growth; and finally, various stellate and acicular crystals, some within cells, others free on the field.

These results of the Histolysis of muscle are still very incomplete, yet I think they give us some indications of the mode in which the tissue breaks up. I may remark, incidentally, that from some of the appearances observed, I am led to adopt views different from those generally received, as to the nature of the striæ, which I am disposed to consider as belonging in greater part, if not entirely, to the sarcolemma.

In considering the chief results arrived at in the study of the process of putrefaction, I am led to believe—

1st. That concurrently with the first order of chemical changes, a certain order of morphic changes takes place before the final dissolution of organic structures, by the action of chemical and physical forces.

2nd. That this series of changes may, under normal conditions, take place very slowly, so that, at the end of many months, and probably of even much longer periods, we are still enabled by the microscope to recognise and identify structures of great delicacy, such as elementary muscular fibre, and that this knowledge admits of important applications.

3rd. That in this process of Histolysis, the first changes consist in the softening, disunion, and separation from each other of the morphic constituents of the tissues, each of which is then subjected to a process of disintegration.

4th. That granules and granular corpuscles appear at an early period, arising probably from recombinations of the particles of the organic fluids. Animalcules appear at this stage.

5th. That granules, corpuscles, vesicles, cells, and granular masses of various kinds and sizes, may form in fluids and tissues undergoing Histolysis, in which no such elements exist when in their normal states.

6th. That generally in the progress of Histolysis, structures very similar to those which are arranged under the first group, or the a-plastic elements of Histogenesis, form at different stages, and that they exhibit the same modes of growth and development, but, like them, are incapable of producing higher forms.

7th. That these morphic elements of Histolysis pass gradually into lower forms, exhibiting occasional instances of endogenous fissiparition, granular disintegration, and other changes, and that the cellular and corpuscular elements, by forming media for endosmose and imbibition, may aid in the disintegration of contiguous structures.

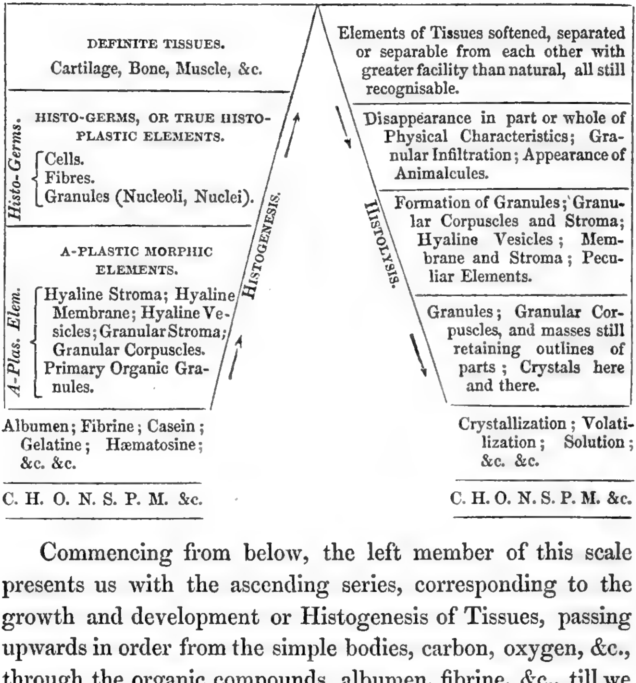
8th. That certain elements may pass directly into a state of molecular disintegration.

9th. That certain corpuscles of peculiar characters, and not identical with any known normal elements, are occasionally formed.

10th. That a period arrives at which chemico-physical forces prevail, which is evidenced by the passage of certain elements into crystalline forms, others passing off by volatilisation, solution, &c., and that in this way the final dissolution of a tissue is accomplished, the several morphic changes which take place probably facilitating and preparing the way for the action of chemical forces.

Lastly, it appears to me that the general scheme of the formation or Histogenesis of organic structures, and their final dissolution, or Histolysis, may be best represented in their mutual relations and analogies by a triangular figure, such as the following:—

SCHEMA.



Commencing from below, the left member of this scale presents us with the ascending series, corresponding to the growth and development or Histogenesis of Tissues, passing upwards in order from the simple bodies, carbon, oxygen, &c., through the organic compounds, albumen, fibrine, &c., till we reach the definite tissues. From the summit of the figure we then pass downwards, through the several phases of Histolysis, until finally, by the processes of crystallization, volatilization, &c., the organic compounds pass again to the state of simple elements. The study of this member of the scale is, of course, as yet in a very imperfect condition, and it offers an immense and highly interesting field for research.

MONDAY, JUNE 13TH, 1853.

THOMAS ROMNEY ROBINSON, D. D., PRESIDENT, in the Chair.

EUGENE CURRY, Esq., was elected a Member of the Academy.

Dr. Todd exhibited to the Academy an ancient Irish reliquary, composed of brass and silver, of exquisite workmanship. It represents a human arm, with closed hand, and is believed to have contained portions of the hand or arm of St. Lachtîn [*pr.* Lachteen], abbot or bishop of Achadh-ur [Fresh-field, now by an erroneous translation called Freshford], in the county of Kilkenny.

St. Lachtîn was a native of Muscraighe (now Muskerry), in the county of Cork, and was descended from the royal family of Conaire II., King of Ireland in the second century. He died, according to the Annals of the Four Masters, in the year 622; and his memory was venerated by the Irish Church on the 19th of March.

This curious reliquary is now the property of Andrew Fountaine, Esq., of Narford Hall, near Swaffham, Norfolk, and has been in the possession of his family for many years. The opportunity of exhibiting it to the Academy has been procured through the influence of Lord Talbot de Malahide, by whom it has been borrowed from its owner, to be exhibited with the Academy's Museum at the Great Exhibition.

It has already been engraved, and a short account of it printed in the Vetusta Monumenta, published by the Society of Antiquaries of London; but the interpretation there given of the inscriptions upon it is full of inaccuracies. It had been previously exhibited to that Society by Sir Andrew Fountaine in 1829.

There are four inscriptions, on plates of brass, running longitudinally down the arm: of these but one is perfect; the other three are illegible at the end, but enough still remains to enable us to fix with certainty the date of this singular specimen of ancient Irish art, and to ascertain the part of Ireland in which it was made. They have been deciphered by Mr. Curry, so far as any traces of the letters still remain, and are as follow:—

First Inscription.

OR̄ do Maelsechnaill u cellachaī do ardrig ua [nechach mumain] do rigni in cumtachso.

"A prayer for Maelseachnaill O'Callaghan, chief-king of Ua [Echach Mumhain], who made this reliquary."

The words enclosed in brackets are not very distinct in the inscription, and are in some degree conjectural, supplied from our knowledge of the fact that this personage was lord of that district, and confirmed by observing that the space left doubtful by the obliteration of the words in the original exactly agrees with what would be required for the words supplied.

Mealseachnaill O'Callaghain died, according to the Four Masters, in 1121.

Second Inscription.

OR̄ do chormac mc̄ meic carthaigi do rig dāna muman dorat . . . . . d . . . . . t . . .

"A prayer for Cormac son of Mac Carthy, Righdamhna [or next heir] of Munster, who gave . . . . ."

This was the Cormac who was king-bishop of Ireland, as he is called by the Four Masters, and who built the celebrated Cormac's chapel on the Rock of Cashel. The Four Masters mention him, at the year 1137, as having made a predatory excursion against Kennedy O'Brien, and the foreigners or Danes of Limerick; and in the following year they record his treacherous murder by Toirdhealbach (or Turlogh), son of Diarmaid O'Brien, and the two sons of O'Connor Kerry. They speak of him as celebrated "for bestowing of jewels and wealth upon the clergy and the churches, an improver of territories and churches," so that it is in strict accordance with this character to find his name on the richly ornamented reliquary before us.

Third Inscription.

OR̄ do tadg mc̄ meic carthaigi do rig . . . . . .

"A prayer for Tadhg son of Mac Carthy Righ[damhna of Munster] . . . . ."

The letters rig are probably the commencement of rig-damna mumain, a title which belonged to this Tadhg, grandson of Carthy, who was brother of Cormac, of whom we have just spoken.

Fourth Inscription.

Or̄ do diarmait mac meic denisc do comarba L . . . . .

"A prayer for Diarmait, son of Mac Denisc, comharb of L . . . . ."

It is greatly to be regretted that the next word is not legible, as it would probably have given us the name of the Saint whose relics were contained in this reliquary. The first letter seems to be L, in which case it was probably Lachtin.

Smith, in his History of Cork (vol. i. p. 84), mentions a reliquary called the Arm of St. Lachteen, which in his time was preserved at Donoghmore, in the county of Cork, by the Roman Catholic priest of the parish, and tells us that the people used to swear on it on solemn occasions, until it was removed by the Roman Catholic bishop, who probably found that a superstitious abuse of it had grown up.

Mr. Curry also states that he remembers to have met with a person of that country, whose habit it was to swear by the arm of St. Lachtin, although he was unable to tell what the arm was.

All these circumstances, and the fact that St. Lachtin was a native of the same country, render it highly probable that the reliquary now exhibited to the Academy is the identical brazen arm of which Smith speaks.

At all events we are enabled to give a tolerably exact date to this ancient piece of art, which, even in its present dilapidated state, exhibits great evidence of the workman's skill in inlaying and minute ornamentation of the most elaborate kind. It is clear that it must have been made before the death of Maelseachnaill O'Callaghan, who is stated in the first inscription to have made or caused it to be made; and, as he died in 1121, it is certain that we have before us a specimen of what could be done by Irish artists in inlaying and jewellery, within the first twenty years of the twelfth century.

Dr. Todd exhibited also the *Missagh*, or *Miosach*, a valuable Irish reliquary, supposed to have formerly contained a MS. of the Gospels or Psalms. The box, however, is now empty.

This beautiful specimen of ancient art is the property of St. Columba's College, Rathfarnham, and has been entrusted by the Warden and Fellows, with the permission of His Grace the Lord Primate, to the Academy, to be exhibited with their Museum at the Great Exhibition.

The word Misach, or Miosach, seems to signify a Calendar, and to be derived from mı or mıꞅ, a month; if so, it may have contained, not a Gospel or a Psalter, like other reliquaries of this class, but a Calendar. The inquisition of 1609, however, which will be quoted presently, evidently assumed the word to be the plural of maıꞅe, an ornament, for it speaks of it as the missagh or *ornaments* left by Columbkille.

An account of this reliquary, with an engraving, will be found in Sir William Betham's Antiquarian Researches, and it is mentioned also in General Vallancey's Collectanea, but the attempt there given, to refer the word Miosach to a Hebrew root, is totally absurd and groundless. Dr. Todd stated also that he could not agree with Sir W. Betham in supposing the inscription to contain the date A. D. 503. The era of Anno Domini, as every chronologer knows, was not adopted at so early a period to define dates, and the character of the inscription would, of itself, even had there been no date, indicate the latter part of the fifteenth or beginning of the sixteenth century. The fact is, that the letter m, the first letter of the date, was mistaken by Sir William Betham for the words Anno Domini, in the contracted form, and the real date is MDXXXIII. or MDXXXIIII., for there is some doubt whether there were originally three or four units.

This is not said with any intention of detracting from the honour which justly belongs to Sir William Betham of being among the first to bring this, and other interesting Irish relics, before the notice of antiquarians. His book, notwithstanding such mistakes as that just noticed, was greatly in advance of the time when it was published, and has done good service in directing public attention to our Irish historical antiquities and ancient manuscripts.

The inscription contains a statement that the case or box now before us was ornamented by Brian, son of Brian O'Muirguissan (or Moreesan), in the year 1533 or 1534.

The inscription is as follows :—

bրιan mac bրιan ua muιguιꝼꝼan ꝺo cumꝺaιg me a° m.ccccc. xxxιιιι.

"Brian mac Briain ua Muirguissan covered me, anno M.CCCCC. XXXIIII."

This connects it at once with St. Columbkille's country: for it appears by an inquisition taken at Lifford,* county of Donegal, quoted by Dr. Petrie in a letter containing an account of this Miosach, and now in the possession of the College of S. Columba, that in the parish of Clonmanny, Donogh O'Morreesen held certain lands as herenach of the bishop of Derry, and coarb of the abbot of Derry, "which were given

* Inquis. Rot. Cancell. Hib., vol. ii. (Ultonia) Append. No. V.

to his ancestors, who were servants of Columkille," and that in the same parish certain lands belonged "to the Vicar and to the keeper of the *missagh* or ornaments left by Columkill," which keeper was undoubtedly the herenach of the bishop and coarb of the abbot, according to the ancient usage of the Irish Church.

The Miosach was preserved amongst the descendants of the original herenachs until the middle of the last century: when it was purchased by Dr. William Barnard, Bishop of Derry, who died in 1768, or perhaps by his son Dr. Thomas Barnard, Dean of Derry, and afterwards Bishop of Killaloe and Kilfenora. The fact, however, most important, as tending to prove our reliquary to be the Miosach, is, that it was purchased in the neighbourhood of Fahan, close to the parish of Clonmanny, where the inquisition of 1609 states it to have been preserved.*

This curious box was offered for sale with the library of the late Bishop Barnard in Dublin; but such was the apathy of the public at that time to these invaluable relics of antiquity, that it found no purchaser, and was bought in by the auctioneer, Mr. Vallance, from whom it passed to his successor, Mr. Jones. It was purchased from Mr. Jones by Sir William Betham, who presented it to the late Duke of Sussex, and it was afterwards sold in London, at an auction, to Mr. Rodd, an eminent London bookseller.

Some time afterwards Mr. Rodd mentioned it to Dr. Todd, as a piece of antiquity supposed to be Irish; Dr. Todd, happening to be soon after in London, called to see it, and recognised it as the Miosach; it was immediately purchased from Mr. Rodd by Lord Adare, now Lord Dunraven, and by him presented to the College of S. Columba in the year 1843.

Dr. Petrie, in his account of this reliquary, quotes also

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* Vallancey, Collect. vol. iv. No. 13, p. 16.

from an ancient Irish historical tale, *The Death of Muirchertach mac Erca*, a passage which speaks of the Cathach, the Bell of St. Patrick, and the Miosach of *St. Carnech*, as the three great and celebrated relics of the Northern Hy-Niall and Hy-Connellians.

If this be the Miosach here spoken of, it is a singular circumstance that these three celebrated reliquaries now stand together on the table of the Academy, and will be exhibited together in the Antiquarian Court of our Dublin Exhibition.

It is fair to say, however, that Dr. Petrie doubts whether the Bell of St. Patrick, now before the Academy, is the bell intended in the document just quoted as one of the three great Hy-Niall relics. There is another bell of St. Patrick in his own collection, which he conceives has an equal claim to be so considered. It is understood, however, that Dr. Petrie intends to exhibit his bell also, and therefore the remark just made will still prove true, that the three great relics of the Hy-Niall may this year be seen together in the singularly interesting antiquarian collection which will be shortly open to the public in the Dublin Exhibition.

Dr. Todd was unwilling to detain the Academy with any further discussion on this subject, as he hoped on a future occasion to make some further remarks on the Miosach when there was not so great a pressure of business before the Academy. He omitted, also, all notice of the Bell of St. Patrick, because the admirable history of it drawn up by Dr. Reeves was already in the hands of all students of Irish archæology.

Dr. Petrie made some observations on the several remains of antiquity exhibited to the meeting by Dr. Todd, and directed attention to the fact that such shrines or reliquaries usually exhibited work of different ages, consequent upon repairs or restorations, or from a desire to increase their beauty by additions, according to the prevailing taste of the time. And he added, that in such instances the original or more ancient work was invariably of a higher style of art and better execution than that of such subsequent additions. He also observed that the crucifix which is now so usually found on such reliquaries is always, obviously, an addition of a later date, and is, in all the instances which have come under his attention, in a more barbarous taste than that of the original, or older work, and is besides of an inferior style of execution.

The Secretary presented, on the part of G. C. Cowell, Esq., Prospect House, Milltown, two volumes of Autograph Manuscripts of Jonathan Swift, D. D., Dean of St. Patrick's, Dublin; one being an account of his daily expenses from May to August, 1735, and a list of his tenants in the Deanery and at Rathbeggan, with the sums payable by them in the year 1734; the other being a collection of thirty-five songs and poems.

The special thanks of the Academy were given to Mr. Cowell for this donation.

Rev. Samuel Haughton read an account of the late Professor M'Cullagh's Lectures on Attractions, and Clairaut's Theorem, reported by Mr. Allman.

Professor M'Cullagh's Lectures on Attractions were delivered to the Candidates for Fellowship in Trinity College in Hilary and Michaelmas Terms, 1846.

Mr. M'Cullagh's Lectures included the attraction of an ellipsoid on a point situated outside it, the attraction of any body on a distant point, and the application of these problems to the Figure of the Earth and Clairaut's Theorem.

The attraction of an ellipsoid on a point outside may be reduced by means of Ivory's Theorem to the attraction of another ellipsoid on a point inside, and the attraction of an ellipsoid on a point inside is reducible, by means of a well-known theorem to the attraction of a similar ellipsoid on a point situated on its surface.

The peculiarity of Mr. M'Cullagh's method consisted in the manner in which he discussed this latter problem.

The three following propositions contain the complete solution of the question :—

PROP. I. THEOREM.—If P be any point on the surface of an ellipsoid, and PC_1 be drawn perpendicular to any axis OC (where O is the centre and C the extremity of the axis); the component of the attraction of the given ellipsoid on the point P, estimated in the direction OC is equal to the attraction of another ellipsoid similar and similarly placed upon a point situated at its vertex C_1.

PROP. II. PROB.—To calculate the attraction of an ellipsoid on a point placed at the extremity of an axis.

PROP. III. PROB.—To find geometrical representations of the attraction of an ellipsoid upon a point situated at the extremity of any axis.

Having completely discussed the question of the attraction of an ellipsoid, Mr. M'Cullagh found the attraction of any body on a distant point by means of the following expressions.

Let O and N denote the centre of gravity and the attracted point; and let the ellipsoid of gyration be described, having O for its centre.

Let a tangent plane to this ellipsoid be drawn perpendicular to ON, cutting it in the point S, and touching the ellipsoid in the point T.

Let M denote the mass of the attracting body, and γ' the distance ON, then—

The attracting force lies in the plane of OST, and if R and P denote the components of attraction in and perpendicular to the direction of the line joining the centre of gravity of the attracting body with the attracted point.

$$R = \frac{M}{\gamma'^2} + \frac{3}{2\gamma'^4}\{A + B + C - 3I\}$$

$$P = \frac{3M}{\gamma'^4}\{OS \times ST\}$$

A, B, C, being the principal moments of inertia of the body, and I the moment of inertion with respect to the axis ON.

The proof of Clairaut's Theorem from the foregoing equations formed the concluding part of Mr. Allman's communication.

Rev. Samuel Haughton read a paper on a Modification of Mr. Green's Formulæ, applicable to the representation of M. Jamin's Experiments on Reflected Polarized Light.

Dr. Petrie made the following observations upon two Irish inscriptions which appear, in tablets, on the sides of a stone which forms the upper portion of the shaft of the great stone-cross of Tuam, now exhibited in the Central Hall of the Great Industrial Exhibition; and of which, through the kindness of the Fine Arts Committee, he had got casts made, to be deposited in the Museum of the Academy. He remarked that he gladly availed himself of the opportunity now afforded him of making this communication, as he had, in his Essay on Irish Ecclesiastical Architecture, been the first to draw attention to this remarkable and truly magnificent remain of Irish art; and more particularly as—from a recent examination of that portion of the monument which bears these inscriptions, and which portion he had not himself previously seen—he was now enabled to give a more complete and accurate copy of one of the inscriptions than that which he had already published.

The first inscription is carved in two parallel vertical lines, to be read from the top downwards, and simply records the name of the Abbot of Tuam, successor of St. Jarlath, by or for whom the cross was erected. The inscription is as follows:

oR̄ do chomarba iarlaithe, do aed u ossin, las in dernad in chrossa.

"A PRAYER FOR THE COMHARBA OF JARLATH, FOR AED O OSSIN, BY WHOM THIS CROSS WAS MADE."

This inscription, which is accurately given in his "Ecclesiastical Architecture of Ireland," is of considerable importance, as it enables us to make a nearer approximation to the true date of the re-erection of the Cathedral Church of Tuam, than that—as it would appear—hypothetically given to it by WARE and HARRIS; and also to correct an error into which both of those able antiquaries have fallen in the interpretation of it. Speaking of the Cathedral Church of Tuam, WARE states it to have been rebuilt "*about* the year 1152, by the Archbishop Edan O'Hoisin, by the aid and assistance of Turlogh O'Conor, King of Ireland." On this statement of WARE's, which has been adopted by HARRIS, Dr. Petrie read the following remarks from his Essay on Irish Ecclesiastical Architecture, pages 312 and 313:—

"It may be doubted, however, that the date assigned to the erection of the Church of Tuam, by Ware, is the true one, and there is, I think, greater reason to believe that it was erected many years earlier,—or, at least, previously to O'Hoisin's having received the pall as an Archbishop in 1152, or even to his succession to the Archbishopric in 1150. For though, in one of the inscriptions above given, he is called the comharba of Jarlath,—which might equally imply that he was Archbishop or Abbot of Tuam,—yet in the following inscription on the base of the great stone cross, now lying in the market-place, he is distinctly called Abbot; and it is not in any degree likely that this inferior title would have been applied to him after his elevation to the Archbishopric; for in one of the inscriptions on the cross or crozier of the Archbishops of Tuam or Connaught,—now, through the liberality of Professor M'Cullagh, preserved in the Museum of the Royal Irish

Academy,—his predecessor, Domhnall, the son of Flannagan O'Dubhthaigh, is expressly called epırcop connacht; and that O'Hoisin was comharba of St. Jarlath, or Abbot of Tuam, as early as 1134, is proved by an entry in the Annals of Innisfallen at that year, stating that he was sent by King Turlogh O'Conor to effect a peace between Munster and Ulster; and indeed there is no reason to doubt that he became Abbot as early as the year 1128, on the death of Muirges O'Nioc.

"The above inscription reads as follows:—

"OR DO U OSSIN; DONDABBAID LAS IN DERNAD.

"'A PRAYER FOR O OSSIN; FOR THE ABBOT, BY WHOM IT WAS MADE.'

"A second inscription on the opposite side of the same base preserves the name of the King, Turlogh O'Conor, as in that on the slab already noticed, and reads as follows:—

"OR DO THOIRDELBUCH UO CHONCHUBUIR, DON .... IARLATH LAS IN DERNAD IN SA ....

"'A PRAYER FOR TURLOGH O CONOR FOR THE * * * * * * * * * * JARLATH BY WHOM WAS MADE THIS * * * *.'

"That this cross was of contemporaneous age with the church, and was intended as a memorial of its founders, or rebuilders, there can be no reason to doubt. Such was the cross of the Scriptures at Clonmacnoise, which, as I have already shown, was designed as a memorial of the erection of the great church there; and such also was the triple-shafted cross at Cashel, just noticed in connexion with Cormac's chapel, though the inscriptions on it are now wholly obliterated. It seems more probable, therefore, that this church was erected previously to 1150, when O'Hoisin became Bishop, and between the year 1128, when he became Abbot, and 1150, when he succeeded as Archbishop. But the precise year of its erection must remain a matter of doubt, till some definite authority be discovered to determine it. If, however, I might indulge in conjecture, I should assign its erection to a period not very long after his succession to the abbacy, and this not only from the perfect similarity of the interlaced tracery which decorates the base of this cross,—of one side of which I annex a sketch, —to that on the archiepiscopal crozier of Tuam, which, according to the Annals of Innisfallen, was made in the year 1123, but also to the traceries on the base of the cross at Cashel made in 1134, and still more with those on the tomb of Cormac, sculptured, as we may assume, in 1138."

Of the justness of the above opinions, Dr. Petrie stated that he was now more than ever satisfied, as he had no doubt that the error into which Ware and Harris had fallen, as to the supposed date of the re-erection of the church, was caused by their assuming that the stone on which this inscription is carved belonged to a monument or tomb raised to the memory of O'Hoisin in his own cathedral, and that the inscription on it was an *Irish* epitaph; whereas it is now absolutely certain, since the several portions of the cross have been put together, in the Great Industrial Exhibition, that this stone was really but one of those portions: and that the cross, as well as the church of which it was the memorial, was erected by O'Hoisin, previously to his accession to the Archbishopric, is fully established by the other inscriptions carved upon the base of the cross, as above noticed.

The second inscription, unlike the first, runs in a series of twenty-four short horizontal lines, each line consisting of from two to four letters. This inscription is not inferior in importance, and is perhaps of even greater interest, than the former; for it—as well as the other inscriptions on the base of the cross —preserves the name of the king by whose munificence the cross and church were, as we may believe, mainly erected,— and in addition, what is nowhere else preserved, that of the Irish artist, to whose taste and skill those structures were indebted for their elaborate sculptured decorations. This latter fact has been only ascertained from an examination of the inscription since the stone was brought to Dublin, and its discovery is the result of the careful cleaning which the tablet received preparatory to the cast being made from it. The inscription reads as follows:—

OR̄ DON RIG DO THURDELBUCH U CHONCHOBAIR. OR̄ DON THAER DO GILLU CR̄ U THUATHAIL.

"A PRAYER FOR THE KING, FOR TURLOGH O CONOR. A PRAYER FOR THE ARTIFICER, FOR GILLU CHRIST O THUATHAIL."

In conclusion, Dr. Petrie observed that the importance of this latter inscription, as preserving the name of the Irish artificer, will be at once apparent,—and that it was fortunate that so many remains of art in Ireland, of the eleventh and twelfth centuries, preserved similar evidences of their Irish manufacture; as without such evidences, all those who maintained that the Irish were ignorant of such art anterior to the arrival of the English (amongst whom the distinguished names of Sir James Ware and Sir William Petty are to be numbered) would, most probably, assert that they were of foreign origin and manufacture,—and it would not be easy to prove the fallacy of such an assertion. But its fallacy is proved by the inscriptions preserved on the shrine of the Bell of St. Patrick, now in the possession of Dr. Todd, and exhibited to the Academy this evening,—and by those on the cross of Muireadhach O'Dubhthaig, or Murry O'Duffy, the predecessor of Edan O'Hoisin in the Archbishopric of Tuam, which is now in the Museum of the Academy. Examples of the jewellery art, of equal beauty and of equal antiquity with these, were not, as far as Dr. Petrie knew, to be found in England; nor was there an example of the ornamented stone cross which could rival that of Tuam in the grandeur of its proportions, and the beauty of its ornamental sculptures.

Professor Sir William Rowan Hamilton exhibited the following Theorem, to which he had been conducted by that theory of geometrical *syngraphy* of which he had lately submitted to the Academy a verbal and hitherto unreported sketch, and on which he hopes to return in a future communication.

Theorem.—Let $A_1, A_2, \ldots A_n$ be any n points (in number odd or even) assumed at pleasure on the n successive sides of a closed polygon $BB_1B_2 \ldots B_{n-1}$ (plane or gauche), inscribed in any given surface of the second order. Take any three points, P, Q, R, on that surface, as initial points, and draw from each a system of n successive chords, passing in order through the n assumed points (A), and terminating in three other superficial and final points, P', Q', R'. Then there will be (in general) *another* inscribed and closed polygon, $CC_1C_2 \ldots C_{n-1}$, of which the n sides shall pass successively, in the same order, through the same n points (A): and of which the initial point C shall also be connected with the point B of the former polygon, by the relations

$$\frac{ael}{bc}\,\frac{\beta\gamma}{\alpha\varepsilon\lambda} = \frac{a'e'l'}{b'c'}\,\frac{\beta'\gamma'}{\alpha'\varepsilon'\lambda'},$$

$$\frac{bfm}{ca}\,\frac{\gamma\alpha}{\beta\zeta\mu} = \frac{b'f'm'}{c'a'}\,\frac{\gamma'\alpha'}{\beta'\zeta'\mu'},$$

$$\frac{cgn}{ab}\,\frac{\alpha\beta}{\gamma\eta\nu} = \frac{c'g'n'}{a'b'}\,\frac{\alpha'\beta'}{\gamma'\eta'\nu'};$$

where

$a = QR$,	$b = RP$,	$c = PQ$,
$e = BP$,	$f = BQ$,	$g = BR$,
$l = CP$,	$m = CQ$,	$n = CR$,
$a' = Q'R'$,	$b' = R'P'$,	$c' = P'Q'$,
$e' = BP'$,	$f' = BQ'$,	$g' = BR'$,
$l' = CP'$,	$m' = CQ'$,	$n' = CR'$;

while $\alpha\beta\gamma\varepsilon\zeta\eta\lambda\mu\nu$, and $\alpha'\beta'\gamma'\varepsilon'\zeta'\eta'\lambda'\mu'\nu'$, denote the semidiameters of the surface, respectively parallel to the chords $abcefglmn$, $a'b'c'e'f'g'l'm'n'$.

