LL.D., F.R.S. (Longmans); "Dogma, Doubt, and Duty," by Charles Hoare (Aston and Mander); "Leisure-Time Studies, Chiefly Biological," by Andrew Wilson, Ph.D., F.R.P.S.E. (Chatto and Windus); "Medicinal Plants," Parts 32 to 35, by Robert Bentley, F.L.S., and Henry Trimen, M.B., F.L.S. (J. and A. Churchill).

THE additions to the Zoological Society's Gardens during the past week include a Toque Monkey (*Macacus pileatus*) from Ceylon, presented by Mrs. Tranchell; two Macaque Monkeys (*Macacus cynomolgus*) from India, presented by Mr. C. Loveless; a Green Monkey (*Cercopithecus callitrichus*) from West Africa, presented by Mr. Henry Hands; a Grison (*Galictis vittata*) from South America, presented by Mr. H. Potier; a Common Hedgehog (*Erinaceus europæus*), European, presented by Mr. Edwin Etty Sass; a Common Boa (*Boa constrictor*) from South America, presented by Mr. D. W. Bell; two South American Snakes (*Zamenis hippocrepis*) from South America, presented by Mr. G. H. Hawtayne; two Small-Scaled Mastigures (*Uromastix microlepis*) from Busreh, presented by Capt. Phillips; a Mesopotamian Fallow Deer (*Dama mesopotamica*) from Mesopotamia, deposited; two Japanese Pheasants (*Phasianus versicolor*) from Japan, a Gold Pheasant (*Thaumalea picta*) from China, a Lineated Pheasant (*Euplocamus lineatus*) from Pegu, two Barred-Tailed Pheasants (*Phasianus reevesi*) from North China, a Siamese Pheasant (*Euplocamus prælatus*) from Siam, two Swinhoe's Pheasants (*Euplocamus swinhoii*) from Formosa, a Bewick's Swan (*Cygnus bewickii*) from North Asia, purchased.

ON THE VERTICAL DISTRIBUTION OF THE LIGHT FROM LIGHTHOUSES PLACED AT HIGH ELEVATIONS ABOVE THE SEA-LEVEL

THE strongest beam of rays proceeding from lighthouse apparatus in high towers is sent to the sea horizon, as being the direction in which the light can be seen at the greatest distance in clear weather.

My late brother, Mr. Alan Stevenson, suggested the dipping of dioptric lights below the normal to a plumb line in his Report of December 10, 1839, to the Commissioners of Northern Lighthouses in the following passage:—"A more serious inconvenience in using catadioptric zones is that in very high towers where some correction of the position of the apparatus becomes necessary so as to direct the rays to the horizon, the means of regulating the zones in a manner similar to that used for the mirrors is inapplicable. The adoption of a high point in the flame for the focus of these zones, however, affords a considerable compensation for this defect, and it might even be entirely obviated by constructing each set of zones of the form suited to the known height of each tower and the required range of each light if such a correction were found to be of sufficient importance to warrant its application."[1]

But though the precaution of dipping the strongest of the light to the sea horizon was followed out by Mr. Alan Stevenson in high towers it was not always attended to, till the year 1860, when Mr. J. F. Campbell, the Secretary of the Royal Commission on Lighthouses, brought the subject prominently forward, and suggested the internal mode of adjustment. Since then the strongest beam has been invariably dipped to the horizon.

It must, however, be remembered that when the weather becomes even in the least degree thick or hazy, not to say foggy, the range of the light is greatly curtailed by atmospheric absorption and refraction; which last produces during fogs irregular diffusion of the light in every plane. So that at high towers where the beam is pointed to a very distant horizon, it is obvious that the strongest light is directed to a part of the sea, where it cannot be seen with certainty unless when the weather is exceptionally clear.

In an interesting paper on what he calls the "*horizontal visual penetrability of the atmosphere*," lately published in the *Journal* of the Scottish Meteorological Society,[2] Mr. A. Cruikshanks, M.A., makes the following remarks as to daylight observations:—"This shortening of the range of view arises from various atmospheric causes. Such obstructions to the horizontal view as low clouds or mists, or falling showers of rain, snow, or hail circumscribe it at once or abruptly from the observer at a distance of from a few yards to many miles off. The other great obstruction to the horizontal range of view is haze, which may or may not co-exist with the other obstructions, and is supposed to consist of minute particles of water, dust, and smoke floating in the air. The haze, unlike the abrupt obstructions to the view, apparently gradually increases with the distance from the observer till objects become invisible at the distance of three or four miles up to seventy, &c., miles."

Mr. Cruikshanks also gives the following table showing the mean results of twenty-one years' observations made at the middle of the day on terrestrial objects such as hills and mountains:—

Under 5 miles. Seen on days.	5 miles but under 10 miles. Seen on days.	10 miles but under 20 miles Seen on days.	20 miles but under 30 miles. Seen on days.	30 miles but under 40 miles. Seen on days.	40 miles but under 50 miles. Seen on days.	50 miles. Seen on days.
19	—	—	—	—	—	—
81	81	—	—	—	—	—
41	41	41	—	—	—	—
49	49	49	49	—	—	—
38	38	38	38	38	—	—
48	48	48	48	48	48	—
90	90	90	90	90	90	90
366	347	266	225	176	138	90

From this table it appears that during the twenty-one years there were 366 days per annum when an object under five miles distance could be seen, and only ninety days when an object fifty miles distant could be seen.