As a very particular *case* of this theorem, we may suppose that $PQRP'Q'R'$ is a plane hexagon in a conic, and BC its Pascal's line.

MONDAY, JUNE 27TH, 1853.

THOMAS ROMNEY ROBINSON, D. D., PRESIDENT, in the Chair.

REV. DR. LLOYD read a paper on the Meteorology of Ireland, as deduced from observations made in 1851, under the direction of the Committee of Science.

Rev. Dr. Drummond read the conclusion of his paper (of which the following is a brief abstract) on the Achievements of Magnus Barefoot, King of Norway, and of his defeat and death in the field of Cobha, in Ireland, A. D. 1103.

On the death of Olave III., King of Norway, A. D. 1093, his son Magnus succeeded to the throne. His right, however, being disputed, he maintained it successfully by the sword. To crush the power of his enemies he made an expedition to Halland, a district about the river Gotha. Having ravaged their country and inflicted capital punishment on their leaders, he returned enriched with glory and spoil. He then determined to add to his dominions by foreign conquest; instigated partly by ambition, and partly, as was reported, by a vision, in which he was admonished to depart from Norway, and threatened with fatal consequences should he refuse. After due consultation with his nobles, a powerful armament, consisting of 160 sail, was soon prepared, and in 1096 left the shores of Norway, many of them never to return. Having laid waste the Orkneys and the Hebrides with fire and sword, but sparing Iona, he took possession of Cantire, and thence sailed to Mann, where his countrymen had formed a colony. Here he strengthened their position by walls and fortifications; and thence proceeded to Anglesea, on the shores of which island he was met by an armed force to oppose his landing. In a conflict which ensued, the leader of the enemy, the Earl of Shrewsbury, was slain. He then entered into an alliance with the Welsh, made peace with the Hebridian Scots, and in 1099 returned to his native dominions, where his presence was required to repel an invasion of the Swedes, over whom he gained a decisive victory. A treaty of peace was then concluded and ratified by his marriage with Margaret, daughter of Inge, the Swedish King. But other cares soon engrossed his thoughts. It became necessary for him to revisit his island conquests, and to aid the Welsh, who had requested him to hasten to their succour. He had it now in contemplation to make a nobler conquest than he had yet achieved, viz., the conquest of Ireland. According to the Chronicle of Mann, he announced his intention to Murchart, the Irish monarch, by sending his shoes, with orders to carry them, in token of submission, through the midst of his palace on Christmas Day. An act of such insolence excited strong indignation in the royal household. It appears, however, that instead of waging war with Murchart, he formed with him an amicable treaty, which was cemented by a contract of marriage between Sigurd, the son of Magnus, and Biadmynia, daughter of the Irish monarch. For some years prior to these events a fierce war had been desolating the fair fields of Ireland, between Murchart O'Brian of the South, and Donnel Mac Loughlan O'Nial of the North, who was regarded by many as legitimate heir to the crown. The royal residences of both potentates were demolished, and numerous battles fought without any decisive issue. In forming an alliance with the Norse King, Murchart may have thought that he would be enabled to reduce his enemies to obedience, and annihilate all rival pretensions to the throne. In 1102 the Ostmen were in arms, ready to assert their independence; and the two kings, Murchart and Magnus, marched with combined forces to besiege Dublin—*munita et opulenta civitas.* The siege was prosecuted with vigour, and the city was obliged to surrender. In the following year the adverse parties of the North and South carried on a desultory warfare, and Magnus made preparations to revisit the conquered islands, and then return to his native country. He had received a promise from Murchart that on a certain day he should receive some herds of cattle to provision the fleet; but as they did not arrive at the expected time, Magnus, who was stationed with his ships somewhere probably on the shores of Down, resolved to land with an armed force, to make a foray, and carry off whatever spoil he could find. When he had advanced a considerable distance into the country, he was suddenly attacked by the natives, and after a desperate conflict, in which many were slain, fell by the stroke of a battle-axe.

It is stated in the notes to the Chronicle of Mann that this event occurred on the 24th of August, 1103,* in the field of

* Eighty-nine years after the battle of Clontarf. Neither the Irish nor the Danish histories have mentioned the name of the locality where Magnus landed; nor of any other place which might enable us to trace the line of his march, or ascertain the spot on which he fell. We have only two authorities, as far as I have been able to learn, for saying that he fell in the field of Cobha, and one of them is probably altogether dependent on the other. The Annals of Boyle say he fell in the year A. D. 1104, in the field of Cobha; and Johnstone, the second authority, in an Appendix to the Chronicles of Mann, states the same fact. Mr. John O'Donovan, the learned translator of the Annals of the Four Masters, a work of which the notes are replete with historical and topographical information, places the field of Cobha in the barony of Upper Iveagh, in the county of Down, nearly midway between Newry and Loughbrickland. From the frequent mention of this field in our Irish histories, it appears to have been a favourite spot for hostings, encampments, skirmishes, and set battles; and hence, from lack of more accurate information, it might have been supposed the place most likely to have been the scene of the Norse King's last conflict. But Magnus did not fall in a set battle, nor is it probable that he could have advanced so far into the country as the field of Cobha, before he was assailed by the vigilant enemy. Moreover, as it is agreed that he was interred in or by Down Cathedral, it may not have been at any great distance thence where he fell. As the spirit of archæology has gone forth, and is pursuing various inquiries in Ireland with success, it might reward the labour of some of our antiquaries thoroughly to explore the surrounding country, with a view to the discovery of weapons of war, and other reliques of ancient times. The county of Down is rich in antiquities, cairns, cromleachs, giant's rings, circles of rude stone pillars, fosse-

Cobha, in the vicinity of Downpatrick, in the cemetery of which the body of Magnus was interred.

Torfæus (p. 146), in giving a summary of the character of Magnus, says—he was a great and magnanimous Prince; strenuous, valiant, distinguished by strength of body and energy of mind, too ambitious of power and glory, persevering in his designs, intrepid in their execution; to his country, by his levies and expeditions, burdensome; to his soldiers indulgent, and, consequently, an object of their love and admiration. When blamed by his friends for too rashly endangering his life by hazardous enterprises, he said, "life was not to be estimated nor measured by length of years, but by victory and renown."

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encircled raths, various monuments—Pagan and Christian, monastic and military. The County Survey of Down says that the Danes penetrated into the country as far as Armagh, and that the raths are commonly known by the name of Danish forts. Certain golden ornaments have also been discovered from time to time, and among them a beautiful crescent, which appears by the description of it to be like one of those in the Museum of the Royal Irish Academy.

In vol. vi. p. 52, of "NOTES AND QUERIES," there is a notice of the burial-place of Magnus, by John W. Hanna, of Downpatrick. Having heard that M. Worsaae, in a recent visit to Ireland, had pointed out a place at some distance from the cathedral of that town, where Magnus was interred, he was anxious to find the spot, but could hear of no tradition concerning it, nor of any place named *Slat Manus.* He seems to have entertained a hope that M. Worsaae might know of some Danish map or history mentioning the particular locality, but without success.

"*Magh Cobha,* the plain of Eochaidh Cobha, the ancestor of the tribe called Ui Eathach Cobha, who were seated in the present baronies of Upper and Lower Iveagh," in the county of Down.—See *O'Flaherty, Ogygia,* part iii. c. 78. The Four Masters, and from them, Colgan, have erred in placing this plain in Tyrone . . . . The older writers place in it the monastery of Druim Mor (Dromore), and the church of Domh-mach Mor Muighe Cobha, which is unquestionably the present "Donaghmore" (in Upper Iveagh), "nearly midway between Newry and Loughbrickland."

The curious reader may see more on this topic by referring to the note, pp. 165, 166, in Mr. John O'Donovan's translation of *Leabhar na g-Ceart,* i.e. the *Book of Rights.*

In stature, he was tall and portly, and altogether worthy to be classed with the greatest and most memorable of kings: yes, it may be added, of warrior kings ambitious of conquest, and who seek for glory, not in the cultivation of the arts of peace, in the moral and intellectual improvement of their species, but in the clash of arms; in the "pomp, pride, and circumstance" of war. Of Magnus it may truly be said, that he was a scourge to his race, that his daring projects were fraught with misery and ruin to thousands of his countrymen as well as to himself. To him how justly may be applied the reflections of a great moralist on "the vanity of human wishes,"* as exemplified in the inglorious termination of another Scandinavian prince's career in a subsequent age!

"Did no subverted empire mark his end?
Did rival monarchs give the fatal wound?
Or hostile millions press him to the ground?
His fall was destined to a barren strand,
A petty fortress, and a dubious hand;
He left a name at which the world grew pale,
To point a moral, or adorn a tale."

Dr. Aquilla Smith read a notice of Irish Tradesmen's Tokens, intended as an Addenda to his List published in the Proceedings, vol. iv. Appendix, p. xxvii.

Dr. Lyons read a further notice of his researches on Histolysis.

"Since the date of my former communication I have been engaged with some further researches on Histolysis, which, while they confirm generally the results I had then arrived at, have led me to the observation of phenomena still more complicated and more highly interesting. The deposit and maturation of the ova of insects, and the development of various forms of animalcules in decaying structures, are phenomena

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* Johnson's Imitation of the 10th Satire of Juvenal.

quite familiar to all observers, and it will be remembered that I noted their occurrence in the second division of the Histolytic Scale. I have in some instances witnessed the abundant development of monads and vibrios as early as the second day, and under certain circumstances they exist in parts still in connexion with the living organism. As the investigation of these living forms did not appear to come directly within the scope of my researches, I took no further notice of them than briefly to assign them their proper place on the scale. In prosecuting further researches, however, I have observed, what no doubt ought to have presented itself to my mind in the first instance, namely, that these animalcules become an element of complexity, and also of great additional interest in the study of the general process of Histolysis, not, as might be supposed, from the possibility of their being confounded with the debris of the tissues under investigation, but from the fact that being themselves subject to the all-pervading law of mortality, when they have sported their hour on the stage they in their turn die, and then undergo putrefactive changes, and mingle their remains with the other decaying elements around them. I have also observed the occurrence of certain microscopic forms of vegetation; protophyta of the simplest kind, such as very minute cells both isolated and aggregated, vegetable filaments, and certain algal forms, being developed in considerable quantities. Under favourable conditions of light I have been enabled in almost all instances to detect a faint greenish colour in all these vegetable forms; with sulphuric acid, and a solution of iodine in iodide of potassium, they usually assume a yellowish tinge, their internal appearances become much more readily seen, and they are themselves distinguishable with great facility from the surrounding elements. At a further stage it is probable these vegetable elements likewise undergo decay.

"These observations add a new interest to the study of Histolysis, and also throw light on some points on which I was hitherto doubtful. The extent to which animalcules of the classes Monadina and Vibrionia become developed is almost incredible,—thousands of them will be found to cover the field in specimens examined from most different sources; they are present at very early periods, probably within twenty-four hours in some cases, and in the oldest rotting tissues which I have examined I have discovered them. I may, however, remark that there are some intermediate stages which I cannot as yet in any way define, at which their development ceases, no trace of animalcule motion being observable.

"Besides the larva of insects familiar to all observers, certain forms of articulata likewise present themselves. I have as yet met with only a form of annelida, most nearly (as I believe) allied to *Polia siphunculus*, which is visible to the naked eye, and under the microscope exhibits a very beautiful internal structure. I have observed two varieties, differing slightly in size and some other particulars; they appear to occur indifferently in all situations.

"In the *debris* of these animalcules, when dead, and undergoing histolytic changes, will be found the nucleated bodies I before described,* as 'peculiar elements.' To recognise these and other elements thus liberated, requires that the living animalcule forms should be carefully studied, and this becomes therefore a necessary preliminary step in the general study of Histolysis, which will be considered at length in its proper place. In the construction of the Histolytic Scale, therefore, in order properly to represent the actual succession of phenomena it will be necessary to insert an ascending line to indicate the period of development, and the growth of vegetable and animalcule forms; and to indicate their subsequent decay and dissolution a second line must be drawn from the summit of the first to the first grade of the Histolytic Scale, showing that these elements now fall in with the general process of decay.

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* Proceedings, *ante*, p. 456.

" These phenomena, no doubt, much complicate the general process; but yet we can follow out the morphic changes of the original tissues in their passage downwards to decay and dissolution, as the practised eye soon learns to detect them, and by preparatory study we are enabled to recognise all forms of extraneous origin. For a long period the original structures retain distinctive characteristics, a circumstance of practical importance, as I have before observed. In some tissues the series of changes is very simple, and may be readily followed throughout: we have an example in adipose tissue, which may be detailed by way of illustration.

"*Adipose Tissue.*—This substance is capable of being recognised by the microscope after a very long time, and when to the naked sight it has not only lost all its usual physical characters, but has assumed a charred and blackened appearance. I have in my possession a specimen of fatty tissue on a glass side, and uncovered, for more than a year and a half, and yet it shows the cellular structure perfectly. In a specimen almost quite black, taken from textures after seven months' putrefaction, and wholly undistinguishable by ordinary physical examination, I have recognised distinctly several groups of fat cells. These cells had all undergone a certain amount of change, for instead of being clear and transparent, they presented finely granular contents, with occasionally a few larger corpuscles. This granular infiltration appears to me the first change which takes place in the fat cell, and I consider it to be owing to the union of its originally homogeneous oily contents with some form of albuminous compound liberated in the histolysis of surrounding tissues, and which has entered the cell-wall by endosmose. In other fat cells a still further change is indicated, their interior being filled with long delicate crystals, arranged in stellate masses, the centre of the stella corresponding nearly with the centre of the cell, the cell wall being still distinctly visible; in other instances this membrane appears to have given way, and the masses of crystals then lie free on the field. Numerous single crystals, apparently liberated from such masses, may be observed floating about. These I regard as crystals of the fatty acids, and as forming the last morphic stage of the Histolytic process in the adipose tissue; the further dilysis of the elements of the crystals only awaits the operation of the necessary chemical and physical forces, which we may conceive to be called into play in a variety of ways. This particular observation of the order of morphic changes, as well as others which I have made, is highly important, as it shows the possibility of Histolysis or morphic dissolution being brought about without the agency of vegetable or animalcule life, thus proving, as I conceive, the independence of the series of changes, and its claims to be considered as a distinct substantive process, taking place in obedience to certain physical laws, and not effected by vegetable and animalcule organisms, the development of which I regard as only a subjective, non-essential phenomenon.

"It is my intention to follow out the histolytic changes as far as I shall be able in the several organs, tissues, and fluids, and I am now engaged with further inquiries on the subject. I may remark that the observation of the several phases of the process presents considerable difficulties, as almost every tissue has certain histolytic peculiarities, and the changes do not progress uniformly in all; thus, in a specimen of cerebral substance of the same date as the structures already noticed, I find that the changes have proceeded to such an extent that without preparatory studies of the phenomena presented in this substance, at earlier periods in the process of its disintegration the appearances are quite unintelligible. I will only further add, that I have noticed very marked and characteristic differences in the smells emitted by different tissues undergoing putrefaction. I have already met with four very distinct and characteristic varieties of smells, and it is highly probable that this observation may be utilized."

APPENDIX.

No. I.

ACCOUNT

OF

THE ROYAL IRISH ACADEMY,

FROM 1st APRIL, 1850, TO 31st MARCH, 1851.

THE CHARGE.

	£	s.	d.	£	s.	d.
To Balance in favour of the Public on 1st April, 1850, ...	. .	. .	.	138	12	0
Parliamentary Grant for 1850, ...	300	0	0			
Quarterly Warrants from Treasury, . .	146	17	8			
Total from Government, .				446	17	8
INTEREST ON STOCK:						
One year's, on £1643 19 6, $3\frac{1}{4}$ per Cent.	53	8	7			
Ditto, „ 717 1 10, 3 „	21	10	2			
Total Interest on Stock, .				74	18	9
RENT OF STABLE, due 1st November, 1850,	21	0	0			
Deduct Poor Rate, ...	0	19	3			
Net Rent of Stable, . . .				20	0	9
TRANSACTIONS AND PROCEEDINGS sold, .	. .	. .	.	27	3	2
LIFE COMPOSITIONS:						
3. Robert Clayton Browne, Esq., . . .	21	0	0			
4. Rev. Orlando T. Dobbin, ...	15	15	0			
Forward,	36	15	0	707	12	4

	£	s.	d.	£	s.	d.
Brought forward,	36	15	0	707	12	4
2. William Harvey Pim, Esq., . . .	21	0	0			
5. Henry Hennessy, Esq., ...	21	0	0			
6. W. B. Wallace, Esq., ...	6	6	0			
1. Ewing Whittle, M. D., ...	15	15	0			
Total Life Compositions, .				100	16	0
ENTRANCE FEES.						
2. Basilio Angeli, Esq., ...	5	5	0			
15. William Oliver Barker, M. D., . .	5	5	0			
9. R. Clayton Browne, Esq., ...	5	5	0			
4. Hugh Carlile, M. D., ...	5	5	0			
11. Rev. Orlando T. Dobbin, ...	5	5	0			
3. Robert Fowler, Esq., ...	5	5	0			
12. James Gibson, Esq., ...	5	5	0			
10. Samuel Gordon, M. D., ...	5	5	0			
14. Daniel Griffin, M. D., ...	5	5	0			
1. W. H. Hardinge, Esq., ...	5	5	0			
13. Henry Hennessy, Esq., ...	5	5	0			
5. Andrew John Maley, Esq., . . .	5	5	0			
8. William Harvey Pim, Esq., . . .	5	5	0			
7. Ewing Whittle, M. D., ...	5	5	0			
6. St. George Williams, M. D., . . .	5	5	0			
Total Entrance Fees, . .				78	15	0
ANNUAL SUBSCRIPTIONS:						
22. Abraham Abell, Esq., ... 1848,	2	2	0			
23. Ditto, ... 1849,	2	2	0			
96. Rev. I. G. Abeltshauser, LL. D., 1850,	2	2	0			
3. Robert Adams, M. D., ... ,,	2	2	0			
184. Ditto, ... 1851,	2	2	0			
185. William Andrews, Esq., . . . 1850,	2	2	0			
186. Ditto, ... 1851,	2	2	0			
150. John Anster, LL. D., ... 1850,	2	2	0			
84. William Barker, M. B., ... 1849,	2	2	0			
85. Ditto, ... 1850,	2	2	0			
6. Edward Barnes, Esq., ... ,,	2	2	0			
200. Ditto, ... 1851,	2	2	0			
54. Sir Matthew Barrington, Bart., 1850,	2	2	0			
180. Michael Barry, Esq., ... ,,	2	2	0			
69. J. Middleton Barry, Esq., . . ,,	2	2	0			
97. Thomas J. Beasly, Esq. . . . ,,	2	2	0			
144. Thomas E. Beatty, M. D., . . ,,	2	2	0			
35. H. Coulson Beauchamp, M. D. ,,	2	2	0			
Forward,	37	16	0	887	3	4

			£	s.	d.	£	s.	d.
	Brought forward,		37	16	0	887	3	4
60.	Edward Bewley, M. D.,	1850,	2	2	0			
86.	Philip Bevan, M. D.,	,,	2	2	0			
201.	Right Hon. the Lord Chancellor,	1851,	2	2	0			
182.	Daniel F. Brady, Esq.,	,,	2	2	0			
158.	William Brooke, Esq.,	,,	2	2	0			
71.	Major William E. D. Broughton, R. E.,	1850,	2	2	0			
76.	Ditto,	1851,	2	2	0			
173.	John Burrowes, Esq.,	,,	2	2	0			
137.	F. W. Burton, Esq.,	1850,	2	2	0			
20.	Very Rev. Dean of Clonmacnoise,	,,	2	2	0			
196.	Ditto,	1851,	2	2	0			
193.	Richard Cane, Esq.,	,,	2	2	0			
83.	John Carley, Esq.,	1850,	2	2	0			
179.	Hugh Carlile, M. D.,	1851,	2	2	0			
72.	Samson Carter, Esq.,	1850,	2	2	0			
157.	George Cash, Esq.,	,,	2	2	0			
14.	Thomas Cather, Esq.,	,,	2	2	0			
48.	B. J. Chapman, Esq.,	,,	2	2	0			
47.	Sir Montague Chapman, Bart.,	,,	2	2	0			
11.	Henry Clare, Esq.,	,,	2	2	0			
98.	F. V. Clarendon, Esq.,	,,	2	2	0			
133.	James Claridge, Esq.,	,,	2	2	0			
155.	E. S. Clarke, Esq.,	,,	2	2	0			
103.	J. S. Close, Esq.,	,,	2	2	0			
18.	Maurice Collis, Esq.,	,,	2	2	0			
154.	F. W. Conway, Esq.,	,,	2	2	0			
49.	Edward J. Cooper, Esq.,	,,	2	2	0			
127.	Ditto,	1851,	2	2	0			
122.	Dominick J. Corrigan, M. D.,	1850,	2	2	0			
151.	Ven. Henry Cotton, LL. D.,	1851,	2	2	0			
64.	John D'Alton, Esq.,	1849,	2	2	0			
31.	M. P. Darcy, Esq.,	1850,	2	2	0			
197.	John Davidson, Esq.,	,,	2	2	0			
117.	J. C. Deane, Esq.,	1848,	2	2	0			
118.	Ditto,	1849,	2	2	0			
126.	Matthew O'R. Dease, Esq.,	1850,	2	2	0			
73.	Rickard Deasy, Esq.,	,,	2	2	0			
101.	Rev. R. V. Dixon, A. M.,	,,	2	2	0			
194.	Charles Doyne, Esq.,	1851,	2	2	0			
17.	William Drennan, Esq.,	1850,	2	2	0			
174.	Michael Donovan, Esq.,	1851,	2	2	0			
111.	Durham Dunlop, Esq.,	1850,	2	2	0			
7.	Earl of Dunraven,	,,	2	2	0			
192.	William Edington, Esq.,	1851,	2	2	0			
	Forward,		130	4	0	887	3	4

	£	s.	d	£	s.	d.
Brought forward,	130	4	0	887	3	4
2. I. C. Egan, M. D., ... 1850,	2	2	0			
161. Ditto, ... 1851,	2	2	0			
88. James S. Eiffe, Esq. 1850,	2	2	0			
153. C. G. Fairfield, Esq., ... 1851,	2	2	0			
163. Lord Farnham, ... ,,	2	2	0			
123. Samuel Ferguson, Esq., . . . 1850,	2	2	0			
21. Alexander Ferrier, Esq., . . ,,	2	2	0			
140. John Finlay, LL. D., ... ,,	2	2	0			
45. Rev. Joseph Fitzgerald, . . ,,	2	2	0			
198. Lord William Fitzgerald, . . . 1851,	2	2	0			
79. Gerald Fitzgibbon, Esq., . . . 1850,	2	2	0			
146. Robert Fowler, Esq., ... 1851,	2	2	0			
46. Robert Franks, Esq., ... 1850,	2	2	0			
38. George A. Frazer, Esq., R. N., ,,	2	2	0			
119. William Frazer, Esq., ... ,,	2	2	0			
91. Rev. J. A. Galbraith, ... ,,	2	2	0			
181. A. E. Gayer, LL. D., ... ,,	2	2	0			
8. Wyndham Goold, Esq., . . . ,,	2	2	0			
41. John Grene, Esq., ... ,,	2	2	0			
169. Very Rev. Dean Gregory, . ,,	2	2	0			
106. William Grimshaw, M. D., . ,,	2	2	0			
139. Thomas Grubb, Esq., ... ,,	2	2	0			
66. Charles W. Hamilton, Esq., . ,,	2	2	0			
164. Ditto, ... 1851,	2	2	0			
81. George A. Hamilton, Esq., M. P., 1850,	2	2	0			
89. John Hamilton, M. D., ... ,,	2	2	0			
26. W. Neilson Hancock, LL. D., ,,	2	2	0			
199. Ditto, ... 1851,	2	2	0			
42. Charles Hanlon, Esq., ... 1850,	2	2	0			
152. W. Henry Hardinge, Esq., . 1851,	2	2	0			
75. James Hartley, Esq., ... 1850,	2	2	0			
92. Rev. Samuel Haughton, . . ,,	2	2	0			
175. William Henn, Esq., ... 1851,	2	2	0			
102. W. E. Hudson, Esq., ... 1850,	2	2	0			
135. Henry G. Hughes, Esq., . . ,,	2	2	0			
170. Edward Hutton, M. D. . . . 1851,	2	2	0			
53. Rev. J. K. Ingram, ... 1850,	2	2	0			
120. Arthur Jacob, M. D., ... ,,	2	2	0			
29. Capt, Henry James, R. E., . ,,	2	2	0			
74. Sir J. K. James, Bart., ... ,,	2	2	0			
82. Rev. J. H. Jellett, ... ,,	2	2	0			
61. Francis M. Jennings, Esq., . ,,	2	2	0			
107. Philip Jones, Esq., ... ,,	2	2	0			
77. Henry H. Joy, Esq., ... ,,	2	2	0			
67. Sir Robert Kane, M. D., . . ,,	2	2	0			
Forward,	224	14	0	887	3	4

		£	s.	d.	£	s.	d.
	Brought forward,	224	14	0	887	3	4
159. J. C. F. Kenny, Esq., . . .	1851,	2	2	0			
125. Thomas F. Kelly, LL. D., .	1850,	2	2	0			
95. G. A. Kennedy, M. D., ...	„	2	2	0			
50. Henry Kennedy, M. D., . .	„	2	2	0			
141. W. T. Kent, Esq., ...	„	2	2	0			
162. Hon. James King, ...	1851,	2	2	0			
16. C. C. King, M. D., ...	1850,	2	2	0			
202. Ditto, ...	1851,	2	2	0			
90. Robert Law, M. D., ...	1850,	2	2	0			
147. Rev. William Lee, A. M., . .	„	2	2	0			
187. William R. Le Fanu, Esq., .	„	2	2	0			
188. Ditto, ...	1851,	2	2	0			
130. George Lefroy, Esq., . . .	1849,	2	2	0			
131. Ditto, ...	1850,	2	2	0			
160. F. L'Estrange, Esq., ...	1851,	2	2	0			
99. W. T. Lloyd, Esq., ...	1850,	2	2	0			
80. Rev. George Longfield, . .	„	2	2	0			
65. Mountiford Longfield, LL. D.,	„	2	2	0			
113. William Longfield, Esq., . .	„	2	2	0			
1. W. H. Luscombe, Esq., . . .	„	2	2	0			
94. William M'Dougall, Esq., . .	„	2	2	0			
172. J. S. M'Donnell, Esq., . . .	„	2	2	0			
33. Rev. R. J. M'Ghee, ...	„	2	2	0			
5. R. R. Madden, M. D., . . .	„	2	2	0			
36. James Magee, Esq., ...	„	2	2	0			
114. Rev. John Magrath, ...	„	2	2	0			
115. Ditto, ...	1851,	2	2	0			
58. Robert Mallet, Esq.	1849,	2	2	0			
70. Ditto, ...	1850,	2	2	0			
149. Ditto, ...	1851,	2	2	0			
138. Rev. Edward Marks, D. D., .	1850,	2	2	0			
128. Henry W. Massy, Esq., . .	1849,	2	2	0			
129. Ditto, ...	1850,	2	2	0			
44. G. M. Miller, Esq., C. E., . .	„	2	2	0			
37. John Mollan, M. D., . . .	„	2	2	0			
168. Christopher Moore, Esq., . .	1851,	2	2	0			
136. David Moore, Esq., ...	1850,	2	2	0			
195. John M'Mullen, Esq., . . .	1851,	2	2	0			
30. William T. Mulvany, Esq., .	1850,	2	2	0			
104. J. M. Neligan, M. D., . . .	„	2	2	0			
132. Arthur R. Nugent, Esq., . .	„	2	2	0			
4. W. J. O'Driscoll, Esq., . . .	1849,	2	2	0			
39. John O'Donovan, LL. D., .	„	2	2	0			
40. Ditto, ...	1850,	2	2	0			
183. N. P. O'Gorman, Esq., . . .	1851,	2	2	0			
	Forward,	319	4	0	887	3	4

		£	s.	d.	£	s.	d.
	Brought forward,	319	4	0	887	3	4
165.	M. M. O'Grady, M. D., ... 1851,	2	2	0			
55.	Arthur S. Ormsby, Esq., . . 1850,	2	2	0			
52.	Jonathan Osborne, M. D., . . ,,	2	2	0			
19.	Charles Ottley, Esq., . . . ,,	2	2	0			
32.	Jacob Owen, Esq., ... ,,	2	2	0			
191.	Very Rev. Dean of St. Patrick's, 1851,	2	2	0			
87.	James Patten, M. D., ... 1850,	2	2	0			
63.	Right Hon. Chief Baron, . . ,,	2	2	0			
51.	James Pim, Esq., ... ,,	2	2	0			
68.	Rev. Classon Porter, . . . ,,	2	2	0			
108.	Algernon Preston, Esq., . . ,,	2	2	0			
142.	Sir Thomas N. Redington, . 1849,	2	2	0			
143.	Ditto, ... 1850,	2	2	0			
62.	Rev. James Reid, ... ,,	2	2	0			
112.	Robert Reid, M. D., ... ,,	2	2	0			
78.	Matthew R. Sausse, Esq., . . ,,	2	2	0			
166.	M. W. Savage, Esq., . . . 1849,	2	2	0			
167.	Ditto, ... 1850,	2	2	0			
9.	O'Neale Segrave, Esq., . . . ,,	2	2	0			
10.	F. I. Sidney, LL. D., . . . ,,	2	2	0			
134.	Oliver Sproule, Esq., . . . ,,	2	2	0			
177.	William Stokes, M. D., . . ,,	2	2	0			
178.	Ditto, ... 1851,	2	2	0			
93.	Aquilla Smith, M. D., . . . 1850,	2	2	0			
15.	Henry Smith, Esq., ... ,,	2	2	0			
28.	Joseph Huband Smith, Esq. . ,,	2	2	0			
124.	Robert W. Smith, M. D., . . ,,	2	2	0			
100.	Rev. Thomas Stack, A. M., . ,,	2	2	0			
105.	M. H. Stapleton, M. B., . . ,,	2	2	0			
34.	D. P. Starkey, Esq., . . . ,,	2	2	0			
156.	Lord Talbot de Malahide, . . 1851,	2	2	0			
116.	Matthew E. Talbot, Esq., . . 1850,	2	2	0			
43.	Rev. J. J. Taylor, D. D., . . ,,	2	2	0			
189.	Ditto, ... 1851,	2	2	0			
27.	W. R. Townsend, Esq., . . 1850,	2	2	0			
121.	Thomas J. Tuffnell, M. D., . ,,	2	2	0			
57.	William B. Wallace, Esq., . . ,,	2	2	0			
24.	J. F. Waller, Esq., ... 1849,	2	2	0			
25.	Ditto, ... 1850,	2	2	0			
148.	C. T. Webber, Esq., ... 1851,	2	2	0			
12.	Rev. John West, D. D., . . 1850,	2	2	0			
171.	His Grace the Archbishop of Dublin, ... 1851,	2	2	0			
13.	George Wilkinson, Esq., . . 1850,	2	2	0			
109.	Robert C. Williams, M. D., . 1849,	2	2	0			
	Forward,	411	12	0	887	3	4

	£	s.	d.	£	s.	d.
Brought forward,	411	12	0	887	3	4
110. Robert C. Williams, M. D., . 1850,	2	2	0			
56. Rev. James Wills, ... ,,	2	2	0			
176. Ditto, ... 1851,	2	2	0			
145. John Wynne, Esq., ... ,,	2	2	0			
190. Hon. Thomas Vesey, M. P., . ,,	2	2	0			
59. George Yeates, Esq., . . . 1850,	2	2	0			
Total Annual Subscriptions, . .				424	4	0
Contingencies.						
Rev. T. R. Robinson, D. D., for carriage of parcels from London, ...	1	2	4			
Total Contingences, . . .				1	2	4
Subscriptions for the Purchase of the Betham MSS.						
29. Right Hon. Justice Ball, ...	2	0	0			
9. John Ball, Esq., ...	2	0	0			
25. T. F. Bergin, Esq., ...	1	0	0			
23. William Brooke, Esq., ...	3	0	0			
32. John Burrowes, Esq., ...	5	0	0			
13. Rev. Samuel Butcher, D. D., . . .	1	1	0			
27. His Excellency the Lord Lieutenant,	15	0	0			
8. Robert Callwell, Esq., ...	3	0	0			
34. Ven. Archdeacon Cotton, ...	1	0	0			
12. Henry Courtney, Esq., ...	1	0	0			
10. Hon. Justice Crampton, ...	5	0	0			
7. Charles P. Croker, M. D., ...	1	1	0			
37. Earl of Dunraven, ...	10	0	0			
18. Robert Fowler, Esq., ...	2	0	0			
6. M. H. Gill, Esq., ...	1	0	0			
20. Sir William R. Hamilton, LL. D., .	1	0	0			
30. — Howell, M. D., ...	1	0	0			
21. J. B. Kennedy, Esq., ...	1	0	0			
1. J. C. Kenny, Esq., ...	8	0	0			
3. Rev. Henry King, LL. D., ...	5	0	0			
19. D. C. Latouche, Esq., ...	1	1	0			
15. Earl of Leitrim, ...	5	0	0			
2. Rev. Humphrey Lloyd, D. D., . .	10	0	0			
31. Rev. Thomas M'Neece, D. D., . . .	2	0	0			
33. Robert Mallet, Esq., ...	1	0	0			
24. W. T. Mulvany, Esq., ...	1	0	0			
Forward,	89	3	0	1312	9	8

	£	s.	d.	£	s.	d.
Brought forward,	89	3	0	1312	9	8
36. M. M. O'Grady, M. D., ...	1	0	0			
28. Rt. Hon. Chief Baron, ...	5	0	0			
22. George Pim, Esq., ...	5	0	0			
17. Henry Roe, Esq., ...	2	0	0			
16. Rt. Hon. Sir William Somerville, Bart., M. P., ...	5	0	0			
5. William Stokes, M. D., ...	10	0	0			
14. Ven. Archdeacon Strong, ...	1	0	0			
35. Lord Talbot de Malahide, ...	5	0	0			
11. Hon. James Talbot, ...	1	0	0			
26. F. Whitla, Esq., ...	1	0	0			
4. William R. Wilde, Esq.,.	5	0	0			
Total Subscriptions for Purchase of Betham Manuscripts, . .				130	3	0
SUBSCRIPTIONS FOR EXCAVATION AT DOWTH TUMULUS.						
1. Thomas Mocral, Esq., ...	10	0	0			
2. Committee of Antiquities, per Rev. J. H. Todd, D. D., ...	34	10	11			
Total Subscription for Dowth Excavation, ...				44	10	11
SUBSCRIPTIONS TO METEOROLOGICAL AND TIDAL EXPENDITURE.						
2. James Apjohn, M. D., ...	5	0	0			
3. Robert Callwell, Esq., ...	2	0	0			
11. Lord Bishop of Cork, ...	2	0	0			
4. Rev. Charles Graves, D. D., . . .	5	0	0			
7. W. N. Hancock, LL. D., ...	1	0	0			
9. Earl of Leitrim, ...	3	0	0			
1. Rev. H. Lloyd, D. D., ...	25	0	0			
10. J. A. Nicholson, Esq., ...	5	0	0			
6. Rev. T. R. Robinson, D. D., ...	5	0	0			
8. Rev. J. W. Stubbs, ...	2	0	0			
5. Rev. J. H. Todd, D. D., ...	2	0	0			
Total Subscriptions to Meteorological and Tidal Expenditure, .				57	0	0
TOTAL AMOUNT OF CHARGE, . .	. . . . .			1544	3	7

THE DISCHARGE.

Antiquities purchased.	£	s.	d.	£	s.	d.
Donegan, John, gold fibula, ...	15	18	9			
Ditto, gold collar, ...	6	9	8			
Ditto, gold ornament, ...	3	8	0			
Enniskillen, Earl of, bronze vessel, . .	1	0	0			
Furlong, R., pipe-stopper, ...	0	3	0			
Murphy, Charles, old spectacles, ...	0	3	0			
Murphy, Patrick, tray and head of wood,	0	10	0			
Morgan, Jerome, ancient seal, ...	1	10	0			
Nugent, John, sundry antiquities, ...	10	0	0			
O'Donnell, I., bronze pot, ...	4	0	0			
Todd, Rev. J. H., D. D., shrine figure, .	7	10	0			
Wallace, S., bronze chisel, ...	0	2	6			
Walsh, Rev. Stephen, crozier and bells, &c., ...	5	0	0			
Total Antiquities purchased, .				55	14	11
Books, Printing, and Stationery.						
Barthes and Lowell, books, ...	0	9	0			
Cleary, Alice, Irish MSS., ...	2	10	0			
Curry, Eugene, on account of transcribing Brehon Laws, ...	15	0	0			
Du Noyer, George, Irish MSS., ...	0	6	0			
Ferrier and Co., stationery, ...	0	9	6			
Gill, M. H., printing Transactions, vol. xxii. part 1, . £113 0 4						
Ditto, part 2, ... 70 4 4						
Ditto, Notices, &c., ... 17 14 7	200	19	3			
Hanlon, G. A., wood-cutting, ...	5	10	0			
Hendrick, stationery, ...	0	11	1			
Hodges and Smith, books, ...	27	7	6			
M'Quaid, H. M., ditto, ...	0	10	6			
O'Brien, Thomas, ditto, ...	0	10	0			
Oldham, William, wood-cutting, . . .	9	15	0			
Forward,	263	17	10	55	14	11

	£	s.	d.	£	s.	d.
Brought forward,	263	17	10	55	14	11
Jones, J. F., stationery, ...	5	2	5			
Johnston and Co., advertising, ...	0	11	6			
O'Reilly, J., books, ...	0	7	6			
O'Shaughnessy, J. S., copper-plate printing,	3	8	6			
Peterkin, James, engraving, ...	3	11	6			
Plunket, James, drawings, ...	2	15	0			
Pilkington, Frederick, binding, ...	70	16	6			
Ray Society, subscription to, ...	1	1	0			
Tallon, John, stationery, ...	3	16	6			
Tyrrell, Gerald, books, ...	0	2	0			
Total Amount of Books, Printing, and Stationery, &c., ...				355	10	3

Coals, Gas, Etc.

	£	s.	d.	£	s.	d.
Alliance Company, for gas and coke, . .	16	7	1			
Edmundson, J., and Co., goods, ...	0	6	3			
Hoey, James, coals and carriage, . . .	7	9	0			
Lambert, J., candles, ...	0	5	3			
Tharell, P., tapers, ...	0	3	10			
Todhunter, T. H., coals and carriage, . .	3	17	6			
Toole, Martin, ditto, ...	10	10	0			
Total Amount of Coals, &c., . .				38	18	11

Repairs of House.

	£	s.	d.	£	s.	d.
Browne, John, painting, &c., ...	7	9	0			
M'Donnell, E., cleaning ash-pit, ...	0	4	0			
Murphy, John, sweeping chimneys, . .	1	1	0			
Surman, George, repairs, ...	16	18	0			
Turner, Richard, heating apparatus, . .	0	2	6			
Total Repairs of House, . . .				25	14	6

Furniture and Repairs.

	£	s.	d.	£	s.	d.
Dobbyn, George, clocks, ...	0	11	0			
Casey, Paul, iron work, ...	0	12	0			
Edmundson, J., and Co., gas-fittings, &c.,	1	2	0			
M'Master and Son, key for clock, . . .	0	2	0			
Surman, George, furniture, &c., ...	15	6	6			
Porter, glass shade, ...	0	2	0			
Total Furniture and Repairs, .				17	15	6
Forward,	. . . .			493	14	1

	£	s.	d.	£	s.	d.
Brought forward,	. . . .			493	14	1
Rent, Taxes, and Insurance.						
National Insurance Company,	9	16	0			
Globe Insurance Company,	5	13	6			
One year's rent of house,	104	9	0			
Minister's Money,	2	15	5			
Pipe Water Tax,	1	19	2			
Total Rent, Taxes, and Insurance,				124	13	1
Salaries, Wages, Etc.						
Ball, Robert, LL. D., Treasurer,	21	0	0			
Clibborn, Edward, Clerk, Assistant Secretary, and Curator of Museum,	150	0	0			
Curry, Anthony, evenings' attendance,	0	15	0			
Drummond, Rev. W. H., D.D., Librarian,	21	0	0			
Graves, Rev. Charles, D.D., Secretary of Council,	21	0	0			
Hamilton, William, hall-porter,	34	4	8			
O'Brien, Thomas, messenger,	39	0	0			
Todd, Rev. J. H., D. D., Secretary of Academy,	21	0	0			
Todhunter, Isaac, Accountant,	46	0	0			
Wright and Oxley, livery hat,	0	18	0			
Total Salaries, Wages, &c.,				354	17	8
Contingencies, Etc.						
Clibborn, Edward, allowance for sundries used in cleaning house, for half year, due 6th January, 1850,	5	0	0			
Ditto, for one year, due 16th January, 1851,	10	0	0			
Expenses of freight and charges on books,	18	18	11			
Stamps for receipts, and commission for receiving dividends,	0	12	2			
Petty charges,	1	2	10			
Postages and stamps,	2	19	0			
Total Contingencies,				38	12	11
Betham Manuscripts.						
Sir William Betham, on account of the purchase of his Irish MSS.,	. . . . .			139	0	0
Forward,	. . . . .			1150	17	9

		£ s. d.	£ s. d.
Brought forward,		. . . .	1150 17 9
Excavation at Dowth.			
Edward Clibborn, balance due him, for wages of men, &c., paid Mr. Frith, to July, 1848, ...		27 10 11	
James Elcock, paid him for damage of land, and restoration of the mound, . . .		16 0 0	
Total Excavation at Dowth, . .			43 10 11
Meteorological and Tidal Expenditure.			
Dobbyn, George, tide-gauges, &c., ...	£38 12 4		
Yeates, George, meteorological instruments, ...	114 16 0		
Total Cost of Instruments, &c.,		153 8 4	
Buncrana station, ...	£0 12 6		
Caherciveen ditto, ...	0 3 6		
Castletownsend ditto, ...	7 17 1		
Courtown ditto, ...	9 4 8		
Cushendall ditto, ...	0 16 10		
Donaghadee ditto, ...	7 18 4		
Dunmore ditto, ...	9 3 0		
Killibegs ditto, ...	3 2 11		
Kilrush ditto, ...	4 10 11		
Kingstown ditto, ...	3 4 3		
Portrush ditto, ...	10 13 0		
Rathmullen ditto, ...	7 15 0		
Valentia ditto, ...	6 8 4		
		71 10 4	
Original expenditure paid out of £225 granted by the Academy, ...		224 18 8	
Clifden station, ...	3 16 2		
Red Bay and Cushendall ditto,	6 12 11		
Scattery ditto, ...	0 13 10		
Supplemental Expenditure paid out of Meteorological and Tidal Subscription, ...		11 2 11	
Contingent expenses, ...	5 4 10		
Postages and Post Office orders,	8 15 0		
Charged in Audit Account to Academy "Contingencies,"		13 19 10	
Forward,		250 1 5	1194 8 8

	£	s.	d.	£	s.	d.
Brought forward,	250	1	5	1194	8	8
Hendrick, R., books, &c., for returns from meteorological and tidal stations, and charged in Audit Account to Academy "Books, Stationery, Etc.,"	17	12	0			
Total Amount of Meteorological and Tidal Expenditure, . .				267	13	5
Total Discharge, ...	. . . . .			1462	2	1
Balance in favour of the Public, in Bank of Ireland, ...	. . . . .			82	1	6
TOTAL AMOUNT OF CHARGE, . .	. . . . .			1544	3	7

GENERAL ABSTRACT OF THE MONTHLY ACCOUNTS OF THE ROYAL IRISH ACADEMY,

AS FURNISHED TO AUDIT OFFICE, FROM APRIL, 1850, TO MARCH, 1851, INCLUSIVE.

Dr.	£	s.	d.	Cr.	£	s.	d.
To Balance, 1st April, 1850,	138	12	0	By Antiquities bought,	55	14	11
To Parliamentary Grant,	300	0	0	By Books, Printing, and Stationery, (A)*	373	2	3
To Treasury allowances,	146	17	8	By Coals, Gas, &c.,	38	18	11
To Interest on Stock,	74	18	9	By Repairs of House,	25	14	6
To Rent of Stable,	20	0	9	By Rent, Taxes, &c.,	124	13	1
To Transactions and Proceedings sold,	27	3	2	By Furniture and Repairs,	17	15	6
To Life Compositions,	100	16	0	By Salaries, Wages, &c.,	354	17	8
To Entrance Fees,	78	15	0	By Contingencies, (B)*	52	12	9
To Annual Subscriptions,	424	4	0	By Betham MSS.,	139	0	0
To Contingencies,	1	2	4	By Excavation at Dowth,	43	10	11
To Subscriptions to Betham MSS. fund,	130	3	0	By Meteorological and Tidal Expenditure, (C)*	236	1	7
To Subscriptions to Dowth Excavation fund,	44	10	11	By Balance indebted on 31st March, 1851,	82	1	6
To Subscriptions to Meteorological and Tidal Expenditure,	57	0	0				
	1544	3	7		1544	3	7

* These amounts are consistent with the instructions of the Audit Office. In the Account, pp. x. xi. xiii., it appears that a part of the sums A and B are added to C, so as to exhibit the gross amount of expenditure under the Meteorological and Tidal service, up to 31st March, 1851.

The Treasurer reports that there is to the credit of the Academy, in the Bank of Ireland, £717 1*s.* 10*d.* in 3 per cent. Consols, and £1643 19*s.* 6*d.* in $3\frac{1}{4}$ per cent. Government Stock, the latter known as the Conyngham Fund.

31*st March*, 1851.

(Signed), ROBERT BALL,
Treasurer.

No. II.

MEASUREMENTS

REFERRED TO IN

THE REPORT OF THE COMMITTEE OF SCIENCE,

DATED MARCH 13, 1852.

Northern Stations.

Donaghadee.—August 15. The height of the zero of the tide-gauge was measured, and the result found to accord with that of the former measurement in 1850.

Cushendall.—August 18. A levelling was taken from the zero of the tide-gauge to a bench-mark on the wall at the road-side north of the tunnel, above the pier. The difference of level was found to be 34·74 feet.

Portrush.—August 23. The zero of the tide-gauge was found to be 12·58 feet below the bench-mark on the pier.

Rathmullan.—August 26. There is no Ordnance bench-mark near to this station. The zero of the tide-gauge was found to be 20·20 feet below the upper surface of the corner coping-stone at the southern end of the pier.

Killybegs.—August 28. The zero of the tide-pole is 18·00 feet below the coping-stone of the pier, to which it is attached. The correspondence of the figures on the second tide-pole was verified by simultaneous observations.

Kingstown.—October 17. The difference of level between the zero of the tide-gauge, and the copper bolt in the coping-stone of the pier near the water-tank, was ascertained by simultaneous observations, and found to be 18·28 feet.

Southern Stations.

Bunown.—August 19. There is no bench-mark at this station. The zero of the tide-gauge was compared with the upper surface of the adjoining pier-stone (the seventh from the angle of the pier) and found to be 18·15 feet below it.

Inishgort.—August 26. There are no tidal observations at this station. The cistern of the barometer was found to be 4·2 feet above the base of the Lighthouse Tower.

Kilrush.—September 1. There was no re-measurement at this station, the tide-gauge having been destroyed by the violence of the sea.

Cahirciveen.—September 2. The zero of the tide-gauge was found to be 23·50 feet below the provisional mark, which is on the upper surface of the coping-stone of the pier of the bridge, at the north-east angle.

Castletownsend.—September 6. The zero of the tide-gauge is 31·94 feet below the Ordnance bench-mark, which is at the foot of the flag-staff.

Courtown.—November 11. The Ordnance bench-mark at this station is a bolt driven vertically in one of the coping-stones on the north side of the channel to the harbour. The zero of the tide-gauge is 17·13 feet below it. The cistern of the barometer is 25·14 feet above the bench-mark.

Dunmore East.—November 12. The Ordnance bench-mark is a vertical bolt driven into one of the coping-stones of the pier, not far from the Lighthouse. The zero of the tide-gauge was found to be 17·59 feet below it.

The levellings taken at Portrush and Dunmore differ considerably in their results from those of the preceding year. This is due to the circumstance that the tide-gauges were not erected at these stations when they were visited in 1850; and consequently, all that could be then done was to level from the bench-mark to some point near the intended position of the gauge, leaving the rest to be done by the observer. The measures taken in 1850 at these two stations must, under these circumstances, be disregarded. At all the other stations the measures taken in the two years are nearly accordant, and their means will be employed in the comparison of the mean tide levels.

No. III.

ACCOUNT

OF

THE ROYAL IRISH ACADEMY,

FROM 1ST APRIL 1851, TO 31ST MARCH, 1852.

THE CHARGE.

	£	s.	d.	£	s.	d.
To Balance in favour of the Public on 1st April, 1851, ...	. . . . .			82	1	6
Parliamentary Grant for 1851, ...	300	0	0			
Quarterly Warrants from Treasury, . .	146	17	8			
Total from Government, .				446	17	8
INTEREST ON STOCKS:						
One year's, on £1643 19 6, 3¼ per Cent.	53	8	5			
Ditto, ,, 717 1 10, 3 ,,	21	10	2			
Total Interest on Stocks, .				74	18	7
RENT OF STABLE, due 1st November, 1851,	21	0	0			
Deduct Poor Rate, ...	0	14	0			
Net Rent of Stable, . . .				20	6	0
TRANSACTIONS AND PROCEEDINGS SOLD, .	. . . . .			1	13	6
LIFE COMPOSITIONS:						
2. Dickinson, Joseph, M. D., ...	15	15	0			
1. Hone, Thomas, Esq., ...	21	0	0			
Total Life Compositions, .				36	15	0
Forward,	. . . . .			662	12	3

	£	s.	d.	£	s.	d.
Brought forward,	.	.	.	662	12	3
ENTRANCE FEES:						
1. Barker, John, M. D.,	5	5	0			
7. Beresford, Ven. Marcus Gervais,	5	5	0			
3. Codd, Francis, Esq.,	5	5	0			
14. Dickinson, Joseph, M. D.,	5	5	0			
15. Jukes, Joseph Beete, Esq.,	5	5	0			
8. Fleming, Christopher, M. D.,	5	5	0			
13. Higgins, Joseph Napier, Esq.,	5	5	0			
9. Hone, Thomas, Esq.,	5	5	0			
16. Kelly, Thomas Tear, Esq.,	5	5	0			
2. Kelly, William, M. D.,	5	5	0			
6. Lyons, Robert D., M. D.,	5	5	0			
10. Pigott, John Edward, Esq.,	5	5	0			
17. Roe, George, Esq.,	5	5	0			
11. Ross, Robert, of Bladensburgh,	5	5	0			
4. Sayers, Rev. Johnston Brydges,	5	5	0			
5. Scully, Vincent, Esq., M. P.,	5	5	0			
12. Smith, Catterson, Esq.,	5	5	0			
Total Entrance Fees,				89	5	0
ANNUAL SUBSCRIPTIONS:						
65. Abeltshauser, Rev. J. G., LL. D., 1851,	2	2	0			
147. Alcorn, Rev. John, ,,	2	2	0			
187. Aldridge, John, M. D., 1850,	2	2	0			
188. Ditto, 1851,	2	2	0			
39. Angeli, Signor, ,,	2	2	0			
178. Anster, John, LL. D., ,,	2	2	0			
31. Baker, Abraham W., Esq., 1850,	2	2	0			
184. Ditto, 1851,	2	2	0			
32. Baker, Abraham W., Jun., Esq., 1850,	2	2	0			
185. Ditto, 1851,	2	2	0			
49. Barker, Francis, M. D., 1850,	2	2	0			
50. Ditto, 1851,	2	2	0			
160. Barker, W. O., M. D, 1852,	2	2	0			
176. Barnes, Edward, Esq., ,,	2	2	0			
92. Barrington, Sir Matthew, Bart., 1851,	2	2	0			
99. Beasely, T. I., Esq., ,,	2	2	0			
141. Beatty, T. E., M. D., ,,	2	2	0			
41. Beauchamp, H. C., M. D., ,,	2	2	0			
48. Bell, John, Esq., ,,	2	2	0			
74. Bevan, Philip, M. D., ,,	2	2	0			
57. Bewley, Edward, M. D., ,,	2	2	0			
14. Booth, Sir W. Gore, Bart., M. P., ,,	2	2	0			
137. Ditto, 1852,	2	2	0			
Forward,	48	6	0	751	17	3

		£	s.	d.	£	s.	d.
	Brought forward,	48	6	0	751	17	3
159. Bourns, Charles, Esq., . . .	1850,	2	2	0			
136. Boyle, R. V., Esq., ...	1851,	2	2	0			
29. Ditto, ...	1852,	2	2	0			
168. Brady, Right Hon. Maziere, .	,,	2	2	0			
134. Brooke, William, Esq., . .	,,	2	2	0			
180. Burroughs, John, Esq., . .	,,	2	2	0			
59. Burton, Frederick W., Esq., .	1851,	2	2	0			
3. Cane, Arthur B., Esq., . .	,,	2	2	0			
146. Ditto, ...	1852,	2	2	0			
4. Cane, Edward, Esq., . . .	1851,	2	2	0			
192. Cane, Richard, Esq., . . .	1852,	2	2	0			
122. Carley, John, Esq., ...	1851,	2	2	0			
107. Carter, Samson, Esq., . . .	,,	2	2	0			
37. Cather, Thomas, Esq., . . .	,,	2	2	0			
88. Chapman, B. J., Esq., . . .	,,	2	2	0			
1. Churchill, Fleetwood, M. D., .	,,	2	2	0			
179. Ditto, ...	1852,	2	2	0			
15. Clare, Henry, Esq., ...	1851,	2	2	0			
123. Clarendon, F. V., Esq., . .	,,	2	2	0			
183. Clarke, E. S., M. D., . . .	,,	2	2	0			
111. Claridge, James, Esq., . . .	,,	2	2	0			
36. Close, J. S., Esq., ...	,,	2	2	0			
113. Collis, Maurice, Esq., . . .	,,	2	2	0			
191. Cotton, Ven. Henry, . . .	1852,	2	2	0			
104. Crampton, Sir Philip, Bart., .	1850,	2	2	0			
105. Ditto, ...	1851,	2	2	0			
51. D'Arcy, Matthew P., Esq., .	,,	2	2	0			
121. Davidson, John, Esq., . . .	,,	2	2	0			
93. Deane, John C., Esq., . . .	1850,	2	2	0			
94. Ditto, ...	1851,	2	2	0			
120. Dease, M. O'R., Esq., . . .	,,	2	2	0			
12. Deasy, Rickard, Esq., . . .	,,	2	2	0			
117. Dobbs, W. C., Esq., ...	,,	2	2	0			
166. Donovan, Michael, Esq., . .	1852,	2	2	0			
196. Doyne, Charles, Esq., . . .	,,	2	2	0			
33. Drennan, William, Esq., . .	1851,	2	2	0			
22. Dungannon, Lord, ...	,,	2	2	0			
114. Dunlop, Durham, Esq., . .	,,	2	2	0			
193. Edington, William, Esq., . .	1852,	2	2	0			
189. Egan, J. C., M. D., ...	,,	2	2	0			
62. Eiffe, James S., Esq., . .	1851,	2	2	0			
201. Enniskillen, Earl of, . . .	1850,	2	2	0			
202. Ditto, ...	1851,	2	2	0			
143. Farnham, Lord, ...	1852,	2	2	0			
135. Ferguson, Samuel, Esq., . .	1851,	2	2	0			
	Forward,	142	16	0	751	17	3