It has lately appeared to me that the strongest beam should be dipped lower than my brother proposed, and as is now everywhere adopted.

The best of the light should certainly be directed to the place where the safety of shipping most requires it. Now it may in most cases be laid down as axiomatic that the peril of any vessel is inversely proportional to her distance from the danger, whether that danger be a lee shore or an insulated rock. Confining ourselves to this one view of the subject, it would follow that the strongest of the light should, in hazy states of the atmosphere, be thrown as near to the shore, or the rock, as would admit of vessels keeping clear of the danger. But such a restriction as this would, if permanent, greatly impair the usefulness of the light by unduly curtailing its range in clear states of the atmosphere; and of course, *cæteris paribus*, the farther off a sailor is warned of his approach to the shore the better and safer. Besides, the loss due to atmospheric absorption increases in a geometric ratio, and as the rays diverge in cones from the apparatus, the power of the light is further decreased in the inverse ratio of the squares of the distances from the shore.

It is of course well known that the sun itself is extinguished by fog, and we cannot expect to compete with that luminary. But seeing there are endless variations in the density of fogs and in the transparency of the air when there is no fog properly so called, it always appeared to me that had we an easy way of doing so, we ought to increase *temporarily* the dip of the light, and thus during haze and fogs to direct the strongest beam to a point much nearer the shore than the sea horizon. At present we direct our strongest light not only in clear weather, when it *can* be seen, but also during fogs, when it cannot possibly be seen, to a *part of the sea where the danger to shipping is in most situations the smallest*, and this is done to the detriment of that region where, even when the weather is hazy, there is at least some chance of the light being visible, and to a part of the sea where the danger to shipping is unquestionably the greatest.

The simplest mode of depressing the light temporarily would be to raise the lamp itself in relation to the focal plane of the lens. But this is, for several reasons, very inexpedient. The proper adjustment of the apparatus to the focus, so as to secure

[1] "On the Application of Catadioptric Zones to Lighthouses," by Alan Stevenson, LL.B. (Edinburgh, 1840.)

[2] *Journal* of the Scottish Meteorological Society, new series, vol. v. p. 97.

its being situate in the section of maximum luminosity of the flame, is a somewhat delicate one, and ought, if possible, not to be disturbed oftener than is necessary for changing the lamp. Moreover, while the raising of the lamp would depress the light which passes through the refracting portion of the apparatus it would have precisely the opposite effect upon the portions which pass through the totally reflecting prisms placed above and below the refracting part, which would then throw the rays upwards to the sky, where they would be useless. But any desired change could be effected by surrounding the flame with prisms spheric on their inner faces, and concentric with the foci of the different parts of the apparatus, so as to depress the rays before they fall upon the main apparatus. Those prisms which subtend the lens would have their thicker ends lowest, and those subtending the reflectors would have their thicker ends uppermost.

The great disadvantage, unless in the case of electric lights, of employing the temporary apparatus which has just been described, arises from the loss of light by divergence, due to the relation subsisting between the radius of the flame and the radii of curvature of the apparatus itself.

But this loss may be prevented by another plan. Outside of the apparatus, and either close to it, or what would be more convenient, close to the glazing of the lantern, movable refractors made of panes of plate glass could be placed during fogs. In ordinary states of the weather, these fog screens, which would be hung by chains passing over pulleys fixed to the top of the lantern, would be close to the inside of the parapet wall of the light-room, and below the apparatus. If these refractors were fitted with counter-weights they could, in the course of a few minutes, be hauled up in front of the apparatus by the hand when the thick weather came on, and pulled down again when it became clear. The panes of plate glass which act as refractors, would be of prismoidal section vertically having their thicker ends placed downwards. The vertical angle of the prisms would in each case depend on the height of the light-room above the sea, and the distance off shore to which the strongest beam of light required to be dipped during fog. But after more fully considering the question, I have come to the conclusion that a great improvement could be effected even without resorting to temporary expedients. From a series of observations made with two kinds of photometer by Messrs. Stevenson, in 1865, on the penetrative power of light from a first order lens and cylindric refractor, it appears that for an angle of 0° 30′ in altitude above the plane of maximum intensity, and for 0° 30′ below that plane, the power of the light does not vary more than at greatest from 4 to 6 per cent., and that if the strongest part be sent to the horizon, about one-half of the whole is sent uselessly to the skies.

Power of Lens in the Vertical Plane.