		£	s.	d.	£	s.	d.
	Brought forward,	142	16	0	751	17	3
16.	Ferrier, Alexander, Esq., . . 1851,	2	2	0			
139.	Ditto, ... 1852,	2	2	0			
82.	Finlay, John, LL. D., . . . 1851,	2	2	0			
63.	Fitzgibbon, Gerald, Esq., . . „	2	2	0			
35.	Fitzgerald, Rev. Joseph, . . „	2	2	0			
52.	Fortescue, Chichester S., Esq., M. P., ... „	2	2	0			
157.	Ditto, ... 1852,	2	2	0			
164.	Fowler, Robert, Esq., ... „	2	2	0			
112.	Fox, Sir Charles, ... 1851,	2	2	0			
27.	Fraser, G. A., Esq., Capt. R. N., „	2	2	0			
125.	Freke, Henry, M. D., ... „	2	2	0			
133.	Ditto, ... 1852,	2	2	0			
119.	Galbraith, Rev. Joseph A., . 1851,	2	2	0			
131.	Gayer, Arthur E., LL. D., . „	2	2	0			
26.	Goold, Wyndham, Esq., M. P., „	2	2	0			
55.	Graves, Robert J., M. D., . . „	2	2	0			
169.	Gregory, Very Rev. James, . „	2	2	0			
170.	Gregory, William, M. D., . . 1850,	2	2	0			
171.	Ditto, ... 1851,	2	2	0			
172.	Ditto, ... 1852,	2	2	0			
67.	Grene, John, Esq., ... 1851,	2	2	0			
18.	Grimshaw, Wrigley, M. D., . „	2	2	0			
186.	Grubb, Thomas, Esq., ... „	2	2	0			
140.	Hamilton, C. W., Esq., . . 1852,	2	2	0			
98.	Hamilton, George A., Esq., M. P., ... 1851,	2	2	0			
118.	Hamilton, John, Esq., ... „	2	2	0			
30.	Hanlon, Charles, Esq., ... „	2	2	0			
85.	Haughton, Rev. Samuel, . . „	2	2	0			
152.	Henn, William, Esq., . . . 1852,	2	2	0			
9.	Hogan, William, Esq., . . . 1851,	2	2	0			
144.	Hudson, William E., Esq., . „	2	2	0			
145.	Ditto, ... 1852,	2	2	0			
76.	Hughes, Henry G., Esq., . . 1851,	2	2	0			
198.	Hutton, Edward, M. D., . . 1852,	2	2	0			
110.	Jacob, Arthur, M. D., . . . 1851,	2	2	0			
28.	James, Henry, Capt. R. E., . „	2	2	0			
148.	Ditto, ... 1852,	2	2	0			
58.	James, Sir John K., Bart., . 1851,	2	2	0			
84.	Jellett, Rev. John H., ... „	2	2	0			
77.	Jennings, Francis M., Esq., . „	2	2	0			
204.	Ditto, ... 1852,	2	2	0			
69.	Jones, Philip, Esq., ... 1851,	2	2	0			
87.	Joy, Henry H., Esq., ... „	2	2	0			
	Forward,	233	2	0	751	17	3

		£	s.	d.	£	s.	d.
	Brought forward,	233	2	0	751	17	3
173.	Kane, Sir Robert, M. D., . . . 1851,	2	2	0			
115.	Kelly, Thomas F., LL. D., . ,,	2	2	0			
64.	Kennedy, G. A., M. D., . . ,,	2	2	0			
13.	Kennedy, Henry, Esq., . . ,,	2	2	0			
190.	Kenny, James C. F., Esq., . 1852,	2	2	0			
142.	Kent, William T., Esq., . . 1851,	2	2	0			
199.	King, Charles C., M. D., . . 1852,	2	2	0			
83.	Law, Robert, M. D., . . . 1851,	2	2	0			
149.	Lee, Rev. William, ... ,,	2	2	0			
102.	Lefroy, George, Esq., . . . ,,	2	2	0			
165.	L'Estrange, Francis, Esq., . 1852,	2	2	0			
89.	Lloyd, W. T., Esq., ... 1851,	2	2	0			
79.	Longfield, Rev. George, . . ,,	2	2	0			
100.	Longfield, Mountiford, LL. D., ,,	2	2	0			
61.	Longfield, William, Esq., . . ,,	2	2	0			
68.	Luscombe, W. H., Esq., . . ,,	2	2	0			
154.	Lyle, Acheson, Esq., . . . 1850,	2	2	0			
155.	Ditto, ... 1851,	2	2	0			
47.	M'Dougall, William, Esq., . ,,	2	2	0			
177.	M'Donnell, J. S., Esq., . . ,,	2	2	0			
70.	M'Ghee, Rev. R. J., . . . ,,	2	2	0			
205.	M'Mullen, John, Esq., . . . 1852,	2	2	0			
38.	Madden, Robert R., M. D., . 1851,	2	2	0			
53.	Magee, James, Esq., . . . ,,	2	2	0			
197.	Mallet, Robert, Esq., . . . 1852,	2	2	0			
17.	Marks, Rev. Edward, D. D., . 1851,	2	2	0			
71.	Melville, Alexander G., M. D., ,,	2	2	0			
96.	Miller, George M., Esq., . . ,,	2	2	0			
167.	Moore, Christopher, Esq., . . 1852,	2	2	0			
97.	Moore, David, Esq., . . . 1851,	2	2	0			
34.	Mollan, John, M. D., . . . ,,	2	2	0			
80.	Monsell, William, Esq., M.P., 1850,	2	2	0			
81.	Ditto, ... 1851,	2	2	0			
6.	Mulvany, W. T., Esq., . . . ,,	2	2	0			
153.	Ditto, ... 1852,	2	2	0			
73.	Neligan, J. Moore, M. D. , . 1851,	2	2	0			
21.	Nugent, Arthur R., Esq. . . ,,	2	2	0			
151.	Ditto, ... 1852,	2	2	0			
43.	O'Donovan, John, LL. D., . 1851,	2	2	0			
129.	O'Driscoll, W. J., Esq., . . 1850,	2	2	0			
130.	Ditto, ... 1851,	2	2	0			
138.	O'Gorman, N. P., Esq., . . 1852,	2	2	0			
156.	O'Grady, M. M., M. D., . . ,,	2	2	0			
108.	Oldham, Thomas, Esq., . . 1850,	2	2	0			
109.	Ditto, ... 1851,	2	2	0			
	Forward,	327	12	0	751	17	3

	£	s.	d.	£	s.	d.
Brought forward,	327	12	0	751	17	3
2. Ormsby, A. S., Esq., . . . 1851,	2	2	0			
132. Osborne, Jonathan, M. D., . ,,	2	2	0			
44. Ottley, Charles, Esq., . . . ,,	2	2	0			
8. Owen, Jacob, Esq., ... ,,	2	2	0			
195. Pakenham, Hon. and Very Rev. H., ... 1852,	2	2	0			
128. Patten, James, Esq., . . . 1851,	2	2	0			
78. Pigott, Right Hon. David R., ,,	2	2	0			
126. Pim, James, Esq., ... ,,	2	2	0			
127. Ditto, ... 1852,	2	2	0			
66. Porter, Rev. Classon, . . . 1851,	2	2	0			
161. Preston, Algernon, Esq., . . ,,	2	2	0			
162. Ditto, ... 1852,	2	2	0			
24. Purdon, W. A., Esq., . . . 1851,	2	2	0			
60. Reid, Rev. James, ... ,,	2	2	0			
90. Reid, Robert, M. D., . . . ,,	2	2	0			
150. Sausse, M. R., Esq., . . . ,,	2	2	0			
103. Sayers, Rev. J. B., ... ,,	2	2	0			
203. Ditto, ... 1852,	2	2	0			
46. Sidney, Frederick J., LL. D., 1851,	2	2	0			
40. Smith, Aquilla, M. D., . . . ,,	2	2	0			
163. Smith, Catterson, Esq., . . 1852,	2	2	0			
5. Smith, Henry, Esq., . . . 1851,	2	2	0			
200. Ditto, ... 1852,	2	2	0			
116. Smith, R. W., Esq., . . . 1851,	2	2	0			
95. Smith, J. Huband, Esq., . . ,,	2	2	0			
86. Sproule, Oliver, Esq., . . . ,,	2	2	0			
91. Stapleton, M. H., M. B., . . ,,	2	2	0			
19. Staples, Sir Thomas, Bart., . 1849,	2	2	0			
20. Ditto, ... 1850,	2	2	0			
101. Ditto, ... 1851,	2	2	0			
158. Ditto, ... 1852,	2	2	0			
56. Starkey, Digby P., Esq., . . 1851,	2	2	0			
7. Segrave, O'Neale, Esq., D. L., ,,	2	2	0			
25. Tighe, Robert, Esq., . . . ,,	2	2	0			
42. Townsend, W. R., Esq., . . ,,	2	2	0			
75. Tuffnell, T. J., M. D., . . . ,,	2	2	0			
194. Vesey, Hon. Thomas, M. P., . 1852,	2	2	0			
23. Vignoles, Charles, Esq., . . 1851,	2	2	0			
174. Walker, R. C., Esq., . . . 1850,	2	2	0			
175. Ditto, ... 1851,	2	2	0			
181. Wallace, Robert A., Esq., . 1850,	2	2	0			
182. Ditto, ... 1851,	2	2	0			
124. Waller, J. F., Esq., ... ,,	2	2	0			
54. West, Ven. John, D. D., . . ,,	2	2	0			
Forward,	420	0	0	751	17	3

	£	s.	d.	£	s.	d.
Brought forward,	420	0	0	751	17	3
72. Wilkinson, George, Esq., . . . 1851,	2	2	0			
10. Wingfield, Hon. and Rev. Wm., 1850,	2	2	0			
11. Ditto, ... 1851,	2	2	0			
106. Wynne, John, Esq., ... „	2	2	0			
45. Yeates, George, Esq., ... „	2	2	0			
Total Annual Subscriptions, . .				430	10	0
CONTINGENCIES.						
For carriage of parcels from London, . .	0	16	10			
Total Contingencies, . . .				0	16	10
SUBSCRIPTIONS FOR THE PURCHASE OF THE BETHAM MSS.						
12. Angeli, Signor B., ...	1	1	0			
2. Blacker, Stewart, Esq., ...	1	0	0			
1. Booth, Sir Robert Gore, Bart., M. P.,	2	0	0			
5. Brady, Right Hon. Maziere, . . .	5	0	0			
4. Deasy, Rickard, Esq., ...	1	0	0			
9. Guinness, Right Hon. Benjamin Lee, Lord Mayor, ...	20	0	0			
8. Hudson, W. E., Esq., ...	5	0	0			
7. Pigott, Right Hon. David R., . . .	2	0	0			
11. Portlock, Lieut.-Colonel, R. E., . . .	2	0	0			
10. Purdon, W. A., Esq., ...	1	0	0			
3. Strong, Ven. Archdeacon, ...	2	0	0			
6. Tobin, J., Esq., ...	1	0	0			
	43	1	0			
Excess of Subscriptions above cost of the MSS., carried to credit of Gold Torque Fund below (see p. xxv.), ...	2	11	0			
Total Subscriptions for Purchase of the Betham MSS., . . .				40	10	0
SUBSCRIPTIONS, ETC., TO METEOROLOGICAL AND TIDAL EXPENDITURE.						
19. Ball, Robert, LL. D., ...	5	0	0			
35. Baillie, Rev. J. K., D. D., ...	1	1	0			
20. Burrowes, John, Esq., ...	1	0	0			
Forward,	7	1	0	1223	14	1

		£	s.	d.	£	s.	d.
	Brought forward,	7	1	0	1223	14	1
22.	Corballis, J. R., Esq.,	1	0	0			
24.	Courtney, Henry, Esq.,	2	0	0			
3.	Dobbin, Leonard, Esq.,	1	0	0			
21.	Donovan, Michael, Esq.,	1	0	0			
32.	Drummond, Rev. W. H., D. D.,	2	0	0			
25.	Dunraven, Earl of,	5	0	0			
11.	Galbraith, Rev. Joseph A.,	5	0	0			
27.	Goold, Wyndham, Esq., M. P.,	1	0	0			
33.	Graves, Rev. Charles, D. D.,	2	0	0			
5.	Guinness, Right Hon. Benjamin Lee, Lord Mayor,	2	0	0			
4.	Harvey, William H., M. D.,	2	0	0			
9.	Haughton, Rev. Samuel,	5	0	0			
16.	Hemans, G. W., Esq.,	1	0	0			
7.	Hamilton, Sir William R., LL. D.,	2	0	0			
30.	Hudson, William Elliott, Esq.,	1	0	0			
10.	Jellett, Rev. John H.,	5	0	0			
26.	Ingram, J. K., LL. D.,	3	0	0			
12.	Larcom, Major Thomas A., R. E.,	3	0	0			
17.	Ditto,	2	0	0			
18.	M'Neece, Rev. Thomas, D. D.,	1	0	0			
6.	Mulvany, William T., Esq.,	1	0	0			
15.	Pim, Jonathan, Esq.,	1	0	0			
23.	Purser, John, Esq.,	1	0	0			
1.	Rosse, Earl of,	10	0	0			
2.	Sabine, Colonel,	1	0	0			
8.	Strong, Ven. Archdeacon,	2	0	0			
28.	Talbot de Malahide, Lord,	1	0	0			
14.	Yeates, George, Esq.,	1	0	0			
	Total Subscriptions,	72	1	0			
	PROCEEDS OF SALE OF INSTRUMENTS.						
31.	Bowie, Lieutenant, . . . £5 5 0						
13.	Knox, Lieutenant, . . . 0 6 0						
29.	Stoll, Captain, . . . 1 14 0	7	5	0			
	Total Subscriptions, &c., to Meteorological and Tidal Expenditure,				79	6	0
	SUBSCRIPTIONS FOR THE PURCHASE OF GOLD TORQUES.						
5.	Ball, Robert, LL. D.,	3	3	0			
1.	Larcom, Major T. A., R. E.,	2	0	0			
	Forward,	5	3	0	1303	0	1

	£	s.	d.	£	s.	d.
Brought forward,	5	3	0	1303	0	1
4. Goold, Wyndham, Esq., M. P., ...	1	0	0			
6. Graves, Rev. Charles, D. D., ...	2	0	0			
2. Robinson, Rev. T. R., D. D., ...	1	0	0			
3. Todd, Rev. J. H., D. D., ...	5	0	0			
	14	3	0			
Excess of Betham MSS. Subscriptions, carried to this head of service, by desire of Rt. Hon. Benj. Lee Guinness, Lord Mayor, as his subscription of £20 more than covered the amount to be paid for the MSS. (see p. xxiii.), . . .	2	11	0			
Total amount of Subscriptions to Gold Torques, ...				16	14	0
TOTAL AMOUNT OF CHARGE, . . .	. . . .			1319	14	1

THE DISCHARGE.

Antiquities purchased.				£	s.	d.	£	s.	d.
Conroy, Mary, sundry antiquities, ...				8	3	6			
Dee, Cecilia, ivory ball, ...				0	10	0			
Donegan, John, gold articles, ...				25	7	2			
Ditto, ditto, ...				4	10	0			
Entee, E. A., bronze belts, ...				2	0	0			
Hughes, James, iron tripod, ...				0	10	0			
Nalty, Michael, stone celts, ...				0	4	6			
Nathan, John, gold brooch, ...				0	10	6			
O'Donnell, James, gold torques, ...				5	0	0			
Swift, Henry, iron sword, ...				0	7	6			
Total Antiquities purchased, .							47	3	2
Books, Printing, and Stationery.									
Barthes and Lowell, charges on books, .				1	7	0			
Curry, Eugene, cataloguing Irish MSS., .				19	19	0			
Ditto, paper, ...				0	15	0			
Ferrier and Pollock, ink and paper, . .				1	3	5			
Gill, M. H., printing vol. iv., Proceedings, ...	£91	14	9						
Ditto, part 1, vol. v., Proceedings, ...	71	13	1						
Ditto, miscellaneous printing,	33	15	6						
				197	3	4			
Harris, E., book, ...				0	5	0			
Jones, J. F., stationery, ...				3	0	6			
Kelly, W. B., books, ...				0	10	0			
Museum of Irish Industry, book, ...				0	2	6			
M'Quaid, Henry, book, ...				0	12	6			
Oldham, William, wood engraving, . .				2	10	0			
Ponsonby, Edward, stationery, ...				2	17	6			
Tallon, John, stationery, ...				2	17	8			
Total Amount of Books, Printing, and Stationery, &c., ...							233	3	5
Forward,				. .	. .		280	6	7

	£ s. d.	£ s. d.
Brought forward,	. . . .	280 6 7
Coals, Gas, Etc.		
Alliance Gas Company, gas and coke, . .	18 12 4	
Dunn, Patrick, bogwood, ...	0 18 0	
Lambert, J., candles, ...	0 3 5	
Stephens, John F., coals, ...	1 11 0	
Tharel, P., tapers, ...	0 2 6	
Todhunter, T. H., and Co., coals, . . .	7 16 0	
Toole, M., coals, ...	1 9 0	
Total Amount of Gas, Coals, &c.,		30 12 3
Repairs of House.		
Boylan, Patrick, papering and painting, .	11 0 3	
Browne, Mrs., cleaning windows, ...	1 10 0	
Casey, Paul, repairs of locks, &c., . . .	0 6 0	
Dunne, Maria, washing, ...	0 2 6	
Kirwan, B., cleaning ash-pit, ...	0 12 0	
Malone, P., shaking carpets, ...	0 7 6	
Murphy, James, sweeping chimneys, . .	0 16 0	
Walsh, John, shaking carpets, ...	0 3 6	
Total Repairs of House, . . .		14 17 9
Furniture and Repairs.		
Brown, Thomas, and Co., blankets, &c., for Porter, ...	2 5 10	
Jones, J. F., fixtures, ...	1 17 0	
Daniel, P., hand-lantern, ...	0 2 4	
Total Furniture and Repairs, . .		4 5 2
Rent, Taxes, and Insurance.		
National Insurance Company, ...	9 16 0	
Globe Insurance Company, ...	5 13 6	
One year's rent of house, ...	104 9 0	
Minister's Money, ...	2 15 5	
Pipe Water Tax, ...	1 19 2	
Total Rent, Taxes, and Insurance, .		124 13 1
Forward,	. . . .	454 14 10

	£	s.	d.	£	s.	d.
Brought forward,	. . . .			454	14	10
Salaries, Wages, Etc.						
Allen, Richard, livery for hall-porter, . .	5	15	0			
Ball, Robert, LL. D., Treasurer, ...	21	0	0			
Clibborn, Edward, Clerk and Assistant Secretary, and Curator of Museum, . .	150	0	0			
Curry, Anthony, evening meetings, . .	1	15	0			
Drummond, Rev. W. H., D. D., Librarian,	21	0	0			
Graves, Rev. Charles, D. D., Secretary of Council, ...	21	0	0			
Hamilton, William, hall-porter, ...	3	19	0			
Ditto, allowed by Council one quarter's wages, on being discharged, ...	8	11	2			
Neville, Patrick, hall-porter, ...	30	5	8			
O'Brien, Thomas, messenger, ...	39	0	0			
Todd, Rev. J. H., D. D., Secretary of Academy, ...	21	0	0			
Todhunter, Isaac, accountant, ...	45	0	0			
Total Salaries, Wages, &c., . .				368	5	10
Contingencies.						
Clibborn, Edward, allowance for sundries used in cleaning house, for the year 1851–52, ...	10	0	0			
Expenses of freight and charges on books,	9	6	11			
Stamps for receipts, and commission for receiving dividends, ...	0	18	2			
Postages and stamps, ...	9	4	9			
Petty charges, ...	4	15	1			
Total Contingencies, ...				34	4	11
Betham Manuscripts.						
Sir William Betham, balance of the purchase of his Irish MSS., ...	. . . . .			40	0	0
Gold Torques.						
Edward Clibborn, on account of his purchase of two gold torques for the Academy, on 3rd October, 1848, ...	. . . . .			16	14	0
Forward,	. . . .			913	19	7

	£	s.	d.	£	s.	d.
Brought forward,	.	.	. .	913	19	7
Meteorological and Tidal Expenditure.						
Paid out of Meteorological and Tidal Subscriptions, and by sale of instruments :						
Caherciveen station, ...	19	8	2			
Castletownsend ditto, ...	8	13	7			
Clifden ditto, ...	6	15	9			
Courtown ditto, ...	8	14	10			
Cushendall ditto, ...	7	4	2			
Donaghadee ditto, ...	5	2	6			
Dunmore ditto, ...	9	19	1			
Killibegs ditto, ...	8	3	8			
Kilrush ditto, ...	0	6	0			
Kingstown ditto, ...	10	14	0			
Portrush ditto, ...	4	19	9			
Rathmullen ditto, ...	5	6	9			
Westport ditto, ...	2	10	10			
Expense of Stations, ...	97	19	1			
George Yeates, for instruments, ...	8	8	6			
Total Amount of Meteorological and Tidal Expenditure, . .				106	7	7
Expenditure on House, 19, Dawson-st.						
Connell, J., removing furniture, books, &c.,	30	9	6			
Gresham, T. M., rent to 25th March, 1852,	77	18	8			
Moylan, D., and O'Brien, Sir Timothy, Bart., as trustees of the Dawson-street Club, for fixtures, ...	100	0	0			
Sundry expenses, moving to and cleaning up, ...	5	15	6			
Total Expenditure on House in Dawson-street, ...				214	3	8
Total Discharge, ...	.	.	. .	1234	10	10
Balance in favour of the Public,	.	.	. .	85	3	3
Total Amount of Charge, .	.	.	. .	1319	14	1

GENERAL ABSTRACT OF THE MONTHLY ACCOUNTS OF THE ROYAL IRISH ACADEMY,

AS FURNISHED TO AUDIT OFFICE, FROM 1st APRIL, 1851, TO 31st MARCH, 1852, INCLUSIVE.

Dr.	£	s.	d.
To Balance on 1st April, 1851,	82	1	6
To Parliamentary Grant,	300	0	0
To Treasury allowance,	146	17	8
To Interest on Stocks,	74	18	7
To Rent of Stable,	20	6	0
To Transactions and Proceedings sold,	1	13	6
To Life Compositions,	36	15	0
To Entrance Fees,	89	5	0
To Annual Subscriptions,	430	10	0
To Contingencies,	0	16	10
To Subscriptions to Betham MSS.,	40	10	0
To Subscriptions to Meteorological and Tidal Expenditure,	79	6	0
To Subscriptions to Gold Torques,	16	14	0
£	1319	14	1

Cr.	£	s.	d.
By Antiquities,	47	3	2
By Books, Printing, &c.,	233	3	5
By Coals, Gas, &c.,	30	12	3
By Repairs of House,	14	17	9
By Furniture and Repairs,	4	5	2
By Rent, Taxes, &c.,	124	13	1
By Salaries, Wages, &c.,	368	5	10
By Contingencies,	34	4	11
By Betham MSS.,	40	0	0
By Meteorological and Tidal Expenditure,	106	7	7
By Gold Torques,	16	14	0
By Expenditure on House, 19, Dawson-street,	214	3	8
	1234	10	10
By Balance indebted 31st March, 1852,	85	3	3
£	1319	14	1

(Signed), EDWARD CLIBBORN, *Accountant.*

The Treasurer reports that there is to the credit of the Academy, in the Bank of Ireland, £717 1*s.* 10*d.* in 3 per cent. Consols, and £1643 19*s.* 6*d.* in $3\frac{1}{4}$ per cent. Government Stock, the latter known as the Conyngham Fund.

(Signed), ROBERT BALL,
Treasurer.

31*st March*, 1852.

No. V.

COLLECTION OF ANTIQUITIES

PRESENTED TO

THE ROYAL IRISH ACADEMY,

BY

WILLIAM T. MULVANY, ESQ., M. R. I. A.,

ON THE PART OF THE COMMISSIONERS OF PUBLIC WORKS IN IRELAND.

Read January 26, and February 9, 1852.

As the member of the Board of Public Works in charge of the department of Arterial Drainage and Inland Navigation in Ireland, I have the honour, on the part of my colleagues and myself, to present to the Academy a collection of antiquities obtained in the execution of the works by the engineers and other officers of the Board. I have also the pleasure to present the private collection of antiquities of Mr. R. A. Gray, one of our engineers; and to exhibit a number of articles, the property of private individuals in Strokestown, in the county of Roscommon, which have been lent to me for that purpose.

The operations of the Board of Works in this department, extending over a very large portion of the island, have been in progress for about nine years, and have cost, up to the present time, about £1,458,000; and, besides the accomplishment of the direct objects of improved agriculture and trade, for which they have been promoted, these operations are full of interest to the scientific man, as regards various hydraulic and hydrodynamic questions, and the relations between the fall of rain and discharge of water from different areas of country of different characters; full of interest to the geologist, from the secrets of nature which, whether in her ancient or more modern laboratory, are laid bare by the deep cuts through strata of various formations in the lowest valleys in the country; and, finally, full of interest to the antiquary, who through their aid finds the beds of deep rivers and lakes laid dry for the first time, the shoals dried and cut through, which, before bridges were thought of or ferries used, formed not only the fords in time of peace, but the contested passes of the country in time of war. In the bars and shoals of our rivers and lakes are exposed, at different depths, the weapons and instruments of various ages and conditions of society, from the most ancient to our own time.

It was early anticipated, and indeed proved by experience in the works carried on for the improvement of the Shannon, that the arterial drainage works would afford opportunities rarely possessed for obtaining antique remains from places under water, which remains, if faithfully described, would be useful adjuncts to our local history; and the attention of the engineers in charge was repeatedly called to the system adopted by the Board of Works, and to the necessity of preserving and describing everything that should be found.

Whilst many things have been saved for the Academy, I regret to acknowledge the conviction, that a still larger portion has been lost, the workmen having been frequently encouraged to break through our rules by traders in antiquities, and by individuals desirous of making private collections, who neglect, or are generally unable, to describe correctly the place where the articles were obtained. Were this done, the Academy might still hope, in time, to recover many of the missing articles; but it is to be feared now that, owing to this neglect, we should only become possessed of numerous duplicates, wanting in the essential matter of historic interest—their identification with locality.

In November last, owing to the recent discovery of antiquities in the artificial islands found in several loughs laid dry or lowered by the drainage operations, we felt strongly the necessity of getting together the articles that had been collected. On the part of our Board I then wrote a circular to the several engineers in charge of the drainage works; the following extracts from that letter will briefly show the principles by which we were influenced, and on which the engineers have acted, in forwarding the collections then made:—

"We are anxious to get up all the antiquities which have been collected by the several drainage engineers, according to the arrangements and instructions issued by us, in order that a collection, to be called 'The Drainage of Ireland Collection,' may be deposited, for security and public inspection, in the Royal Irish Academy, where it will be added to the collection made by the Shannon Commissioners."

"An object of great importance is to have the antiquities identified with the locality where they were found, and we therefore wish to have attached to each thing found a card, with a description on one side of the place where found, name of townland, parish, barony, and county, and the name of the engineer by whose care and attention it has been collected; and on the other side of the card a description of the precise locality, the material in which imbedded, its depth, allusion to other antiquities found with it, and such other matters of interest as occur to you to record. With these views, and especially that of identification with the locality, as in a very remarkable and permanent way illustrating the local and general history of the country, you will readily perceive the importance of collecting and forwarding everything found, even though there be several of the same kind; as, looking forward to a classification in localities, they will illustrate the universality or otherwise of certain practices, and confirm or confute historical manuscripts, poems, &c. If with the articles collected you will, in addition to the cards, forward a letter or brief paper descriptive of them, with a catalogue, and any facts, opinions, or traditions connected with the neighbourhood where they have been found, you will confer additional advantage on the public; and care will be taken to have your paper recorded, and its statements brought before the Academy. In cases where islands of artificial construction, raths, or other works, have been discovered or cut into, descriptive drawings and sections will be of the greatest importance, and you are requested to forward them."

"You will understand this letter as referring also to all officers in your department who may have collected any such articles, and with whom I may have omitted to communicate. It is so palpably better for the interest of all that the articles found should be deposited in a great national museum, with the names of the collectors recorded, than to have a few scattered articles possessed by individuals, and ultimately lost,—it is so clearly our duty as public officers to have the collection so deposited,—that I place entire reliance in your using your influence to collect and forward everything that has and shall be found."

To that circular there has been a cheerful and satisfactory response on the part of the engineers who have been successful in making collections; and I now proceed to present the collections received, and to furnish such information as has been afforded.

[Mr. Mulvany then exhibited the antiquities presented (*vide* pages liii to lxvi.) and read the following extracts from letters received in reply to his circular.]

[*From* Mr. Richard A. Gray.]

"Drainage Office, Kinnegad,
"*December* 1, 1851.

"Dear Sir,—I herewith forward to you a case containing forty-four specimens of Irish antiquities, principally of a warlike character, obtained from the excavations connected with the improvement of the Boyne and Deel rivers, in the counties of Meath, Westmeath, Kildare, and King's County.

"In addition, I beg to add twenty-five from my own collection, which I will feel obliged by your presenting to the Academy, and at the same time decline your offer to reimburse my expenses incurred in obtaining the articles belonging to the Drainage collection.

"Amongst the Drainage articles is an iron two-edged sword, No. 1, on which, inlaid with gold, are represented six female figures, bearing banners; there are three on either side, corresponding exactly in position and size, each four inches in length, and extending along the blade. It was found imbedded in bog, close to a ford across the Deel, connecting the lands of Derrymore and Riversdale, in the county of Westmeath. It probably belonged to the time of Hugh De Lacy, in the twelfth century.

"An iron weapon, No. 6, of a compound character, was found near the castle of Donore, imbedded in gravel and sand, about two feet under the bed of the river. Along with it was found a short sword, with ornamental guard, labelled No. 12; and a battle-axe, No. 5, in the same place, imbedded in alluvial deposit, beside the river.

"These weapons probably belonged to the Scots, who, with Robert and Edward Bruce, were encamped near Trim, under cover of a wood (Longwood?), in the spring of 1317. The first-named weapon I have seen no duplicate of, nor any description more than a drawing in Meyrick's Ancient Armour (vol. i. plate 28), representing weapons used in 1312.

"The sword with the ivory handle, No. 4, was found below Stoneyford Bridge, in the side-cutting of our excavations; it was lying on the gravel (formerly the bed of the river), and covered with alluvial deposit four feet in depth. It belonged to one of the volunteers of 1779.

"The other sword, No. 2, is a yeomanry sword of 1798.

No. 3, with the brass handle, marked with the initials R. T. 9, was found about a mile above Clonard. I think it likely that it belonged to some of Lieutenant Tyrrell's corps who defended Clonard in 1798; or perhaps to the besiegers of Tycroghan Castle, in 1641.

"The key, No. 13, was given to me by Mr. Ledwich of Kilrathmurry, adjoining Clonard, and was found in some excavations about his farm buildings.

"One of the iron swords, No. 32, was found in the Little Boyne, near Kinnefad Castle; and the other, No. 7, beside the rath of Clonard. The remains of a small bucket, presented to the Academy by Dr. Barker some time since; a brass pot; and some small swords, &c., were found in the same portion of the works, and disposed of by the men without my knowledge.

"The large bronze blade, No. 14, and two others like it; the iron dirk, No. 9, and another like it, in better preservation; the iron spear, No. 21; bronze do., Nos. 22 and 23; and the ornament, No. 18, were found, nearly all together, a mile below Stoneyford, on the Boyne River, at which point no ford is described on any of the published maps; nor is it spoken of by tradition, although it must have been well known, as both bronze and iron weapons were found more plentifully here than at any other place above Trim. Indeed, with the exception of this point and Donore, very few antiquities have been found along the course of the Boyne works; at the last-named place no bronzes were discovered.

"The bone dirk, No. 15, was found a quarter of a mile below Clonard, and with it some stone spear-heads, of about nine inches in length, and half-an-inch in thickness. These were taken away by the men, to be used as hones; and I could not recover any of them. From all I could learn, I believe they were made of clay-slate; there were no other weapons got near them; they were under about four feet of sand, and seven feet below the surface of the land; and from the existence of the bar at the quarry, or rocky shoal, at Moneymore, a couple of miles down the river, they must have been lost in water; and it is likely the entire valley was submerged at the time, as the quarry commanded a level of four feet over where they were discovered.

"It will be seen by examining the labels attached to the different articles, that very few, comparatively speaking, were obtained from the Deel; and those two, Nos. 29 and 30, present a great contrast with the rest, both as to material and workmanship; and if we are to judge of their ages from those circumstances, No. 30 must be very ancient.

"Respecting the specimens presented from my own collection, I regret I can give little valuable information, as that received from the persons I got them from may not be correct, and was confined in most cases to the name of the locality where they were obtained; however, such as it is, I have marked it on each.

"It may be interesting to know, that the large sword, No. 37, was found in the same townland as seven golden balls already in the Academy, viz. Tumna, in the county of Roscommon.

"I can form no opinion as to what the two tubes, Nos. 43 and 44, are; but the smaller one contains a piece of timber, which was in it when found, and which fitted it completely.

"I am, dear Sir, yours faithfully,

"Richard A. Gray.

"*William T. Mulvany, Esq., Commissioner of Public Works, Custom-house, Dublin.*"

[Memorandum *to accompany the Antiquities sent by* Mr. Fraser.]

"Castlebernard District.

"Some of the antiquities found in this district were got in the valley of the Camcor River; the others in the valley of the Pass Stream, a small tributary of the former.

"The greater part of the valley is composed of alluvium brought down from the Slievebloom Mountain. As a proof of the great extent to which the alluvium has been deposited, even within a comparatively recent period, may be instanced the finding of the remains of a small mill, imbedded in the sand and gravel, at the junction of the Kilmaine River with the Camcor. Portions of the walls were found, forming an irregular figure about 13 feet by 11. In one end was found what appeared to be the opening for the axle of the water-wheel; and just opposite to it, on the outside, the timber-head stock framing for the support of the gudgeon. The top of this framing, and consequently the axle of the wheel, was about nine feet below the present surface of the land. This old mill was right in the way of the new channel; and Mr. Byrne, who saw the walls before they were removed, says the whole structure was of a most rude construction.

"The discovery of the remains of ancient mills beneath the present surface of the land is not unusual in Ireland, but I have never heard of any being found so deeply imbedded as were the remains of this one.

"Articles, Nos. 1, 2, 3, 4, and 5.—The two axes, the crook, and spear-heads were found in the fissures of the limestone rock at Syngefield; they were covered with about one foot in depth of indurated gravel.

"The spear-head, No. 3, differs from the one, No. 4, in having a well-defined spine, but both are of the ordinary kind.

"No. 6.—The piece of sword-blade has nothing peculiar about it. Indeed it is very strange that a greater number of comparatively modern implements of war were not found near Birr, considering the many engagements, skirmishes, and sieges which took place about that town and neighbourhood, particularly between the adherents of James II. and William III.

"No. 7.—The horse-shoe is quite a puzzle to me. From the position of the nails, the convex side must have been towards the ground. Whether it was the general form used at the time, or whether it was made to suit a particular form of foot, or particular service, I cannot tell.

"No. 8.—The skull. The hole in this skull is like what would be made by a pistol bullet.

"These eight articles were found in the valley of the Camcor Proper; the remainder were found in the valley of the Pass Stream.

"Just above the Pass Bridge, at the east end of Droughtville Demesne, is a marsh called the Muddy Lake on the Ordnance Map, but by the people the Island Lough. On the north side of this marsh there is a small island, on which are the remains of Kiltubrid Castle. Between the castle and mainland, on the north side, there is an ancient causeway, about 100 yards in length. Our new channel crossed this causeway, within thirty yards of the castle. In the excavation we found several large pieces of oak timber, that had evidently been framed together, as the mortices were tolerably perfect. From their position in the old causeway, and the lowest part of the marsh being at that place, they were evidently part of the drawbridge. Here, too, we found the articles 10, 11, 12, and

13. Off No. 10 a part of the timber handle has been broken since we got it,—observe the ornament at the end of the handle.

"No. 12.—The pan. This appears to be neither brass nor the ordinary bronze; it is, I believe, what is called *white bronze.* It was evidently used on the fire, but there is no trace of a handle.

"No. 13.—The coins. Three are of the reign of Charles I.; two of Elizabeth; the others I cannot decipher. Two of them most defaced were most probably worn as ornaments hung from a chain; I infer this from the small hole in each of them.

"No. 14.—The two brooches were found in the townland of Droughtville, about twelve inches under the surface.

"Borris-in-Ossory District.

"The antiquities from this district were nearly all found in the valley of the Nore, on the north side of the town of Borris-in-Ossory.

"The bronze swords, 1, 2, 3, 4; the iron spear-heads, 5 and 7; the swords, 6 and 8; with the three skulls, 13, 14, 15,—were all found at Kildrinagh Ford, on the bed of the old river, and within the space of forty-four yards. They were resting on the hard gravel bed of the old river, with about one foot of loose material over them.

"On the south side of the river is the townland of Peafield (originally named, I believe, Shangownagh); near to the river are the remains of a fine rath; and on the other side, in the townland of Kildrinagh, are the remains of another rath, of even a more important character. At this part of the river, and nearly in a line between these forts, was the ford of Kildrinagh.

"Some time before our works reached this ford, I ascertained the tradition respecting a great battle that had been fought there; some said between the Irish and the Danes, the former being posted on the north side, the latter on the south side of the river, where there are the remains of extensive entrenchments, still called 'Danes' Fort.' Others said the battle was fought long before the Danes came to Ireland; but all agreed that a battle had taken place, and that Kildrinagh Ford was the scene of the greatest slaughter. I gave particular directions to have the excavations at this place carefully watched, and the result was the finding of the antiquities described here.

"Just at the ford were found the remains of a bridge of black oak timber, some of the pieces still framed together. The remains of this bridge were rather under the land, on the north side of the river, as though the latter had slightly changed its course.

"It may at first appear strange that so slight a covering as one foot was over these swords, considering the length of time they must have lain there; but it must be remembered that they were found *lying on the hard gravel ford*, where deposit of loose matter very seldom takes place.

"The edges of the bronze swords are now a good deal hacked; this was not the case when they were found; their edges were then quite even and sharp. They were hacked by the men and others before they came into my possession. The longest of the bronze swords had the rivets in the handle when they were found; they fell out, and were lost.

"In two of these swords the handle and blade formed one casting; in the other two the handles are attached. I do not think the process of attaching the handles can be called *welding*, for there appears to have been no fusion of the metal. It appears to have been effected by inserting the blade in a slit in the handle, and then beating the sides of the handle over the blade. In one case the roughness appears to have been filed or ground off. The edges are beautifully formed, and very hard. It is now generally believed that this fine hard edge was given by *cold hammering*.

"Believing these swords to be of greater antiquity than the period of the Danes' invasion, or that of the general use of iron, I doubted the fact of the bronze and iron weapons being found together, but the men were positive about it. Still considering their being found at a ford, and the many engagements that have taken place at various periods in this part of the country, it is yet doubtful whether they were dropped in the Nore at the same time.

"The skein or knife, No. 9, and the skull, No. 10, were found close together, in the townland of Clashnamuck, in the old river, about quarter of a mile above Kildrinagh Ford.

"The spear-head, No. 11, and the iron helmet, No. 12, were found in the same townland, in the bed of the old river, in mud, about three feet below the surface of the land.

"The spear-head, No. 16, was got in the bed of the river, under the mail-coach road bridge, in loose gravel and mud. The Nore did not occupy this position in former times; its course was altered when the present road was made.

"The bronze ring, No. 17, was found lying upon the gravel, with four feet of peat over it. I can give you no idea of the use of it.

"(Signed),

"WILLIAM FRASER.

"*January* 17, 1852."

[*From* MR. KLASEN, *as to the Crannog at Cloonfinlough, King's County.*]

"Cloonfinlough, a small lake, the area of which is about 200 acres, is situated three miles from the river Blackwater (the main channel of the Derryholmes district), and about two from Clonmacnoise, or the Seven Churches, King's County. By the sinking of the Goulan tributary the water of this lake was lowered about six feet; and near the south-west end, on Tullabeg site, a small island was laid bare; it was nearly circular, and about seven yards in diameter. This island had not been visible, even in the dryest seasons, during the recollection of a man of the name of Connor, who has lived adjoining the lake for the last ninety-eight years. On digging up the island, it was found to have been evidently of artificial construction, the natural bottom being very thin bog-stuff, on which long logs of bog-oak and fir had been laid, and on these a layer of stones of different sizes, but generally about the dimension of a man's head; on the stones was a thick deposit of mud, bog-stuff, and decomposed dung (left by wild fowl), interspersed with sticks, &c. Accompanying the whole was a rough sort of stockade, or row of oak piling, all under water; each pile measured about eight inches in diameter. The centre of the island was about two feet higher than the exterior. On the north side, about two feet from the surface, were discovered a few small flags, placed as a sort of pavement or hearth; and on the same were about 300 bullets, mostly of the size of musket-balls, but varying to that of small pistol-bullets. A quantity of bad castings and broken pieces of lead were also found, showing that the bullets had been cast on the spot, and many of them in bad moulds. Near the centre of the island was found a brass tube, with a small flange at one end; the whole about two feet long, and originally straight, one-third of an inch in diameter, and supposed to have belonged to a still. On excavating the centre, the remains of a cask were found, which, to judge from the size of the hoops, must have been of considerable size; the hoops were of ash, and the staves and bottom of oak. A variety of bones, apparently horses' teeth, and bones of sheep, goats, or deer, were got, as also a piece of a skull.

"Tradition says that a large sum of money is buried here, and several persons have dug for it, but, as far as I am aware, without success; no coin was found by us. There is also a report that a large silver bell, formerly belonging to the Seven Churches, was thrown from the island, and lies buried at the bottom of the lake.

"I send some of the bullets, a piece of the tube, a small spear, and the piece of the skull found.

"P. J. KLASEN,
"*District Engineer, Ferbane.*

"*January* 19, 1852."

[*From* MR. S. U. ROBERTS.]

"DRAINAGE OFFICE, GALWAY,
"*January* 19, 1852.

"MY DEAR SIR,—In accordance with the instructions contained in your letter of 27th November last, I forward this day, by railway, a box containing all the antiquities collected in the course of the execution of the works under my superintendence, labelled with a description of the locality, &c., where they were found, as directed by you. I annex a catalogue of the articles, which were found in every instance at or near Galway, in the channel of the River Corrib.

"I regret that the collection is not a larger one, and more worthy of admission into the national collection of antiquities, though care has been taken to preserve every relic of antiquity which has been found.

"The small number of antiquities may, in a great measure, be ascribed to the rapid flow of the river, as it formerly existed, at the shoals, where our excavations have been carried on. By this means many objects of antiquarian interest have probably been carried into the deep water adjacent, or into the sea. It is, however, to be hoped that our works of clearing up the navigation channel through the lake, during the approaching season, may disclose some remains of antiquarian interest.

"It is reported by the boatmen of the lake that a canoe, forty feet in length, made of the trunk of a tree hollowed out, is sunk in the lake, opposite Annadown. This, when our operations in its vicinity shall be in progress, I will, should it be your wish, make it my object to recover.

"With reference to the fact,* that so few remains of the weapons or utensils of the ancient Irish have been discovered in this neighbourhood, I would observe, that few or none of the ornaments, weapons, or utensils of gold and bronze, of beautiful workmanship, which are so frequently met with in other parts of Ireland, have been found here, within the limits of my observation. This circumstance would seem to mark a formerly existing inferiority of population and civilization in this province, as compared with the eastern and central portion of our island.

"I am, my dear Sir, yours faithfully,

"(Signed), SAMUEL ROBERTS.

"*W. T. Mulvany, Esq.*"

* [In this observation there are strong grounds for believing that Mr. Roberts is mistaken. I find in the Annals of the Four Masters, for the year 1178, the following record:

"The River Galliv was dried up for a period of a natural day; all the articles that had been lost in it from remotest times, as well as its fish, were collected by the inhabitants of the fortress, and the people of the country in general."

Again, in 1191, in the Annals of Kilronan:

"The River Galliv was dried up this year; and there was a hatchet found in it, measuring a hand, from one point to the other; and there was a spear found in it, measuring three hands and three fingers in breadth, and a hand from the shoulder in length."—*See* O'Donovan's Annals of the Four Masters, note under year 1199.

O'Flaherty, in his Iar-Connaught, also states that the river became suddenly dry on Tuesday, 7th September, 1647; and again on the 23rd February, 1684, during the continuance of a great frost.

These statements are quite reconcileable with the nature of the district. The large lakes acting as reservoirs, and the probable stoppage of some of the cavernous passages from Lough Mask and other parts of the Catchment Basin, coupled with the discharging powers of the cavernous passages of Terryland or Castlegar, above the town of Galway, might produce the result; whilst, owing to the existence of Lough Corrib and its expanse, there are in reality no deposits carried down by the river to cover any things that had been lost.—W. T. M.]

[Mr. Thomas J. Mulvany's *Memoranda relative to Artificial or Stockaded Islands in the Counties of Leitrim, Cavan, and Monaghan.*]

"Twenty-five of these islands have already been observed in the progress of the Drainage operations now being carried on in the above-named counties, viz.:

IN THE COUNTY OF LEITRIM.

District of Ballinamore and Ballyconnell.	Drumaleague Lough,	2	
	Lough Scur,	2	
	Castlefore Lough,	1	
	St. John's Lough,	4	
District of Eslin.	Loughtown Lake,	1	
	Aghakilconnell Lough,	1	
	Funshinagh Lough,	1	
	Lough Mac Hugh,	2	
	Cloonbo Lough,	2	
	Cloonfinnan Lough,	1	
	Cloonboniagh Lough,	1	
	Cloonturk Lake,	2	
		—	20

IN THE COUNTY OF CAVAN.

District of Lough Oughter and Gowna.	Lough Aconnick,	1	
	Derreskit Lough,	1	
		—	2

IN THE COUNTY OF MONAGHAN.

District of Leesborough.	Leesborough Lake,	1	
	Kilmore Lake,	2	
		—	3
			25

"These are all the islands that have been as yet ascertained to be constructed artificially; but there are several others now visible in some of the lakes of Cavan and Leitrim, which have all the appearance of belonging to the same class, but which have not yet been actually examined, in consequence of want of time, and in some cases of the difficulty of reaching them, there being no boats on many of the lakes.

"The cases that have been particularly examined are those in Drumaleague Lough, Lough Scur, Loughtown Lake, and Leesborough Lake. These have been carefully measured and examined on the surface, and in most instances cuts have been made across the centre of the island, for the purpose of ascertaining its interior construction. In most of the other cases mentioned in the list, the surface merely has been examined, and the dimensions of the inclosure measured.

"The general features of construction are very much alike in all these islands:

"1st. They are surrounded by stakes, driven generally in a circle from sixty to eighty feet in diameter; but in some cases the inclosure is larger, and of an oval shape, as for instance, that in Loughtown Lake, which is 120 feet from east to west, and 100 feet from north to south; and one of those in Lough Mac Hugh, which measures 118 feet in one direction, and seventy-four feet in another.

"2nd. These outside stakes are generally of oak, from four to nine inches in diameter; sometimes driven in a single row, sometimes double, and in some cases, as that of island No. 1, in Drumaleague Lake, of which a sketch plan is given in drawing 2, fig. 1, the stakes are found in single row in parts of the island, and in double or treble rows, or clusters, in other parts. The island in Loughtown Lake differs from the others in being surrounded by a mass of stakes upwards of fifteen feet wide, and rather inclined towards the centre of the island.

"3rd. The portions of the stakes remaining in the ground are evidently the lower ends of young trees, or of branches of large trees, which were stuck down just as they grew in the wood; the thicker end downwards, and bearing the marks of the hatchet by which they were felled. A considerable length of these stakes must, therefore, have projected over the ground; and they may probably have been joined together by horizontal branches, interlaced so as to form a screen, well calculated to serve for shelter or defence. All the portions of the stakes which were above ground have been destroyed by time; but the portions remaining below ground, particularly where the stratum is pure peat, are generally very sound at the heart, and have become as black as the oak usually found in bogs.

"4th. The surface within the staked inclosure is usually covered over with a layer or two of round logs, cut into lengths of from four to six feet, over which are found more or less stones, clay, and gravel. In some cases, where the foundation is very soft, as in island No. 2 of Drumaleague Lake, of which a section is given in drawing 2, fig. 2, the layers of timber are very deep. In other cases, where the ground is naturally firm, as in island No. 1 in the same lake, the platform of timber is confined to a portion of the island. See the plan of this island in drawing 2, fig. 1.

"5th. In almost every case a collection of flat stones has been found near the centre of the inclosure, having marks of fire on them, and apparently having served as a hearth. In the island No. 2 of Drumaleague Lake there were three of these hearths found in different parts of the inclosure.

"6th. Considerable quantities of bones are generally found upon or around the island, being apparently those of deer, black cattle, and hogs; the skulls of the cows being long and narrow, with very short horns.

"7th. In almost every case one or more pairs of quern stones have been found within the inclosure.

"8th. In many cases pieces of oak-framing have been found, with mortices and cheeks cut in them. Some of these, such as what were found on island No. 2 of Drumaleague (see drawing 3, fig. 3), appear to have been portions of an ordinary door-frame; but others, such as those found on the island in Lough Scur and in Loughtown Lake (see drawing 3, figs. 1 and 2), are portions of a heavy frame, the use of which does not appear so evident.

"These structures were generally covered with water, and only discovered when the surface of the lake in which they lie was lowered in the course of the operations connected with the drainage of the adjacent land. In some cases a small portion of the centre of the island was visible when the lake happened to be at its low summer level, but seldom attracted any particular attention, being looked upon as merely the top of a shoal. The surfaces of many of these inclosures, however, were found to be two or three feet below the summer level of the water; and one of those in Drumaleague Lake was *five* feet under water.

"The streams which form the outlets from many of these lakes run through strata of alluvial deposit and peat, in which great quantities of timber are to be found; and the inference appears to be natural, that the level of the lake has risen subsequently to the formation of the islands, and very probably in consequence of the destruction of extensive woods which grew along the shores, and the *debris* of which, accumulating at the outlet of the lake or swamp, gradually raised the level of the water.

" If this explanation be correct, it obviously places the date of construction of these islands at a very remote period.

" In some cases, however, the only outlet from the lake was a stream with a rocky bed; and in such cases, the fact of the islands having become submerged can only be accounted for by supposing that the weight of the water-soaked timber, the clay, stones, and other heavy materials placed on the surface, produced a gradual subsidence of the soft bottom on which it was constructed; and the same line of reasoning will of course be applicable, in some degree, to all the other cases.

" In most instances there appears to have been nothing known about these islands by the people living in the vicinity. At St. John's Lake, in the county of Leitrim, where portions of the islands were occasionally dry at very low states of the water, they appear to have attracted some notice; and I am told that there is a tradition in the neighbourhood, that they were used at some remote period for the illicit grinding of corn, though I am not aware when or under what circumstances the making of meal was prohibited. In Loughtown Lake a portion of the island was always exposed to view; and it is believed by the persons in the neighbourhood that it was, about a hundred years ago, a place of refuge for robbers, who had it all fenced in, and a wooden house on it.

" The cases that have come to my knowledge of any metal articles being found on these islands are very few. Mr. Coe, who examined the island in Leesborough Lough, mentions that there was found on it an iron skein or long knife, seventeen inches long, including four inches of that part which must have fitted into a wooden handle, the blade being thirteen inches long, one and a quarter inches wide at the handle, and a quarter of an inch thick at the back, tapering towards the point.

" In the island in Aghakilconnell Lough, in the Eslin district, three iron pots were found, one of them of a triangular shape. And in one of the islands in St. John's Lake were found three silver coins, which I have forwarded with the collection of drainage antiquities, and which appear to me to be of the reign of Edward I. I have seen an impression taken from a coin found, as I understand, on a similar island, near Strokestown, in the county of Roscommon, and which is precisely the same as one of the coins above mentioned.

"If the coins be, as I presume, of the reign of Edward I., it would lead to the conclusion, that the islands were in use at the close of the thirteenth or beginning of the fourteenth century. The finding of a stray coin or two furnishes, certainly, but slender grounds for arriving at a conclusion in a matter of this sort; yet there are circumstances connected with the history of the particular period to which these coins refer us, which seem to render it not at all improbable that these inclosed islands were constructed as places of shelter, defence, and refuge.

"There can be no doubt that, about the year 1330, when Donald O'Neil, King of Ulster, wrote to Pope John XXII., as to the sufferings of the Irish, the lands round the lakes where these islands have been found, as well as the greater portion of the adjacent country, were covered with wood, while many of the lakes themselves were little better than marshes. And supposing the natives to have been driven to those woods and marshes for refuge, it is very natural that they should form encampments of the nature of these inclosed islands, to protect themselves from their enemies. The woods also furnished them, probably, with abundance of deer, hogs, and other animals, which served them for food, and the bones of which are found in such quantities about these islands; and the querns would, of course, be in requisition for grinding any corn they could convey to the islands.

"In those cases where the islands are found at a considerable distance from the shore of the lake, and surrounded by deep water, the means of communication with the shore must have been by a raft or boat. In Drumaleague Lake a canoe was found (of which a drawing is given, No. 4), imbedded in the mud on the shore opposite one of the islands, and about as deep below the level of the surface of the lake as the island itself. It was eighteen feet long, cut out of a solid oak tree, and was in tolerable preservation when found, but fell to pieces after being some time exposed to the air. In other cases, where the islands are in shallow water, and near the verge of the lake, the communication may have been by means of a gangway of timber, a portion of which may have been moveable at the pleasure of the people within the inclosure.

"The islands in Loughtown Lake, Drumaleague Lough, and Lough Scur, were examined by Mr. Leonard; and that in Leesborough Lake by Mr. Coe. More detailed examination shall be made, as opportunity offers, of the other islands mentioned in the list I have given, and also of any others that may be met with; and it is probable that some antiquities may be found in some of them which will serve to throw more light on their probable age and uses.

"THOMAS J. MULVANY.

"BELTURBET, *Jan.* 9, 1852."

[*From* MR. JOHN O'FLAHERTY.]

"STROKESTOWN, *January* 9, 1852.

"MY DEAR SIR,—By this night's coach I send you a box, containing all the articles of antiquity or curiosity that I have been able to collect myself, which were discovered at the artificial islands in this neighbourhood; together with a large number of articles which have been lent to me by Miss Morton, John Devenish, Esq., Mrs. Devenish, and Dr. Conry, and which I have in your name promised shall be returned in the course of a short time.

"I have attached to each article the name of the owner, and in *red ink* the place where the article was found. There is also a number on each article, corresponding with the numbers contained in the accompanying list.

"In Ardekillan Lough there are four artificial islands; in Cloonfinlough, two; in Clonfree, two; in Lough Lea, three; and in Derreen Lough, one. I am also informed that there is one in Kilglass Lough, but I have not seen it. I shall, however, from time to time, as my duties will permit, visit these places, and get all such information as may prove interesting; but I have been too busy up to the present time to do so.