° ′		Means of four sets of observations.
0 40	above the level of maximum	·90
0 30	,, ,, ,,	·94
0 20	,, ,, ,,	·97
0 10	,, ,, ,,	·98
0 0	maximum power	1·00
0 10	below the level of maximum	·99
0 20	,, ,, ,,	·97
0 30	,, ,, ,,	·96

Note.—These results, which are the means of four sets of observations, did not extend further in the vertical plane.

Result of Dipping Light as Proposed, Contrasted with Present System.

Present System.		Proposed System.	
Above horizon.	Power.	Above horizon.	Power.
° ′		° ′	
0 40	·90 lost on sky.	0 20	·90 lost on sky.
0 30	·94 ,, ,,	0 10	·94 ,, ,,
0 20	·97 ,, ,,	0 0	·97 on horizon.
0 10	·98 ,, ,,		
0 0	1·00 on horizon.		
Below horizon.		Below horizon.	
0 10	·99 on sea.	0 10	·98 on sea.
0 20	·97 ,,	0 20	1·00 ,,
0 30	·96 ,,	0 30	·99 ,,
		0 40	·97 ,,
		0 50	·96 ,,

Applying these observations, so far as they extend in the vertical plane, to the case of lighthouses elevated much above sea-level, we see that to dip the strongest beam to a point much nearer the shore than the sea horizon, while it would not appreciably affect the visibility there, would even, so far as the observations go, increase the power of the light nearer the shore. Those who have been close to a lighthouse on a hazy night must have noticed the luminous rays passing through the air far above the sea-level, and cases are adduced by Mr. Beazeley of shipwrecks having occurred when the light could not be seen by the sailors, although their vessels were stranded close to the tower. As the lens has the greatest divergence, and is the only agent for giving light near the shore, it only should be dipped so as to throw as few of the rays as possible uselessly on the skies, while the reflecting prisms, which have much less divergence, will remain as at present throwing their rays to the horizon. By this different distribution of the light from the lens and the prisms, although the strongest beams from the lens were dipped 0° 20′ below the horizon, which causes a loss there of 3 per cent. of lens power, yet the loss on the *whole* light coming from both lens and prisms, taken at Mr. Chance's valuation of 70 and 30 respectively, will be reduced to only about 2 per cent., while the sea near the shore will be more powerfully illuminated than at present. It may, however, be fairly questioned whether the strongest beam ought not to be dipped to 0° 30′, as this would still further increase the power near the shore, and would only depreciate the light at the horizon by about 5·8 per cent. It is well to remember that, should the flame, through neglect of the keeper, fall at any time below the standard height, such a defect will operate most injuriously on the light falling near the shore, and not so much on that sent to the horizon. Now there can be no question that in all ordinary cases a vessel with such an offing as twenty miles, which is the sea-range due to 300 feet of elevation, is in a far safer position than if she were within a mile or two of the shore, and hence the propriety of increasing the light near the shore so long as we do not to any appreciable extent reduce it at the horizon.

T. STEVENSON

MEDICAL ENDOWMENTS AT OXFORD

WE have been requested to publish the following details of existing endowments assigned by founders to the study of Medicine and of Human Anatomy and Physiology as bearing on Medicine :—

I. The Regius Professorship of Medicine, as at present constituted, is worth about 500*l.* a year. The items are : (1) from the Queen's exchequer, 35*l.* ; (2) as Master of Ewelme Almshouse, 250*l.* ; (3) as Aldrichian Professor of Medicine, 126*l.* ; (4) examination and graduation fees, 70*l.* to 100*l.*

II. Lord Lichfield's Clinical Professorship, which is not united with the Regius Professorship, is worth 200*l.* a year.

Dr. H. W. Acland holds both the Regius and the Clinical Professorships : no instruction is given by Dr. Acland in either capacity.

III. The Linacre Professorship of Physiology and Anatomy has absorbed the old foundations for the encouragement of human anatomy, namely, the Tomlinsian Prælectorship and the Aldrichian Professorship. It is worth 800*l.* a year, the sum which Merton College pays in place of the original endowment entrusted to it by Thomas Linacre, founder of the College of Physicians, and once a lecturer on medicine in Oxford. The Linacre Professor is engaged in teaching Comparative Anatomy to candidates for the B.A. degree.

IV. A separate Demonstratorship of Anatomy, worth 200*l.* a year, also still exists, and was intended by the commissioners of 1852 to provide for the teaching of human anatomy, as designed by Tomlins and Aldrich. The gentleman who holds this post is Curator of the Museum of Comparative Anatomy and does not teach Human Anatomy.

V. The beautiful old Physic Garden founded by Earl Danby in 1622 is another heirloom of the Medical Faculty of Oxford. The chair of Botany was endowed by Dr. Sherard and the College of Physicians of London elect the professor. By special provision, the clergy are excluded from this professorship, and *preference is to be given to a medical graduate.* The chair is now worth, with later additions, about 400*l.* a year.

VI. Lastly, a very important trust fund is administered by the governing body of Christ Church, the bulk of which was left by Dr. Matthew Lee in 1755 to provide for anatomical teaching in relation to medicine *exclusively.* Dr. Lee's expression of his