"I forward also a survey and section of the artificial island (through which we made a deep cut) at Ardekillan, which is by far the largest and most important of them all, and which will, I trust, be found satisfactory. I got a similar cut made through one of the Lough Lea islands, ninety feet long, and nine feet wide, but we met nothing worth mentioning, except plenty of all kinds of bones; there were also evident traces of a large fire, as in the Ardekillan case.

"In the collection forwarded you will find the few things got at Lough Lea. With regard to my own collection, I beg to hand them to you as a donation.

"I got a long box, 6 feet × 6^{in} × 6^{in}, hammered into the bank of the cut I made through Ardekillan, as I told you I would; and I have got the stratification into the box without being disturbed, and in great perfection, which I shall forward per canal boat. I forward also a large collection of bones and horns of elk, red deer, &c., old guns, swords, curious stones, &c., not got at the islands.

"I have heard that the description given to the Royal Irish Academy as to the locality where the five gold rings were found which were discovered in the execution of the drainage works in this district, and presented by the Lord Lieutenant to the Academy, is incorrect. I beg you will set the matter right; they were found in the demesne of Strokestown, in *solid* cutting, lying just between the gravel and turf, at a depth of six feet under the surface, in the townland of Vesnoy, near the ruins (marked and called on the Ordnance Sheet) of 'Urney Church,' in the parish of Bumlin, barony and county of Roscommon.

"I am, my dear Sir, yours truly,

"(Signed), JOHN O'FLAHERTY.

"*W. T. Mulvany, Esq.*"

In order to show the value of collections of antiquities, when the articles are arranged according to the localities in which they have been found, I have had all those obtained on the Lower Bann River so arranged, keeping distinct the articles found at each shoal, as at Toome, Portglenone, and Portna, which were the great fords or passes across this river. And in reference to the first, Toome,—the bar or shoal over which Lough Neagh discharged itself into the Lower Bann,—it is to be observed, that the Annals of the Four Masters, at the years 1099, 1149, 1181, 1197, 1198, 1199, refer to occasions when this ford was used for the passage of large bodies of armed men. On some of these, it is not unreasonable to suppose that some of the articles found in the excavation, and now presented to the Academy, were lost.

I find by the Academy's Proceedings on 29th November last, when Mr. D. Kelly read a paper as to the Artificial Islands near Strokestown, that both Dr. Petrie and Lord Enniskillen made remarks identifying these islands with the crannogs of our Annals; and I need scarcely say that the facts fully confirm this view of the subject. But to prove what important aid the discovery of antiquities, and a correct examination and record of the circumstances affecting their discovery, may furnish in the illustration of history and topography, I may, perhaps, without trespassing on the proper field of the antiquary, be permitted to make a few remarks.

I find by the very cursory examination of the Annals of the Four Masters which I have had time to make, direct reference to these crannogs, from the year 1150 to 1603, a period of 453 years.

In reference to the crannogs found in the Strokestown district, county of Roscommon, referred to in Mr. D. Kelly's paper, and from which so many beautiful articles of antiquity are now presented, I beg to say that the principal of these crannogs is Ardekillan, through the remains of which we have had a deep cut made, as shown on the accompanying plan and section, prepared by Mr. O'Flaherty, the resident engineer.

At this crannog upwards of fifty tons of bones were found by the peasantry, and sold at the rate of 2*s.* per cwt., being purchased for the Dublin market.

In reference to this very interesting place, I beg to call attention to the following extracts from the Annals of the Four Masters:

"A. D. 1368. Teige, son of Manus, son of Cathal, son of Domnall O'Connor, was treacherously taken prisoner by Rory, son of Turlough (i. e. the O'Connor), in his (Rory's) own fortress at Ardanchoillin, after he had been brought thither by Cormac Mac Donough to O'Connor's house."

"A. D. 1388. Domnall O'Connor made an incursion into Machaire Connacht, and burned Ardanchoillin and the island, Lough Carrigan. Donnell Oge Mac Donnell (i. e. the constable of gallowglasses) was slain in this incursion."

"A. D. 1489. War was conjointly waged against O'Connor by Rory, son of Felim," &c. "They made a conjoint incursion against him into Ardanchoillan, where they struck and knocked down Cathal Roe O'Connor," &c.

Dr. O'Donovan in his note identifies the Ardanchoillan here mentioned properly with the Ardakillen near Strokestown, but says no ruins (alluding to the "fortress" spoken of in 1368) are now to be seen here, except three earthen forts. The drainage of the lake has, however, now clearly exposed the "fortress"—the "crannog"—to view. There can be little doubt it is that shown in Mr. O'Flaherty's plan, and from which a large proportion of the antiquities have been collected; nor, considering the probability that this crannog was garrisoned and used for more than a hundred years, and perhaps frequently burned, need we wonder at the large amount of bones thrown out by the well-fed warriors, the great number of antiquities, or the evidences of fire so extensively exhibited in the cutting made through the remains of the crannog; whilst these matters all tend to confirm the truth and value of the Annals.

But the matters of greatest interest in connexion with the crannogs is to ascertain the period of the first adoption of such modes of defence, as I suspect these crannogs existed long previous to 1150, which is the earliest allusion to them that I have found as yet in the Annals; and secondly, having now found them, and knowing their purpose, to make such diligent searches as shall lead to useful results, by the collection of many matters which would naturally be brought to these water forts as places of security, and which, being either lost there, or thrown into the water in the extremities of siege, or drowned with their owners in the last struggles of a warlike life, would remain hidden in the depths until now. My only fears are, that in many instances they have been so deeply covered by marl and other deposits, as to escape our means of search.

In that highly interesting part of ancient Breifny traversed by the Junction Canal, many of these islands, as adverted to, exist; and we have not yet lowered the waters of some of the lakes mentioned in the Annals—M'Gauran, for instance—at the year 1512.

I have every reason to hope, from the attention called to this subject, and the instructions issued, we may still expect many interesting additions to our collection.

In conclusion, I wish to state that the Commissioners of Public Works request that the articles collected under their instructions, and now presented, should be arranged and kept according to the localities in which they have been found. I trust I may not be misunderstood as resting any part of the argument in favour of a geographic or local arrangement upon the influence of a donor's request; the object and interest which the Academy and the Commissioners (who are mostly members of the Academy) have in this matter cannot be otherwise than common.

I submit that a leading principle in arranging a museum of antiquities like ours should be, as far as possible, to obviate repeated reference to catalogues, at least as to information, which the arrangement itself may directly convey, even to the cursory observer; whilst the mind of the more attentive and studious will, by an arrangement depending on recorded facts instead of theories, be led naturally to comparisons and scrutiny highly conducive to the advance of real knowledge.

I am quite aware that the exact locality of a great many articles in the Museum is unknown, but of a very large proportion it is known; whilst of much of the remainder at least the county where they were discovered is recorded. And if the principle of geographic arrangement were once adopted with the articles whose localities are known, I feel confident that it would be so valued by parties connected with the localities of the articles, as greatly to facilitate historic inquiries, and secure other contributions.

Indeed, it has always appeared to me to be due to parties presenting antiquities, due to the localities, and to the persons interested in them, either by ownership of lands where they were found, or by historic events connecting their ancestors therewith, that antiquities taken therefrom should be preserved in some public museum, where their safety and connexion with the locality should be guaranteed. I would suggest that the publication of such a resolution on the part of the Academy, with the allocation of a suitable space, arranged even in counties, and a distinct published record of donors, would, if there was a spark of national pride or genuine patriotism in the country, soon lead to presents and bequests from various parties.

I will not presume—I am not sufficiently informed—to enter into the vexed question of whether or not there are sufficient distinctive characteristics to mark the different eras when weapons and utensils of stone were used, as compared with those of compounds of brass, those of iron, and other metals. But I will ask, what pleasure or instruction there would be in looking at interminable ranges of stone hatchets (I do not know what sound authority there is for designating them "Celts"), or of brazen swords, iron dirks, &c., and other matters of precisely the same classes? Whilst, on the other hand, who can look at an arrangement of the articles found in any one locality,—as in the several shoals of the Shannon, in respect to which my friend, Colonel Jones, furnished information; or those of Toome, Portglenone, and Portna, on the Bann River; and the crannogs of Ardekillan and Cloonfinlough, which

I exhibit to-night, and have arranged temporarily, to illustrate this view,—who can regard these without intense interest, a desire to look deeper into the history of the locality, and an effort to compare the matters found in each with others of the same class, in other and perhaps very remote districts?

Take, for instance, a stone hatchet, or a flint arrow-head,—the natural and first questions are, where found? of what kind of stone made? Is there any of the same description in the neighbourhood? if not, how near? And thus the inquiry goes on, until light is thrown, by comparison or investigation, on the history of the locality, which it is probable it would never receive from the more general and so called *scientific* arrangement proposed.

I propose to you the collection of data, the placing and recording of articles of antiquity, and the facts affecting them, with a stringent adherence to truth, precisely as the articles have been found, and the facts occurred. I submit that it is peculiarly the province of a great and learned body like the Academy to adopt this course, leaving it to individuals, on their personal responsibility, to found on the facts recorded, and, if they please, to publish to the world, any theories or assumptions they think fit; leaving it to the discovery and future publication of ancient manuscripts that may yet be found to alter views at present entertained, or to throw light on what may at present appear obscure, and leaving to posterity, unshackled by the authoritative decision of this Academy, the free powers to test by your faithful arrangement and true records the numerous theories that may yet be raised as to the extraordinary and somewhat anomalous ancient history of this country.

ARTICLES *collected by* RICHARD A. GRAY, ESQ., *District Engineer.*

From the River Boyne.

4. Iron sword. From the townland of Moyfin, barony of Moyfenrath, county of Meath.

6. Giesarm; and 12, Short iron sword: found together. 5. Iron battle-axe. Found on the gravel, under six feet of alluvium, near the old Castle of Donore. From the barony of Moyfenrath, county of Meath.

19. Iron sword. Found on surface of bed of river, below Alder island. From the townland of Moyfeagher, barony of Lune, county of Meath.

32 c. Iron sword. Found at junction of Rivers Blackwater and Boyne, two feet under the bed of the river, in gravel. From the townlands of Donore and Castlerickard, baronies of Upper and Lower Moyfenrath, county of Meath.

10. Iron dirk. Found in bed of old course of River Boyne, half-a-mile from site of No. 11. From the townland of Annagh, barony of Upper Moyfenrath, county of Meath.

17. Bronze armlet. Found in the new cutting at the junction of the Deel and Boyne Rivers, a quarter of a mile above Donore Castle. From the townland of Ballymahon, barony of Upper Moyfenrath, county of Meath.

25. Bronze spear-head. Found in the gravel, five feet under the surface, near Inchamore Bridge. From barony of Upper Moyfenrath, county of Meath.

2. Iron sword. Found in alluvium, near Clonard Bridge. From the townland of Mulpedder, barony of Upper Moyfenrath, county of Meath.

3. Iron sword, with brass handle. Found in the gravel in bottom of river, about one foot deep. From the townland of Tycroghan, barony of Upper Moyfenrath, county of Meath.

26. Bronze spear-head. Found on surface of bottom of channel of the river, immediately above Stoneyford Bridge. From townland of Moyfin, barony of Upper Moyfenrath, county of Meath.

14. Bronze sword. 22 and 23. Bronze spear-heads. 18. Bronze horse gear. 21. Iron spear-head. 9. Iron dirk. From the townland of Moyfin, barony of Upper Moyfenrath, county of Meath.

15. Bone dagger. Found on hard blue clay, in bed of river, four feet under sand. From townland of Ballyonan, barony of Carbury, county of Kildare.

16. Bronze sword. Found in the cutting for the new course of the river, on hard gravel, and five feet under alluvium. From townland of Rahin, barony of Carbury, county of Kildare.

28. Iron arrow-head. Found in a bog, about four feet deep, just above Ballyboggin Bridge, on River Boyne. From the townland of Russelswood, barony of Carbury, county of Kildare.

11. Short sword. Found on bottom of a deep hole in the old course of the river. From the townland of Russelswood, barony of Carbury, county of Kildare.

32 b. Skull of black bear. Found in new cutting for channel of the Boyne, above Leinster Bridge, about four feet under the surface. From the townland of Kilrathmurry, barony of Carbury, county of Kildare.

From the River Deel.

1. Two-edged iron sword. Found near Anadruse Bridge. From the townland of Derrymore, barony of Farbill, county of Westmeath.
20. Plated brass pin. Found near No. 1.
29. Bronze spear-head. Found under eighteen inches of hard gravel in Killyon demesne. From townland of Killyon, barony of Upper Moyfenrath, county of Meath.
30. Bronze spear-head. Found in bog, on the gravel, five feet below the surface, in side-cutting the river. From the townland of Joristown Lower, barony of Farbill, county of Westmeath.
8. Two-edged iron sword. Found imbedded in bog, about half-a-mile from Anadruse Bridge. From the townland of Ballinlig, barony of Farbill, county of Westmeath.
31. Iron javelin-head. 60. Iron dagger, with bone mounting of handle. 61. Long iron skein. 62. Short iron skein. 63. Broad iron knife. 64 and 65. Iron knives. 66. Iron spear-head. Found in pond at Killyon, close to old churchyard, near River Deel. From townland of Killyon, barony of Upper Moyfenrath, county of Meath.

From the Clonard River.

7. Iron sword. Found five feet under surface of sand in the channel of the river. From the townland of Mulpedder, barony of Moyfenrath, county of Meath.
24. Iron spear-head. Found in sand, four feet under surface of bottom of river, near Kinnegad Bridge. From townland of Kinnegad, barony of Farbill, county of Westmeath.
13. Large iron key. Found on lands of Kilrathmurry, near Clonard, barony of Carbury, county of Kildare.

From the Little Boyne.

32. Iron sword. From the townland of Kinnefad, barony of Warrenstown, King's County.
27. Iron spear-head. Found in excavating new channel. From the townland of Kinnefad, barony of Warrenstown, King's County.
32 A. Bronze bridle-bit. Found at Kinnefad Bridge. From the townland of Kinnefad, barony of Warrenstown, King's County.

Articles *presented from the private Collection of* Richard A. Gray, Esq., *C. E.*

33. Bronze dagger. Found near Carrick-on-Shannon, in parish of Killucan, county of Roscommon.
34. Bronze sword. Found at Carrick-on-Shannon, county of Leitrim.
35. Bronze sword. Found near Ardcarney Church, barony of Boyle, county of Roscommon.
36. Bronze sword; and 39. Large bronze spear-head. Said to have been found at Coote Hall shoal, on Boyle Water. From the barony of Boyle, county of Roscommon.
37. Large bronze sword. Said to have been found at Tumna, on Boyle Water, barony of Boyle, county of Roscommon.
38. Iron spear-head. Found in bed of a stream in the parish of Killucan, townland of Mullaghmore, county of Roscommon.
40. Bronze spear-head. Found at Corryolish, parish of Kiltoghast, county of Leitrim.
41. Iron spear-head. 42. Bronze spear-head. 43. Bronze tube, with wood in it. 44. Large bronze tube. Found at Carrick-on-Shannon, county of Leitrim.

45–48. Four bronze celts. Locality unknown.

49 and 50. Two bronze celts. Found at Galway.

51–53, 58, and 59. Five bronze pins. Locality unknown.

54–57. Four brass buckles. Locality unknown.

Articles *collected by* William Frazer, Esq., M. R. I. A., *District Engineer.*

From Drainage District of Castlebernard, King's County.

1 & 2. Two iron axes. 3 & 4. Two iron spear-heads. 5. Iron hook. Found in old course of River Camcor, near the town of Birr. From the townland of Syngefield.

6. Portion of blade of small iron sword. 7. Iron horse-shoe. Found in alluvium six feet under surface. From the townland of Clonbrone.

8. Human skull. Found four feet under surface in sandy clay. From the townland of Ballyduff.

10. Iron skein. Found in Pass Stream, a tributary to Camcor.

11. Large iron spear-head. 12. Pan. 13. Eight silver coins, viz., three of Charles I.; two of Elizabeth, and three defaced. 15. Iron mounting for wooden spade. 16. Iron basket-hilt of sword. Found near Kiltubrid Castle. 17. Wooden beetle. 18. Wooden oar-blade or paddle. Found at the island, five and a half feet under surface, beneath the old drawbridge at Kiltubrid Castle.

14. Two ornamented bronze brooches. From Droughtville.

From Drainage District of Borris-in-Ossory.

1–4. Four bronze swords. 5 and 7. Two iron spear-heads. 6 and 8. Two short iron swords. 13, 14, 15. Three human skulls. Found in bed of River Nore.

9. Iron skein (imperfect). 10. Human skull. Found in bed of River Nore, three feet under surface of peat, near the town of Borris-in-Ossory.

11. Iron spear-head. 12. Iron helmet. Found three feet under the surface in bed of River Nore. From the townland of Clashnamuck.

16. Iron spear-head. Found in bed of River Nore, under bridge near Borris-in-Ossory.

17. Large bronze ring. From townland of Tinderry, barony of Eliogarty, and county of Tipperary.

From Drainage District of Templemore, River Suir, Co. of Tipperary.

1. Iron skein. Found in bed of river above Knocknagera Bridge, barony of Eliogarty.
2. Small iron skein. Found in gravel three feet under surface. From the townland of Penane, barony of Eliogarty.
3. Stone celt. Found ten chains above Knocknageera Bridge, in clay and gravel, four and a half feet under surface.
4. Iron basket-hilted sword. Found in loamy clay three feet under surface. From townland of Aughall.
5. Seven half-crown pieces, one crown-piece, one shilling, and one sixpence, cannon money of James II.; one halfpenny, Charles II.; a sixpence of William III. Found in limestone quarry at Loughmore, below Templemore.
6. Glass bottle. Found near Carrigahorrig.
7. Brass medal of St. Dominick. Found in ruins of Greyfort Castle, near Borrisokane.

Articles *collected by* P. J. Klasen, Esq., *District Engineer.*

From the Brusna River.

1. Pig's skull. Found three feet under bed of river above Ballycumber bridge, barony of Garrycastle.
4. Large stone celt. Found four feet under the surface in new cut for the river near Clara.
11. Human skull and leg bones. Found near Ferbane in a gravel bank at side of the river.
12. Portion of the skull of a deer. Found in bank of river near Ballycumber Bridge.
13. Iron dagger with wooden handle, inlaid with lead. Found in Kincor mill-race, near Ferbane.
15. Blade of iron sword. Found in bed of river at Coole Castle.
17. Bronze spear-head. 18. Bronze brooch. Found in old bed of Brusna, opposite ruins of old Abbey of Wheery.
2. A skull. Found on surface at junction of the Boor River and Shannon, county of Westmeath.
3. A skull. Found three feet below land at Springfield, barony of Geasehill, King's County.
5. A small stone celt. Found in the Blackwater, about three and a half feet under river bed. From Derryholmes district, King's county.
10. Large bone. Found under Blackwater Bridge, the remainder of the skeleton, being under the foundation, could not be removed. From the townland of Cloghalbeg, King's County.
14. Bone spear-head. Found four feet under the surface of land in Ballyboughlan River. From barony of Kilcoursey, King's County.
16. Human skull. Found four feet under surface near Ballycumber. From Barony of Garrycastle, King's County.
19. Seventeen leaden bullets; a leaden weight for end of handle of whip; an iron square spear-head or spike. 20. Part of human skull, found in the artificial island in Cloonfinlough, barony of Garrycastle, King's County.

Articles *collected by* Samuel U. Roberts, Esq., *District Engineer, from the River Corrib, County of the Town of Galway.*

2. Iron spear-head. 3. Modern light cavalry sword. 4. Ancient iron sword-blade. 5. Iron battle-axe. 11. Iron javelin-head. 14. Fifty copper coins, mostly defaced. Found in the bed of river at Galway.

6. Bronze dagger. 12. A stone bullet or ball. Found in bed of river at Newcastle shoal.
7. Six stone celts. Found in excavating the ancient ford at Menlough.
9 & 10. Two iron cannon balls. Found in bed of the river near the salmon weir, Galway.
13. Hilt of modern heavy cavalry sword. Found in bed of river of the new bridge, Galway.

Articles *collected by* Samuel U. Roberts, Esq., *and forwarded by* Robert Manning, Esq., *District Engineer.*

From the River Glyde Drainage District, County of Louth.

1. Bronze spear-head. 2. Iron sword. 3. Bronze sword. Found in the year 1847, about three feet under gravel deposit in bed of the river, about 1100 yards in south-east direction from Derrycrammagh ford.

From the Ardee District, County of Louth.

6. Left-handed pistol. 7. Long horse-pistol. 8. Basket-hilted sword. Found in the mill-pond near Dawson's Bridge.
5. Human skull. 9 and 10. Two long rapiers. Found in 1845 in bed of River Dee, about four perches above Burley Bridge; and with them a portion of a saddle, and some bones and shoes of a horse.
11 & 12. Two iron pike-heads. 13. Portion of sword sheath. 14. Fragments of an iron chain. 15. Iron battle-axe. 16. Quern. Found in bed of River Dee, townland of Ballygowan and Richardstown.

Articles *collected by* Thomas J. Mulvany, Esq., *District Engineer, from the Ballinamore and Ballyconnell District.*

27. A glass bottle. Found in sinking bed of Woodford River at Drummeltagh shoal, county of Fermanagh.
6. Bronze cup. Found in river between Lough Marrave and Lough Scur, county of Leitrim.
7. Three silver coins of the reigns of Edward I. or II., and III. Found in crannog in St. John's Lough, county of Leitrim.
8. Bronze pin. 9. Short bronze sword. Found at Ballyduff Bridge, near St. John's Lough.

10. Short bronze dagger. Found at Creevy, near Ballinamore, county of Leitrim.
11. Bronze spear-head. 12. Bronze hatchet. Found at Ardrum, near Ballinamore, county of Leitrim.
13. Ornamental brooch. Found at Cormeen, near Ballyheady bridge, county of Cavan.
25. Royal arms of Spain on large plate of cast iron. Found in bed of Woodford River, between Ballyconnell and Ballyheady, county of Cavan.
22. Stone celt. Found at Drumraine, near Ballinamore, county of Leitrim.
—. Two casks of bones. 28 and 29. Two pair of quern-stones. Found in crannogs in Lough Scur, and in Drumaleague Lough, county of Leitrim.
4. Portion of antlers of elk. Found at Ballyconnell, county of Cavan.
26. Model of portion of oak frame, one-fourth of original size. Found in crannog in Lough Scur, county of Leitrim.

From Loughs Oughter and Gowna, and River Erne District, County of Cavan.

4. Bronze dagger. Found at Butler's Bridge, barony of Upper Loughtee.
15. Bronze celt. Found at Bessbrook, barony of Lower Loughtee.
16 & 17. Two bronze celts. Found at Derrindrehid, barony of Tullyhunco.
18. Bronze sword. Found at Urney, barony of Upper and Lower Loughtee.
23 & 24. Two stone celts. Found at Killeshandra.

From the Rinn and Blackriver and Eslin Districts, Co. of Leitrim.

1. Elk's head, with lower portion of antlers complete. Found at Cloone.
19. Bronze spear-head. Found at Rinn.
20. Bronze short sword. Found at Clooncumbur, on the Blackriver.
2. Elk's head. Found at Kilnagross, barony of Mohill, county of Leitrim.

From Leesborough District.

3. Portions of skeleton of elk. Found in barony of Dartree, county of Monaghan.

From Dungolman District.

5. Iron two-edged sword. Found near Baskin Bridge, townland of Dungolman, barony of Kilkenny West and Rathconrath, county of Westmeath.

From Killimor District.

21. Bronze celt. Found at Killimor, barony of Longford, county of Galway. Presented by Martin Farrell, Esq., C. E.

ARTICLES *collected by* JOHN O'FLAHERTY, ESQ., *Resident Engineer, from the Drainage District of Strokestown, Co. Roscommon.*

1. Bronze pin, with ring. Found in the townland of Clooneenhartland, barony of Ballintober North.
2. Small brass bowl. 3. Iron bill-hook. 4. Long iron spear-head. 5. Iron shears. 6. Large tooth. 7. Portion of hone-stone. 8. Bronze pin, with ornamented head and ring. 9. Bronze pin, with ring. 10. Small bronze pin, with perforated head. 11. Small bronze pin and piece of thick wire. 12. Bone needle and pin. Found in the crannog in Cloonfinlough, barony of Roscommon.
13. Large ornamented bronze pin, with ring. 14. Bronze pin, with solid ornamented head. 15–19. Five small bronze pins. 20. Bronze or brass harp pin. 21. Bronze hook. 22 and 23. Two bone needles. 24 and 25. Bone spears. 26. Large tooth. 27. Spud of deer's horn. 28. Piece of hone-stone. 29. Piece of stone ring. 30. Small piece of round stick. 31. Small silver ornament. 32. Iron hatchet and handle. 33. Iron gouge. 34. Iron knife-blade. 35. Part of iron hinge, and large spike nail. 36. Wooden hoop. 37. Parcel containing portion of wooden hoop; ashes of different kinds; a fragment of cinerary urn; bones and teeth of animals; old iron nails; knife-blades, &c. 110. Wooden scoop. Found in the crannog of Ardakillen Lough, barony of Roscommon.
38. White bronze or brass brooch. Found in the crannog at upper end of Ardakillen Lough, barony of Roscommon.
39. Piece of circular grindstone. 40. Block of flint. 41. Old iron key. 42 and 43. Portions of blades of iron swords. 44. Piece of bone spike. Found in the crannog of Lough Lea, barony of Roscommon.

45. A pair of modern stirrup-irons. 46. An iron hatchet-head. Found in crannog in Derreen Lough, barony of Roscommon.

47. Iron bill-hook. Found in six feet of solid cutting, in the townland of Tuam, barony of Ballintober South.

111. Bronze celt. Found in the bed of the river, above Bunnamuckagh Bridge, parish of Cloonfinlough, in 1849.

112. Iron sword. Found in the bed of the old river, five feet under surface, in bog in the townland of Clooncahormaher.

113. Barrel of a matchlock. 116. Round stone. Found in bed of old river, about six feet under bottom, below Sallowford.

114. Box containing section of strata. From the crannog in Ardakillen Lough.

115. Round stone. Found in hard limestone gravel, between eight and nine feet under the surface, in the townland of Corraslira.

3. Elk's head, horns, and several bones. Found in solid bank, seven feet under surface, in townland of Bumlin.

4. Part of horn of elk. 5. Head and horns of red deer. Found about seven and a half feet under surface, when deepening and widening the new cut for the river. From the townlands of Ballymore and Ballinafad.

7. Deer's horns and bones. Found in the strand at mouth of Cloonfree Lough, when the water was lowered.

8. Deer's horns. Found in old river, at mouth of Lough Flaskey.

9. Deer's horns. Found when deepening the old river at Foxborough.

12. Deer's horns. Found in Ardakillen Lough.

Articles *collected by* George Tarrant, Esq., *District Engineer, from the Drainage Districts of Dunmore and Monivea, Co. Galway.*

2. Bronze spear-head. Found about one foot under the bed of River Clare, in gravel, in the townland of Pollaconagune, barony of Dunmore.

5. Bronze dagger. Found about four feet under surface, in clay and gravel, in the townland of Kilcloughans.

8. Long piece of soft stone, carefully shaped. Found about eight feet under surface, in gravel under peat, in excavating a minor drain from Lough-a-Claureen to River Clare.

9. A portion of a stone similar to No. 8. 11. Stone celt. Found in the gravel, about two feet under the alluvial soil, when excavating the tap drain, townland of Gardenfield.

12. Human skull. Found two feet under surface of the cut from Lough-a-Claureen.

13. Bronze javelin-head. Found resting on limestone gravel, under four feet of alluvial deposit. 14. Bronze spear-head. 15 and 16. Portions of blades of bronze swords. Found resting on limestone gravel, under three feet of alluvial deposit. 17. Half-crown of James II., cannon money. Found resting on limestone gravel, under two feet of deposit. From Brooklodge demesne, near Knockmoy.

1, 7, 19, and 20. Antlers. Found eight feet under the surface, in black peat, townland of Pollaconagune, barony of Dunmore.

3. Antler. Found eight feet under the surface of black peat, at Gardenfield, barony of Dunmore.

4. Antler. Found about four feet under the surface, adjacent to River Clare, in alluvium in the townland of Lehid.

6. Antler. Found about six feet under surface, and resting on marl and clay, in the townland of Ballygaddy.

18. Antler. Found under three feet of alluvial deposit, within a quarter of a mile of the old Abbey of Knockmoy, in the townland of Liss, barony of Tiaquin.

Articles *collected by* Frederick Barry, Esq., *District Engineer, in the Drainage District of Lough Mask and River Robe, County of Mayo.*

1. Iron war hatchet and handle, and small iron spear. 2. Bronze fittings of small bridle-bit. Found in the mud, two feet under the bed of the River Robe, near Robe Abbey.

Articles *collected by* Charles S. Ottley, Esq., M. R. I. A., *District Engineer, from Toome Bar, the ancient ford between the Counties of Derry and Antrim, at the outlet of Lough Neagh by the Lower Bann River.*

1. Small iron knife-blade and handle. 2 and 3. Two-handed iron sword blades. 4. Iron sword with pommel. 5, 6, and 7. Three iron skein blades. Found in from one to three feet buried in the sand of the Bar.

8 & 9. Iron reaping-hook, and blade of sword, with brass guard. Found lying beside each other, about three feet under the surface of Bar, about midway across the ford.

10. Bronze spear-head. 11, 12, 13, 15, 16, 17, and 18. Seven bronze swords, of different sizes and patterns. 14, 19, 20, and 21. Four bronze daggers. Found scattered over the hard bottom of the Bar, at a depth of from one to three feet under the surface of the sand, and mostly adjacent to the ruins of the old Castle of Toome on the Antrim shore.

22. Piece of bronze tubing. 23. Stone celt. 24 and 25. Two bronze celts. 26. Petrifaction resembling a cow's horn. Found in excavation in Toome Bar, Antrim side, near Toòme Castle, and about three feet under the surface.

27. Fifteen flint knives, found with several others in one mass, on the old hard gravel bed of the river, not far from Toome Castle, on the county of Antrim side.

45. An iron three-legged pot. 46. A pot, partly composed of brass and iron plates. Found in the River Bann, just below Toome Bar, four or five feet under the surface.

47. Six pieces of petrified wood. Found in Toome Bar, five feet under the surface.

From the Shoal at Portglenone, between the Counties of Derry and Antrim.

28. Iron bayonet. 29. Iron basket-hilted sword, with names on hilt.

30. Iron pike-head. Found buried in the bank in cutting off bend of River Bann, on the Derry shore, and supposed to be traces of Rebellion in 1798.

31. Four flint knives. Found with others, deep in bed of River Bann, at Portglenone.

32. Two flint arrow-heads. Found in excavating for the foundations of Portglenone new bridge.

From the Shoal at Portna.

34. Two bronze brooches and ring. Found buried in the clay a short way under the surface, on the Antrim bank of the Portna rapids.

33. Bronze hatchet. 35. Bronze dagger. 36, 37, 38, and 39. Stone hammers, with perforations in them for handles. 40, 41, and 42. Stone celts. 43. Two flint knives. From the excavations of Portna shoall, in the gravel bed of the river, from one to three feet deep under surface, on the Antrim side.

From the River Blackwater.

44. Small brass pot, with three iron legs and handle. Found twelve feet under surface of ground in new cut for River Blackwater, just below junction of Ulster Canal near Charlemont Fort.

ARTICLES *collected by* JOHN W. KELLY, ESQ., *District Engineer, from the Drainage District of the River Quinn, County of Clare.*

1. Bronze spear-head. Found in the bed of the river, under two and a half feet of clay, 200 perches east of Danganbrack Castle.
2. Spur. Found in bed of a small stream, under about three feet of limestone gravel, 260 yards north of Dangan Castle.

ARTICLES *collected by* JOSEPH CONEYS, ESQ., *District Engineer, from the Drainage District of the River Comoge, County of Limerick.*

1. A bronze celt. Found in excavating through the shoal in the river near Fedamore, between Glenogra and Sixmilebridge.
2. Bronze celt. 3. Bronze spear-head. Locality unknown.

SYNOPSIS *of the several Collections of Antiquities, &c., made by the District Engineers, presented to the* MUSEUM *of the* ROYAL IRISH ACADEMY *by* W. T. MULVANY, ESQ., *on the part of the* COMMISSIONERS OF THE BOARD OF WORKS IN IRELAND.

		No. of Lots.
Collected by	Richard A. Gray, Esq., including donation of 25 articles from private collection,	69
,,	William Fraser, Esq.,	63
,,	P. J. Klasen, Esq.,	16
,,	Samuel U. Roberts, Esq.,	16
,,	Do., forwarded by Robert Manning, Esq.,	17
,,	Thomas J. Mulvany, Esq.,	33
,,	John O'Flaherty, Esq., and donation,*	61
,,	George Tarrant, Esq.,	20
,,	Frederick Barry, Esq.,	3
,,	Charles S. Ottley, Esq.,	74
,,	John W. Kelly, Esq.,	2
,,	Joseph Coneys, Esq.,	3
	Total presented,	377

* Included in the list, p. lxi.

Besides the Articles presented and described in the several Lists, MR. MULVANY exhibited several Collections of Antiquities, borrowed by MR. JOHN O'FLAHERTY from MRS. DEVENISH, MR. DEVENISH, MISS MORTON, and DR. CONRY. These consisted altogether of sixty-one articles, said to have been found in the crannogs in the lakes near Strokestown.

No. VI.

ACCOUNT

OF

THE ROYAL IRISH ACADEMY,

FROM 1st APRIL, 1852, TO 31st MARCH, 1853.

THE CHARGE.

	£	s.	d.	£	s.	d.
To Balance in favour of the Public on 1st April, 1852,	. . . . .			85	3	3
Parliamentary Grant for 1852,	300	0	0			
Quarterly Warrants from Treasury,	146	17	8			
Total from Government,				446	17	8
INTEREST ON STOCKS:						
One year's, on £1643 19 6 at $3\frac{1}{4}$ ℔ Cent.	53	8	7			
Ditto, ,, £717 1 10 at 3 ,,	21	10	4			
Total Interest on Stocks,				74	18	11
TRANSACTIONS AND PROCEEDINGS sold,	. . . . .			7	9	9
LIFE COMPOSITIONS:						
John Barker, M. D.,	21	0	0			
Right Hon. M. Brady, Lord Chancellor,	6	6	0			
E. J. Cooper, Esq.	6	6	0			
Henry H. Head, M. D	21	0	0			
J. Beete Jukes, Esq.	21	0	0			
Sir Robert Kane,	6	6	0			
Robert Mallet, Esq.	6	6	0			
Total Life Compositions,				88	4	0
Forward,	. . . . .			702	13	7

	£	s.	d.	£	s.	d.
Brought forward,	. .		.	702	13	7
ENTRANCE FEES:						
David Brereton, M. D., ...	5	5	0			
William Dargan, Esq., ...	5	5	0			
Lundy E. Foot, Esq., ...	5	5	0			
Henry H. Head, M. D.	5	5	0			
William Nelson Irwin, M. D.	5	5	0			
Arthur Leared, M. D., ...	5	5	0			
Rev. Alexander Leeper, ...	5	5	0			
A. H. M'Clintock, M. D., ...	5	5	0			
James S. Muspratt, Esq.	5	5	0			
Sir Francis Waskett Myers, ...	5	5	0			
Henry James Porter, Esq., ...	5	5	0			
Gilbert Sanders, Esq., ...	5	5	0			
Total Entrance Fees, .				63	0	0
ANNUAL SUBSCRIPTIONS:						
Rev. J. G. Abeltshauser; Robert Adams, M. D.; Rev. John Alcorn; William Andrews, Esq.; Signor Angeli; and John Anster, LL.D., ... 1852	12	12	0			
William Armstrong, Esq., . 1850–52	6	6	0			
Abraham Whyte Baker, Esq.; Abraham Whyte Baker, Jun., Esq.; John Barker, M. D., . . 1852	6	6	0			
William Barker, M. D., . . . 1851–52	4	4	0			
Sir Matthew Barrington, Bart., . 1852	2	2	0			
Michael Barry, Esq., ... 1851–52	4	4	0			
F. W. Burton, Esq.; T. I. Beasley, Esq.; T. E. Beatty, M. D.; H. C. Beauchamp, M. D.; John Bell, Esq.; Archdeacon Beresford; P. Bevan, M. D.; and Edward Bewley, M. D., ... 1852	16	16	0			
Sir Robert Gore Booth, Bt., M.P., 1853	2	2	0			
D. F. Brady, M. D., ... 1852	2	2	0			
William Brooke, Esq.; and John Burrowes, Esq., ... 1853	4	4	0			
Very Rev. R. Butler, . . . 1852–53	4	4	0			
A. B. Cane, Esq., ... 1853	2	2	0			
Edward Cane, Esq., ... 1852–53	4	4	0			
H. Carlile, M. D., ... 1852–53	4	4	0			
Samson Carter, Esq.; Thomas Cather, Esq.; and B. J. Chapman, Esq., ... 1852	6	6	0			
Forward,	81	18	0	765	13	7

	£	s.	d.	£	s.	d.
Brought forward,	81	18	0	765	13	7
B. J. Chapman, Esq.; and Fleetwood Churchill, M. D., ... 1853	4	4	0			
Henry Clare, Esq.; F. V. Clarendon, Esq.; J. Claridge, Esq.; E. S. Clarke, Esq.; Francis Codd, Esq.; and M. Collis, Esq., 1852	12	12	0			
F. W. Conway, Esq., . . 1851–52	4	4	0			
Adolphus Cooke, Esq., . . 1851–52	4	4	0			
E. J. Cooper, Esq., ... 1852	2	2	0			
D. J. Corrigan, M. D., . . 1851–52	4	4	0			
Ven. Henry Cotton, ... 1853	2	2	0			
M. P. D'Arcy, Esq., . . . 1852–53	4	4	0			
John Davidson, Esq., and Rickard Deasy, Esq., ... 1852	4	4	0			
Rev. R. V. Dixon, . . . 1851–52	4	4	0			
M. Donovan, Esq., and Charles Doyne, Esq., ... 1853	4	4	0			
William Drennan, Esq., . 1852–53	4	4	0			
Lord Dungannon, . . . 1852–53	4	4	0			
William Edington, Esq., . . . 1853	2	2	0			
J. S. Eiffe, Esq.; Earl of Enniskillen; and Major Fairfield, . . 1852	6	6	0			
Lord Farnham, ... 1853	2	2	0			
Samuel Ferguson, Esq.; John Finlay, LL.D.; and Rev. Joseph Fitzgerald, ... 1852	6	6	0			
Lord William Fitzgerald, . 1852–53	4	4	0			
Gerald Fitzgibbon, Esq., . 1852–53	4	4	0			
Christopher Fleming, M. D., . . 1852	2	2	0			
Lundy E. Foot, Esq., ... 1853	2	2	0			
G. A. Frazer, Esq., ... 1852	2	2	0			
William Frazer, Esq., . . 1851–52	4	4	0			
Rev. J. A. Galbraith, A. M., . . 1852	2	2	0			
Edmond Getty, Esq., . . 1850–51	4	4	0			
James Gibson, Esq.; Wyndham Goold, Esq., M. P.; Samuel Gordon, M. D.; Robt. J. Graves, M. D.; Dean of Kildare; John Grene, Esq.; Dan. Griffin, M.D.; W. Grimshaw, M. D.; and Thomas Grubb, Esq.; 1852	18	18	0			
C. W. Hamilton, Esq., ... 1853	2	2	0			
John Hamilton, Esq.; W. Neilson Hancock, LL.D.; and W. H. Hardinge, Esq., ... 1852	6	6	0			
Forward,	210	0	0	765	13	7

	£	s.	d.	£	s.	d.
Brought forward,	210	0	0	765	13	7
James Hartley, Esq., . . 1851–52	4	4	0			
Charles Hanlon, Esq.; and Rev. Samuel Haughton, ... 1852	4	4	0			
William Henn, Esq., ... 1853	2	2	0			
Joseph N. Higgins, Esq., and William Hogan, Esq., . . . 1852	4	4	0			
J. K. Ingram, LL.D., . . 1851–52	4	4	0			
Arthur Jacob, M. D.; Sir John K. James, Bart.; Rev. John H. Jellett, A. M.; Philip Jones, Esq.; Henry H. Joy, Esq.; Sir Robert Kane, M. D.; and T. F. Kelly, Esq., LL.D., ... 1852	14	14	0			
William Kelly, M. D., . . . 1852–53	4	4	0			
G. A. Kennedy, M. D., and Henry Kennedy, M. B., ... 1852	4	4	0			
J. C. Kenny, Esq., ... 1853	2	2	0			
William T. Kent, Esq., . . . 1852	2	2	0			
Charles Croker King, M. D., . . 1853	2	2	0			
Robert Law, M. D., ... 1852	2	2	0			
Arthur Leared, M.D., and F. L'Estrange, Esq., ... 1853	4	4	0			
William R. Lefanu, Esq.; George Lefroy, Esq.; W. T. Lloyd, Esq.; Rev. George Longfield; Mountiford Longfield, Esq., LL.D.; and William Longfield, Esq., . 1852	12	12	0			
W. H. Luscombe, Esq., . 1852–53	4	4	0			
R. D. Lyons, M. D.; R. R. Madden, M. D.; and J. S. M'Donnell, Esq., ... 1852	6	6	0			
William M'Dougall, Esq., 1852–53	4	4	0			
James Magee, Esq., and Rev. R. J. M'Ghee, ... 1852	4	4	0			
Andrew J. Maley, Esq., . 1852–53	4	4	0			
Rev. Edward Marks, D. D., . . 1852	2	2	0			
H. W. Massey, Esq., . . 1851–52	4	4	0			
G. A. Melville, M. D., and George M. Miller, Esq., ... 1852	4	4	0			
G. M. Miller, Esq., ... 1853	2	2	0			
John Mollan, M. D., ... 1852	2	2	0			
Christopher Moore, Esq., . . . 1853	2	2	0			
David Moore, Esq., and J. M. Neligan, M. D., ... 1852	4	4	0			
Arthur R. Nugent, Esq., . . . 1853	2	2	0			
Forward,	323	8	0	765	13	7

	£	s.	d.	£	s.	d.
Brought forward,	323	8	0	765	13	7
John O'Donovan, LL.D., ... 1852	2	2	0			
M. M. O'Grady, M. D., ... 1853	2	2	0			
Thomas Oldham, Esq.; Charles Ottley, Esq.; Jacob Owen, Esq.; and Jonathan Osborne, M.D., . 1852	8	8	0			
Very Rev. Dean of St. Patrick's, 1853	2	2	0			
James Patten, M. D.; Right Hon. David R. Pigot; J. E. Pigot, Esq.; and Rev. Classon Porter, 1852	8	8	0			
Henry Porter, Esq., ... 1853	2	2	0			
Wellington Purdon, Esq.; Rev. James Reid; and Robert Reid, M. D., ... 1852	6	6	0			
J. L. Rickards, Esq., . . . 1851–52	4	4	0			
George Roe, Esq., ... 1853	2	2	0			
M. R. Sausse, Esq.; Vincent Scully, Esq., M. P.; Oliver Sproule, Esq.; F. J. Sidney, LL.D.; Aquilla Smith, M. D.; Joseph H. Smith, Esq.; Robert W. Smith, M. D., ... 1852	14	14	0			
Rev. Thomas Stack, . . . 1851–52	4	4	0			
M. H. Stapleton, M. D.; D. P. Starkey, Esq.; William Stokes, M. D.; and Lord Talbot De Malahide, ... 1852	8	8	0			
M. E. Talbot, Esq., . . . 1851–52	4	4	0			
Very Rev. J. J. Taylor, D. D.; Robt. Tighe, Esq.; R. W. Townsend, Esq.; and T. J. Tuffnell, M. D., 1852	8	8	0			
Hon. Thomas Vesey, M. P. . . . 1853	2	2	0			
Charles Vignoles, Esq., ... 1852	2	2	0			
R. C. Walker, Esq., ... 1852	2	2	0			
J. F. Waller, LL. D. 1852	2	2	0			
Sir Francis Wasket-Myers, 1852–53	4	4	0			
Charles T. Webber, Esq., and Ven. John West, D.D., ... 1852	4	4	0			
His Grace the Archbishop of Dublin, ... 1852–53	4	4	0			
George Wilkinson, Esq., . . . 1852	2	2	0			
R. C. Williams, M.D., . . 1851–52	4	4	0			
Rev. James Wills; Rt. Hon. John Wynne; and Geo. Yeates, Esq., 1852	6	6	0			
Total Annual Subscriptions,				434	14	0
Forward,	. .	. .	.	1200	7	7

	£ s. d.	£ s. d.
Brought forward,	. . . . .	1200 7 7
CONTINGENCIES.		
For carriage of parcels from London, . .	0 3 8	
Total contingencies, . .		0 3 8
SUBSCRIPTIONS TO METEOROLOGICAL AND TIDAL EXPENDITURE.		
Andrew S. Hart, LL.D.	. . . . .	2 0 0
PROCEEDS OF SALES OF INSTRUMENTS, &c.		
John Foreman, sundry materials, . .	0 6 11	
F. J. Sidney, LL.D., barometer and thermometer, ...	3 15 0	
Total Proceeds of Sales, ...		4 1 11
SUBSCRIPTIONS FOR THE PURCHASE OF GOLD TORQUES.		
Thomas Hutton, Esq., ...	1 0 0	
Rev. J. K. Bailie, D. D., ...	1 1 0	
Samuel Ferguson, Esq., ...	1 0 0	
William Henry Harvey, M. D., . . .	1 0 0	
Earl of Dunraven, ...	5 0 0	
Lady Dunraven, ...	1 0 0	
Lord Talbot de Malahide, ...	2 0 0	
M. H. Gill, Esq., ...	1 0 0	
Total Subscriptions to Gold Torques,		13 1 0
HOUSE IN GRAFTON-STREET.		
Alliance Gas Company's deposit on Purchase, ...	155 0 0	
Total payment on account of purchase of House in Grafton-street,		155 0 0
TOTAL AMOUNT OF CHARGE, . . .	. . .	1374 14 2

THE DISCHARGE.

				£	s.	d.	£	s.	d.
Antiquities purchased.									
Casey, Mrs., bronzes, &c., ...				7	10	0			
Conroy, Mary, iron articles, &c., . . .				3	1	6			
Donegan, John, gold lunets, &c., . . .				34	16	9			
Donoghoe, William, iron and bronze antiquities, ...				1	17	6			
Edwards, William, figure of crucifixion, .				3	0	0			
Geraghty, Michael, gold brooch, . . .				0	10	6			
Kelly, George, bronze pot, ...				1	5	0			
Mason, Thomas, bronze head, ...				0	10	0			
Underwood, James, iron articles, &c., . .				10	0	0			
Total Antiquities purchased, . .							62	11	3
Books, Printing, and Stationery.									
Ray Society, subscription for 1851–52, .				2	2	0			
Barthes and Lowell, charges on books, .				0	15	0			
Camden Society, subscription for 1849–51,				3	0	0			
Chamney, Robert, reporting meetings for Proceedings, ...				11	11	0			
Ferrier and Co., wrapping-paper, . . .				0	15	5			
Gill, M. H., printing Transactions, vol. xxii. part 3, . .	£92	2	11						
Ditto, Proceedings, vol. v. part 2, ...	61	6	7						
Ditto, miscellaneous printing,	13	15	5						
Ditto, on account of Transactions, vol. xxii. part 4, . .	50	0	0						
				217	4	11			
Grey, Charles, engraving for Transactions,				7	7	0			
Hanlon, G. A., woodcuts, ...				4	17	6			
Hendrick, R., stationery for Meteorological Returns, ...				10	15	0			
Hodges and Smith, books, 1850–52, . .				111	6	7			
Kelly, W. B., book, ...				0	10	0			
Madden, John, printing receipts, . . .				0	7	11			
Oldham, William, woodcuts, ...				2	0	0			
Forward,				372	12	4	62	11	3

	£ s. d.	£ s. d.
Brought forward,	372 12 4	62 11 3
Pilkington, F., binding books, ...	26 15 10	
Quaid, James, book, ...	0 12 6	
Tallon, John, Jun., stationery, ...	3 19 3	
Thom, Alexander, books, ...	6 5 0	
Total Amount of Books, Stationery, &c., ...		410 4 11
Coals, Gas, Etc.		
Alliance Gas Company, for gas and coke,	16 4 0	
Hamilton, William, candles, &c., . . .	0 4 7	
Holmes, Thomas, for coals and carriage, .	21 17 3	
Lambert, J., candles, ...	0 6 0	
Tharel, P., tapers, ...	0 2 5	
Total Amount of Coals, Gas, &c.,		38 14 3
Repairs of House.		
Bray, John, cleaning ash pit, ...	0 5 0	
Murphy, James, sweeping chimneys, . .	0 6 0	
Surman, George, repairs on house in Grafton-street, ...	10 0 0	
Total Repairs of House, ...		10 11 0
Furniture and Repairs.		
Brown, J., repairing sundries, ...	0 1 6	
Casey, Paul, repairing locks, &c., . . .	0 13 0	
Dobbyn, George, repairing clocks, &c., .	4 0 6	
Edmundson and Co., gas-fittings, in Dawson-street, ...	10 10 2	
Maguire, John, locks, ...	0 2 0	
Murphy, J., tin reflector, ...	0 0 10	
Porters' earthenware, ...	0 2 7	
Scully, William, rat-trap, ...	0 2 6	
Torkington, J., window-blinds, ...	0 12 0	
Total Furniture and Repairs, . .		16 5 1
Rent, Taxes, and Insurance.		
National Insurance Company, ...	9 16 0	
Globe Insurance Company, ...	5 13 6	
Half-year's rent of Grafton-street house, .	52 4 6	
Forward,	67 14 0	538 6 6

	£	s.	d.	£	s.	d.
Brought forward,	67	14	0	538	6	6
Board of Public Works, on account of rent of Dawson-street house, ...	73	8	10			
Ministers' money on Grafton-street house,	2	15	5			
Parish cess, on ditto, ...	0	13	6			
Ministers' money on Dawson-street house,	2	15	5			
Total Rent, Taxes, and Insurance, .				147	7	2
Salaries, Wages, Etc.						
Ball, Robert, LL. D., Treasurer, . . .	21	0	0			
Clibborn, Edward, Clerk, Assistant Secretary, and Curator of Museum, . . .	150	0	0			
Curry, Anthony, evening meetings, . .	1	15	0			
Drummond, Rev. W. H., D. D., Librarian,	21	0	0			
Graves, Rev. Charles, D. D., Secretary of Council, ...	21	0	0			
Murphy, J., hall-porter in Dawson-street house, ...	31	7	6			
Neville, J., ditto, in Grafton-st. house,	15	2	10			
O'Brien, Thomas, messenger, ...	39	0	0			
Todd, Rev. J. H., D. D., Secretary of Academy, ...	21	0	0			
Todhunter, Isaac, Accountant, ...	50	0	0			
Total Salaries, Wages, &c., . . .				371	5	4
Contingencies.						
Clibborn, Edward, allowance for sundries used in cleaning house, for the year 1852–53, ...	10	0	0			
Expenses of freight and charges on books,	19	19	0			
Postage stamps and postage, ...	9	14	5			
Petty charges, ...	6	7	5			
Total Contingencies, ...				46	0	10
Gold Torques.						
Edward Clibborn, on account of his purchase of two gold torques for the Academy, on 3rd October, 1848, ...	. . . . .			13	1	0
Forward,	. . . . .			1116	0	10

	£ s. d.	£ s. d.
Brought forward,	. . . .	1116 0 10
Meteorological and Tidal Expenditure.		
Portrush station,	4 4 3	
Donaghadee ditto,	3 9 3	
Rathmullen ditto,	4 9 9	
Buncrana ditto,	3 10 1	
Total Meteorological and Tidal Expenditure,		15 13 4
Expenses on House, No. 19, Dawson-st.		
Bray, J., cleaning ash-pit,	0 6 0	
Casey, Paul, repairing locks, bells, &c.,	3 12 0	
Reilly, P., cleaning ash-pit,	0 2 6	
Total Expenditure on House in Dawson-street,		4 0 6
Expenses on Sale of Grafton-st. House.		
J. F. Jones, commission for sale,	15 10 0	
Ditto, Advertising, &c.,	2 18 6	
Total Expenses,		18 8 6
Cunningham Medal.		
West and Son, gold medal,	. . . .	22 0 0
Total Discharge,	. . . .	1176 3 2
Balance in favour of the Public,	. . . .	198 11 0
Total Amount of Charge,	. . . .	1374 14 2

GENERAL ABSTRACT OF THE MONTHLY ACCOUNTS OF THE ROYAL IRISH ACADEMY,

AS FURNISHED TO AUDIT OFFICE, FROM 1st APRIL, 1852, TO 31st MARCH, 1853, INCLUSIVE.

Dr.	£	s.	d.	Cr.	£	s.	d.
To Balance, 1st April, 1852,	85	3	3	By Antiquities,	62	11	3
To Government Grant,	300	0	0	By Books, Printing, &c.,	410	4	11
To Treasury allowance,	146	17	8	By Repairs of House, Grafton-street,	10	11	0
To Interest on Stock,	74	18	11	By Rent, Taxes, &c.,	73	18	4
To Transactions and Proceedings sold,	7	9	9	By Furniture and Repairs,	16	5	1
To Life Compositions,	88	4	0	By Salaries, Wages, &c.,	371	5	4
To Entrance Fees,	63	0	0	By Contingencies,	46	0	10
To Annual Subscriptions,	434	14	0	By Coals, Gas, &c.,	38	14	3
To Subscriptions to Meteorological and Tidal Expenditure,	2	0	0	By Meteorological and Tidal Expenditure,	15	13	4
To Subscriptions to Gold Torques,	13	1	0	By Gold Torques,	13	1	0
To Contingencies,	0	3	8	By Expenditure on 19, Dawson-street,	4	0	6
To Meteorological Instruments sold,	4	1	11	By Gold Medal,	22	0	0
To Deposit on Sale of Grafton-street House,	155	0	0	By Expenses on Sale of Grafton-street House,	18	8	6
				By Board of Works,	73	8	10
					1176	3	2
				By Balance indebted 31st March, 1853,	198	11	0
	1374	14	2		1374	14	2

The Treasurer reports, that there is to the credit of the Academy, in the Bank of Ireland, £717 1*s.* 10*d.* in 3 per cent. Consols, and £1643 19*s.* 6*d.* in $3\frac{1}{4}$ per cent. Government Stock, the latter known as the Conyngham Fund.

31*st March*, 1853.

(Signed), ROBERT BALL,
Treasurer.

No. VII.

SUPPLEMENT TO CATALOGUE

OF

TRADESMEN'S TOKENS,

PUBLISHED

IN THE PROCEEDINGS OF THE ROYAL IRISH ACADEMY, VOL. IV. PART II.

BY

AQUILLA SMITH, M. D., M. R. I. A.

The Towns marked with an *asterisk* do not occur in the original Catalogue.

*ANNAMOE, CO. WICKLOW.

1.	ROBART . MELDRVM .	OF . ANAMO*** .	

ARMAGH, CO. ARMAGH.

2.	ROBERT . MCCONCHY .	OF . ARDMAGH . MART .	

*ARTICILIE, *see* ARTIKELY.

*ARTIKELY, CO. LONDONDERY.

3.	IOHN . HILLHOVSE . MARC^{H}.	OF . ARTICILIE .	

ATHLONE, CO. WESTMEATH.

4.	IAMES . LENON . OF .	ATHLON . MARCHA .	
5.	IOHN . MI**** . OF.	ATHLONE . MARCHANT .	1656
6.	RICHARD . EATON . OF.	ATHLONE . CHAND*** .	
7.	WALTER . DOWDALL . OF .	ATHLONE . MARCHANT .	

ATHY, CO. KILDARE.

8.	IAMES . SWANTON .	EXCISE . OFICE . IN . ATHY.	

*BALLINASLOE, CO. GALWAY.

9.	ROBERT . WARNER . POST . MASTE^{R}.	IN . BALLINISLOE .	

* BALLYJAMESDUFF, CO. CAVAN.

10. IOHN . DALIN .	BALLYIA*** . DVFFE .	1668

* BALLYMONEY, CO. ANTRIM.

11. JOHN . HARPER . OF .	BELLYMONEY . MARCHANT.	

BANDON, CO. CORK.

12. IOHN . WREN . OF .	BANDON . BRIDEWELL .	1659

*BANDON BRIDGE, CO. CORK.

13. B . B .	THREE . CASTLES .	

BELFAST, CO. ANTRIM.

14. HVGH . SPEIR . MARCHNT.	IN . BELFAST . HIS . PENNY.	
15. WILLIAM . MOORE . IN .	BELFAST . MARCHANT .	

BELLEMANOGH, CO. ANTRIM.

16. IOHN . WALLAS . MARC .	IN . BELLEMENOCK .	1671

BELTURBET, CO. CAVAN.

17. RICHARD . HARRISON .	BE******AT . POSTMR .	

BOYLE, CO. ROSCOMMON.

18. EDWARD . MVNNS .	IN . BOYLE .	1678

CARLOW, CO CARLOW.

19. EDWARD . RYNOLDS .	OF . CARLO . MARCHANT .	
20. IOHN . MASTERS .	IN . CA****LOVGH .	1657
21. THOMAS . MOORE . OF .	CARLO . POSTMASTER .	

CARRICKFERGUS, CO. ANTRIM.

22. WILLIAM . MAGEE . OF .	CARRICKFERGVS .	

CA****LOVGH, *see* CARLOW.

CLONES, CO. MONAGHAN.

23. IOSEPH . SCOFIELD .	IN . CLOVNIS .	1670

CLONFERT, CO. GALWAY.

24. IAMES . *****AN . IN . CLONFERT . MARC .

CLONMEL, CO. TIPPERARY.

25. IOHN . HARWOOD . OF . CLONMELL . MA .

CLOVNIS, *see* CLONES.

COLERAINE, CO. LONDONDERRY.

26. R** . BROWNE . MARCHANT . IN . COALRAINE .
27. WILL . GODFREY . MARCHANT. IN . COLERAINE .

* COLLOONEY, CO. SLIGO.

28. HENNERY . DOWDALL . OF . COOLLVNY . MARC . 1671

* DEMNEENE, *see* MALLOW.

DINGLE, CO. KERRY.

29. TOBY . CREANE . DINGLE-COVCH. . IRON . WORKE .

DOWNPATRICK, CO. DOWN.

30. ROBERT . KING . OF . DOVN . PATRICK . MAR .

DROGHEDA, CO. LOUTH.

31. EDWARD . MARTIN. IN . DROGHEDA .
32. IOHN . **AYE. OF . DROHEDA . 1663
33. IOHN . ROOKES . OF . DROGHEDA . MART. TAY . 1671

DROMORE, CO. DOWN.

34. WILL . WILNE . OF . DROMORE . DISTILLER . 1667

DUBLIN, CO. DUBLIN.

35. ALEXANDER . AICKIN. MARCHANT . IN . SKINER . ROW . DVBLIN . —65
36. ELNATHAN . BROCKE . SEEDMAN. IN . HYGHE . STREETE . DVBLIN . 1657

37.	ELVATHAN . BROCKE .	IN . DVBLINE .	1656
38.	HVGH . PRESTON . AT Y^{E} BLACK .	BOY . IN . S^{T} GEORGES . LANE . DVBLIN .	1666
39.	IONATHAN . BVTTERTON . PEWTR—	ER . HIGH . STREETE . DVBLIN .	—63
40.	IOHN . FLEETWOOD .	CASTLE . STREET . DUBLIN .	
41.	LEANARD . ****IOTT .	CI : C***E . HILL . DVBLIN .	1657
42.	ROBERT . BROCK . IN .	NEW . STREET .	1656
43.	WILLIAM . MILLES . CLO-THIR.	HIGH . STREET . DVBLIN .	1671

ENNIS, CO. CLARE.

44.	*** . WHITE . OF . ENNIS.	***RCH . HIS . HALFPENNY .	

GALWAY, CO. GALWAY.

45.	EDMOND . COYNE .	IN . GALLWAY . MARCHANT.	1669
46.	IOHN . MORREY . OF .	GALLWAY . MARCHAN .	
47.	NICHOLAS . KIRWAN .	OF . GALLWAY . MAR .	

KILDARE, CO. KILDARE.

48.	CHRISTOPH . CVSACK .	OF . KILDARE . MARCH^{T}	

KILKENNY, CO. KILKENNY.

49.	FOR Y^{E} . VSE . & . CONVENI-ENCIE .	OF . THE . INHABITANTS . KILKENY . (HAPENNY *countermarked*)	1677
50.	THOMAS . TALBOT . OF .	KILLKENY . VINTNER .	
51.	THOMAS . TOOLE . OF .	KILKENY . MARCH .	

KINSALE, CO. CORK.

52.	A . KIN**** . ***THING .	*** . **** . OF . KINSALE .	1655

LIMERICK, CO. LIMERICK.

53.	B . G . OF . LIMERICK .	NEAR . KEY . LANE .	1668

LISBURN, CO. ANTRIM.

54.	GEORGE . LOCKART .	LISBVRN . MARCH^{T}	

LISNEGARVY, CO. ANTRIM.

55. OLIVER . TAYLOR . MARCH— ANT . IN . LISNEGARVY . 1658

LONDONDERRY, CO. LONDONDERRY.

56. WILLIAM . KYLE . OF . LONDONDERRY . MARCHANT .

LOUGHREA, CO. GALWAY.

57. DANIELL . KELLY . MER . IN . LAVGHREAGH .
58. HENRY . BARGERY . OF . LOGHRAY .

* MALLOW, CO. CORK.

59. IOHN . HOLLANDS . PENCE . Y^E . DEMNEENE . & . MOYALLO . CHANG^E . 1668

MARYBOROUGH, QUEEN'S CO.

60. EDWARD . NICHOLIS . OF . MARIBROVGH .

* MITCHELSTOWN, CO. CORK.

61. THOMAS . COOKE . OF . MICHELS . TOWN . 1661

MOYALLO, *see* MALLOW.

NAVAN, CO. MEATH.

62. DANIEL LEIGH . OF . NAVAN . MARCHAN . 1668

NEW-STREET, *see* DUBLIN, Robert Brock.

NEWTOWN LIMAVADY, CO. LONDONDERRY.

63. IOHN . OLLIVER . OF . NEWTOVN . LIMAVADY .

ROSCOMMON, CO. ROSCOMMON.

64. IOHN . HINDS . OF . ROSCOMON . MARCHAN^T .
65. IOHN . SLATAR . OF . ROSCOMMON .

SLIGO, CO. SLIGO.

66. WILLIAM . CRAFORD . OF . SLIGOE . MARCH^T .

* STROKESTOWN, CO. ROSCOMMON.

67. TADY . MAHON . MARC . OF . STROCKE . TOVNE .

* TRALEE, CO. KERRY.

68. IAMES . CONNOR . IN . TRALY . MICHAELL . FALKINER .

WATERFORD, CO. WATERFORD.

69. THOMAS . NOBLE . MERCH— ANT . OF . WATERFORD .

WEXFORD, CO WEXFORD.

70. ISAAK . FREEBORN . OF . WAXFORD . INN***PER .
71. WILLIAM . I . REVILL . OF . WAXFORD . MARCHANT .

YOUGHALL, CO. CORK.

72. WALLTER . HIBBARD . OF . YOVGHALL . 1668

SUPPLEMENT TO APPENDIX

OF

FARTHING TOKENS ISSUED IN IRELAND FROM 1832.

* ARMAGH, CO. ARMAGH.

1. JA^{S}. ARMSTRONG . & . C^{O}. IRON- MONGERS . & . GROCERS . ARMAGH . W^{M}. ARMSTRONG . & . SON . SILK . MERCERS . HABERDASHERS . &c . LURGAN .

* ATHLONE, CO. WESTMEATH.

2. BURGESS . & . C^{O}. DRAPERS . MERCERS . CHURCH . S^{T}. ATHLONE . & . MAIN . S^{T}. MOATE . CHURCH . S^{T}. ATHLONE . MAIN . S^{T}. MOATE . & . WILLIAM . S^{T}. TULLAMORE .

* BALLYMACARRET, CO. DOWN.

(A suburb on the Down side of Belfast Bridge. Its proper name is Ballymacart, so called after Macart O'Neal.)

3. JAMES . JONES . BALLYMACARRETT . *The Queen's Head.* THE . BALLYMACARRETT . GROCERY . & . HABERDASHERY . ESTABLISHMENT . *A Balance.*

* BALLYMENA, CO. ANTRIM.

4. GREENE . & . SINCLAIR . BALLYMENA . *A Hat.* WOOLLEN . DRAPERS . HABERDASHERS . BOOTS . AND . SHOES .

* BARRACKTON, CO. CORK.

(A suburb adjoining the Barracks near Cork.)

5. JOHN . M^{c}CARTHY . GROCER . AND . SPIRIT . DEALER . N^{o}. 1 . BARRACKTON. THE . CHINA . MAN . *A Chinaman holding a branch of a tea tree in his left hand.*

BELFAST, CO. ANTRIM.

6. B. HUGHES . ONE . FARTHING . BELFAST . RAILWAY . BAKERY . *A sheaf of wheat.*
7. WILLIAM . GILMORE . TEA . DEALER . GROCER . FRUIT . WINE . & . SPIRIT . MERCHANT . 14 . HIGH . S^{T}. BELFAST . VICTORIA . QUEEN . OF . GREAT . BRITAIN. *The Queen's Head.*
8. M^{c}KENZIE . BRO^{s}. MAY . S^{T}. BELFAST . BRASS . FOUNDERS . PATENT . AXLE . MAKERS . & . GAS . FITTERS .
9. MACKENZIE . & . SAUNDERS . BELFAST . *Thistle and shamrock* . PAYABLE . AT . THE . SCOTCH . HOUSE . N^{o}. ^{36} . HIGH . STREET .
10. C . & . P . M^{c}GLADE . GROCERS . WINE . & . SPIRIT . DEALERS . BELFAST . ONE . FARTHING . PAYABLE . AT . 34 . EDWARD. S^{T} . & . 71 . SMITHFIELD .

CLONMEL, CO. TIPPERARY.

11. PETER . M^C^SWINEY . & . CO . ABBEY . S^T^ . CLONMEL . *The Queen's Head.* — PETER . M^C^SWINEY . & C^O^ . MERCERS . & . DRAPERS . ABBEY . S^T^ . CLONMEL .

CORK, CO. CORK.

12. WILLIAM . REARDON . SHANDON . STREET . CORK . — *The Queen's Head.*

13. ROGERS . PAPER . HANGINGS . CORK . — PAINTING . PLUMBING . &c . 82 . GEORGES . S^T^ .

* DOWNPATRICK, CO. DOWN.

14. HUGH . CROSKERY . WINE . SPIRIT . & . TEA . MERCHANT . — PAYABLE . AT . MY . NEW . ESTABLISHMENT . DOWNPATRICK . ONE . FARTHING . *A sprig of shamrock at each side of the words "my new."*

DUBLIN, CO. DUBLIN.

15. ANDREWS'S FAMOUS . 4/S. TEA. — THE . TEA . ESTABLISHMENT . ANDREWS . AND . C^O^ . DUBLIN. *View of the Establishment.*

16. M^C^SWINEY . DELANY . & . COMPANY . LOWER . SACKVILLE . S^T^ . DUBLIN . — DUBLIN . OPENED . MAY . 1853. *In the field a view of the Warehouse.*

17. SCOTT . BELL . & . C^O^ . SUCCESSORS . TO . HARVIES . & . C^O^ . WELLINGTON . QUAY . DUBLIN . — SILK . MERCERS . DRAPERS . & . HOSIERS . *In the field, rose, thistle, and shamrock.*

18. BYRNE . & . C^O^ . 6 . & . 7 . GRANBY . ROW . DUBLIN . *The Queen's Head.* — BYRNE . & . C^O^ . TEA . & . WINE . MERCHANTS . 6 . & . 7 . GRANBY . ROW . DUBLIN .

19. MICHAEL . KILLEEN . WOOLLEN . DRAPER . *The Queen's Head.* — NATIONAL . WOOLLEN . HALL . 10 . DAME . STREET . DUBLIN .

20. O'GRADY . CLINTON . & C^O^ . 19 . & . 20 . HENRY . S^T^ . DUBLIN . DRAPERS . — MAY . IRELAND . FLOURISH . *A Harp under which is a sprig of Shamrock.*

21. J . PLUNKETT . LEATHER . MERCHANT . 1 . AUNGIER . S^{T}. DUBLIN. *The Queen's Head.*
IMPORTER . OF . FRENCH . & . ENGLISH . LEATHER . SHOE . TRIMMINGS. &c . WHOLESALE. & . RETAIL .

22. TALTY . MURPHY . & . C^{O}. 9 . & . 10 . HENRY . S^{T}. DUBLIN . *The Queen's Head.*
TRIMMINGS . HABERDASHERY . BERLIN . WOOLS . HOSIERY . SHIRTS . GLOVES . &c .

23. WEBB . & . C^{O}. LINEN . & . WOOLLEN . DRAPERS . 10 . 11 . & . 12 . CORN . MARKET . DUBLIN .
VICTORIA . QUEEN . OF . GREAT . BRITAIN . *The Queen's Head.*

GALWAY, CO. GALWAY.

24. GEO^{E}. FARQUARSON . & . CO . WOLLEN . DRAPERS . PAYABLE . AT . GALWAY .
GEORGE . FARQUARSON . & . C^{O}. GALWAY . ONE . FARTHING . 1839 .

25. I . FORTUNE . & . C^{O}. LINEN . & . WOOLLEN . DRAPERS . HOSIERS . HATTERS . & . HABERDASHERS . GALWAY .
I . FORTUNE . & . CO . GALWAY . *The Queen's Head.*

26. MICHAEL . HENNESSY . WOOLLEN . DRAPER . HATTER . &c . GALWAY .
ONE . FARTHING . PAYABLE . AT . EYRE . SQUARE . GALWAY .

27. MICHAEL . HENNESSY . WOOLEN . & . FANCY . WAREHOUSE . EYRE . SQUARE . GALWAY .
ONE . FARTHING . PAYABLE . AT . M^{L}. HENNESSY'S . EYRE . SQUARE . GALWAY .

* KILMALLOCK, CO. LIMERICK.

28. DAN^{L}. O'BRIEN . DRAPER . KILMALLOCK .
The Queen's Head.

* KINGSTOWN, CO. DUBLIN.

29. HARRISON . & . C^{O}. SUCCESSORS . TO . J . BEWLEY . LOW^{R}. GEORGES . S^{T}. KINGSTOWN .
HARRISON . & . CO'S . TEA . IS . THE . BEST. *In the field, rose, thistle, and shamrock.*

LIMERICK, CO, LIMERICK.

30. SCARR . BROTHERS . TEA . MEN . 15 . PATRICK . STREET . LIMERICK . EXHIBITION . PALACE . LONDON . 1851 . *In the field, The Crystal Palace.*

* LOUGHREA, CO. GALWAY.

31. JAMES . O'FLYNN . LOUGHREA . 1842 *within a wreath of shamrocks.*

* LURGAN, CO. ARMAGH, *see* ARMAGH.

* MONAGHAN, CO. MONAGHAN.

32. F . ADAMS . MONAGHAN . *A wreath of shamrock.*

* MOATE, CO. WESTMEATH, *see* ATHLONE.

* QUEENSTOWN, CO. CORK.

33. SWANTON . & . C^{o} . DRAPERS . QUEENSTOWN . *The Queen's Head.*

SKIBBEREEN, CO. CORK.

34. P . VICKERY . HARDWARE . HOUSE . SKIBBEREEN . TRIMMING . AND . FANCY . WAREHOUSE .

* TULLAMORE, KING'S COUNTY, *see* ATHLONE.

The following Token does not bear the name of the Town in which it was issued.

35. GROCERY . AND . SPIRIT . TRADE . 1 . FREDERICK . STREET .

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re.—T

Ba p A	To	Meteorological Instruments Purchased.	Law Costs of Incorporation, &c.	Total Discharge.	Treasurer's Balance in Hand at the end of the Year.
£ l.		£ s. d.	£ s. d.	£ s. d.	£ s. d.
]	7	....	211 4 3½	267 15 8½	454 10 6½
45 6½	8	....	......	33 12 8	766 13 10½
76(0½	11	....	40 19 0	607 4 7	589 8 9½
58 9½	1(	33 2 2½	92 15 0	727 19 4	366 14 6½
366 6½		11 6 0½	......	657 15 6½	166 8 6
166 6	1	....	......	731 8 2½	1058 17 2½
058 2½	1	....	......	438 19 9½	863 3 2
863 2	1	....	......	455 4 6½	886 2 1½
886 1½	1	....	......	587 10 8	628 15 5½
28 5½	1	....	......	375 7 6½	1037 18 4
37 4	1	—— ?	—— ?	No Return.	No Account.
Ant.	1	—— ?	—— ?	No Return.	No Account.
Ant.		....	13 12 10½	767 12 0	165 17 6
5 6		...	......	411 18 9½	307 0 6½
7 6½		...	15 1 2	572 7 2	115 12 0
5 0	1	...	......	1638 16 9½	260 18 3½
3½		...	......	328 17 1	435 9 5½
51					

SYNOPSIS OF THE ACCOUNTS OF THE ROYAL IRISH ACADEMY,

FROM APRIL 18, 1785, TO MARCH 16, 1816.

PREPARED FROM THE RETURNS AS CERTIFIED BY THE AUDITORS APPOINTED BY THE COUNCIL.

Printed by Order of Council of February 16, 1846, from the original Accounts, to complete the Return in the Proceedings, Vol. III., Appendix, No. IV.

Note.—The following Sums are in the late Irish Currency.

Year	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] from Treasury	Grant from Parliament	[illegible]	Balance [illegible]	Total Charge	[illegible]	[illegible]	[illegible]	[illegible]	Contingencies	Furniture and Repairs	[illegible]	Rent, Taxes, and Insurance	[illegible]	[illegible] Stock	Premiums paid	Commission for collecting Subscriptions	[illegible] Purchases	[illegible]	Total [illegible]	Total [illegible] at end of the Year
	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d
1785		722 6 3				159 5 0	563 1 3						Nil.	722 6 3		0 11 0		4 3 7	16 8 7	4 11 0			30 11 3					211 4 3½	267 15 8½	451 10 6½
1786		315 16 0				118 15 0	56 17 6	175 3 6					451 [illegible] 6½	800 6 6½				3 16 6	0 5 5				20 10 9						83 12 8	706 13 10½
1787		429 19 6				108 1 3	108 1 3	213 17 0					760 [illegible] 10½	1196 13 4½	61 0 3	277 11 4		13 19 1	10 19 6	30 17 2			168 18 3					40 19 0	607 4 7	583 8 9½
1788		352 12 6				28 8 9	119 8 9	204 15 0		152 12 7			589 [illegible] 9½	1094 13 10½	118 8 3½	70 0 0		32 17 7½	9 17 1	59 8 10	65 16 9	182 11 6	83 2 0½				33 2 2½	92 15 0	727 19 4	366 14 6½
1789		410 8 0				45 10 0	79 12 6	275 5 6	Conyngham Bequest,—	57 1 6			306 [illegible] 6½	824 4 0½	105 16 7½	189 15 6½	18 19 4	10 4 10½	44 17 2½	23 10 9	34 1 7½	135 9 0	83 11 6½				11 6 0½		657 15 6½	166 8 6
1790		381 12 5	43 0 0	29 4 5			91 0 0	218 8 0	1072 10 0	169 14 6			166 [illegible] 6	1799 5 5	54 10 3	129 0 1½		48 5 11	7 4 0½	79 10 6	46 9 10	204 11 6	161 16 0½						731 8 2½	1058 17 2½
1791		243 5 9					85 6 3	157 19 6					1058 17 2½	1302 2 11½	71 11 1	93 18 0		29 0 5	12 7 6½		1 6 9	131 10 6	99 5 6						438 19 9½	863 3 2
1792		398 9 0	40 0 0			22 15 0	56 17 6	188 16 6		169 14 6			863 [illegible] 2	1341 6 8	5 5 7½	167 15 6		16 13 4	11 10 1		11 7 6	156 18 9	85 13 9						455 4 6½	886 2 1½
1793		280 4 0	89 0 0			22 15 0	22 15 0	154 11 0	Donation,— 50 0 0				886 [illegible] 1½	1216 6 1½	7 19 6			14 16 7½			815 6 0	133 8 6½	66 0 0		50 0 0				587 10 8	628 15 5½
1794		671 7 5		109 8 11	51 3 9	159 5 0	22 15 0	328 14 9		113 3 0			628 [illegible] 5½	1413 5 10½		179 13 8		4 0 0		4 9 6	102 13 5½	14 10 0	20 0 0		50 0 0				375 7 6½	1037 18 4
1795		—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?			1037 [illegible] 4	No Return.	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	No Return.	No Account.
17[illegible]		—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?			No Account.	No Return.	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	—— ?	No Return.	No Account.
1797	Proceeds of Government Grant of £670 and £7 5s 7d added, in 3½ per cents., to represent the Conyngham Bequest.	670 6 6		115 4 6	51 3 9		142 3 9	361 14 6		113 3 0		150 0 0	No Account.	933 9 6	27 9 5½	175 7 7		42 17 0	17 19 6½	9 0 1½	89 16 5	209 10 10	135 13 9		65 9 8½	30 14 5½		13 12 10½	767 12 0	165 17 6
1798		265 15 6	Interest on Government Stock.	31 10 10½	25 11 10½	45 10 0	39 16 3	143 6 6	54 3 4	513 3 0		100 0 0	165 17 6	718 19 4	16 16 2½	160 5 7½		31 18 8	2 19 4½	1 14 1½	22 13 6	66 9 0	80 0 0			9 2 3½			411 18 9½	307 0 6½
1799		267 15 8		17 10 8		22 15 0	34 2 6	193 7 6		113 3 0			307 [illegible] 6½	687 19 2½	0 17 4	169 8 10½		37 15 9	1 6 5	1 13 0½	60 16 0	205 8 7	80 0 0					15 1 2	572 7 2	115 12 0
1800	1400 0 0	401 0 1	12 5 0	20 4 1		45 10 0	45 10 0	277 11 0		113 3 0	970 0 6*	300 0 0	115 [illegible] 0	1899 15 1	41 5 8½	184 16 0		49 9 4	19 17 7½		80 1 6	169 8 0½	125 10 0	977 5 7					1638 16 9½	260 18 8½
1801	1400 0 0	418 11 0	12 5 0	7 0 9		68 5 0	39 16 3	291 4 0		84 17 3			2[illegible]0 [illegible] 5½	764 6 6½	7 0 3½			27 12 11	23 18 0½			164 15 10	105 10 0						328 17 1	435 9 5½
1802	1400 0 0	425 12 8	49 0 0	121 2 4			39 16 3	212 11 1		210 1 2½		300 0 0	435 9 5½	1401 3 4	27 19 2	257 16 5½		21 5 4½	35 1 6	52 5 8	42 18 0	102 15 2	102 15 0		15 0 0	72 4 11		35 5 11	768 6 2	632 17 2
1803	1400 0 0	601 14 9					28 8 9	578 6 0		211 13 2			682 17 2	1476 5 1		243 16 6		31 16 6	27 10 11½		4 18 9½	219 6 2	113 2 0			66 11 5		8 6 11	718 9 3	757 15 10
1804	14[illegible] 0 0	211 1 1		9 11 4	17 1 3	22 15 0	22 15 0	138 15 6		211 13 3		272 9 6	757 15 10	1482 19 8	138 19 6½	427 17 11		75 10 5½	33 1 0½		62 9 4½	264 15 2½	228 5 0		16 19 1	27 17 2½			1175 15 6	307 4 2
1805	1400 0 0	376 5 0	171 10 0					204 15 0		120 16 7½			3[illegible]7 4 2	8[illegible]1 5 9½	54 0 1	104 3 2			1 5 2			63 14 3	42 15 0			10 14 9½			276 12 8½	527 13 1
1806	1400 0 0	410 10 4	49 0 0	161 6 4			22 15 0	177 9 0		80 11 1			527 18 1	1018 14 6	12 7 0	70 14 11½		34 9 9	8 8 2½		8 13 8	105 12 11½	105 10 0			7 10 5½			353 7 0	665 7 6
1807	1400 0 0	349 6 0	49 0 0		68 5 0			232 1 0		161 2 2			665 7 6	1175 15 8	35 1 6½			38 14 2½	8 11 1			174 6 11½	80 0 0			2 9 10		18 2 4	387 8 11½	788 6 8½
1808	1400 0 0	376 16 11	49 0 0	63 5 8			89 16 3	204 15 0		161 2 2			788 6 8½	1326 5 9½		57 12 9		38 11 11	13 9 0			185 11 6	125 10 0			2 9 10			428 5 0	898 0 9½
1809	1400 0 0	196 6 1½	49 0 0		34 2 6	22 15 0	84 2 6	90 8 7½		161 2 2			858 0 9½	1255 9 1½	10 1 6			29 11 1	10 11 6	21 11 2	33 5 6	174 1 9½	135 10 0			104 10 7			525 6 1½	730 2 11½
1810	1400 0 0	386 0 7	49 0 0	40 2 10	17 1 3			279 16 6		161 2 2			730 2 11½	1277 5 8½	68 10 8½	354 4 9		27 4 3	27 16 5½		5 6 3	158 6 0½	164 10 0		80 0 0	30 12 1½			846 10 7	130 15 1½
1811	1400 0 0	391 16 10	49 0 0	13 19 4	17 1 3	22 15 0	28 8 9	170 12 6		165 3 0			130 15 1½	837 14 11½	88 12 8	18 4 0		26 13 0	22 9 6	2 18 1	18 6 9	181 10 11	168 5 0			30 2 2		97 16 6	602 18 7	*295 1 4½
1812	1400 0 0	300 19 1½	49 0 0		25 11 10½		33 16 3	186 11 0		166 13 0			295 1 4½	762 13 6	19 6 8			20 18 0	7 11 0	2 0 4½		218 10 11	168 5 0		50 0 0	31 5 2		44 12 10	594 9 8	168 3 10
1813	1400 0 0	413 16 9	49 0 0		17 1 3	45 10 0	11 7 6	230 18 0		166 14 0			168 3 10	748 13 7	49 1 6½	18 9 10		24 6 0	19 2 8½	53 10 0	7 13 6	101 2 11	168 5 0		49 6 2	37 4 8			531 2 4	217 11 3
1814	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	67 11 [illegible]	[illegible]	[illegible]		1[illegible] 1 0			217 1 [illegible]	7[illegible]1 [illegible] 6	28 7 1			[illegible]	1[illegible] 11 7		[illegible]	[illegible]	1[illegible]		[illegible]	[illegible]		[illegible] 1 0	[illegible] 2	21[illegible] 17 4
1815	1400 0 0	659 14 9	49 0 0		17 1 3	393 11 6	79 12 6	111 9 6		136 13 0	650 11 4		214 17 4	1382 16 5	10 11 8	206 5 0		30 19 2	17 8 8		8 11 0	198 13 1	168 5 0			49 1 6			679 15 1	703 1 4

* Money voted by Parliament to supply the loss of the Conyngham Trust Fund for Premiums, &c.—See Conyngham Bequest in year 1790.