

almost impossible to carry out any scientific or literary inquiry in a complete manner, without resorting to the great national museum. There are doubtless many things which the Trustees have not done, but is it a slight matter that they have given us, on the whole, by far the most extensive and complete body of collections anywhere brought together in the world? The library and reading-room alone are enough to do honour to their management, and it is almost impossible to fathom the degree in which this library assists every kind of inquiry. When we are least aware, we are often enjoying the fruits of investigation in that library; the late Prof. Boole, for instance, spent the last few months of his life in the Museum, pursuing an exhaustive inquiry into previous writings on the subject of Differential Equations.

As regards the other collections, I presume that no one will call in question their enormous extent; and the fact that they are not adequately lodged and displayed as yet, is due to their very vastness, and to the fact that Government would not, until lately, afford the money for the new buildings. As regards the real interests of original inquiry, too, comparatively little harm is done by the want of room for exhibition, since *bond fide* scientific students can always obtain access to the collections.

I am far from denying that the officials who have conducted the South Kensington Museum have, by an enormous expenditure of public money, collected together a great quantity of beautiful objects of art, and have thus not only afforded opportunities for art study, but have made this museum a very agreeable and fashionable lounge. But I must protest against the notion, apparently countenanced in NATURE, that the scientific value and work of a national museum is to be measured by the number of millions of persons who saunter through the galleries. No doubt the utility of a museum in affording popular instruction and elevated amusement to large masses of people is very considerable, but this popular work is altogether of a different order from the strictly scientific object of collecting together all the products of intellect and of Nature. It is an unavoidable misfortune of the best and highest work in science that it is quite unobtrusive. The public is struck by the thousands who crowd the decorated galleries of South Kensington. There is nothing to attract public attention in the two or three hundred bookworms patiently plodding through the books in the Museum library, or the few students turning over the drawers of the zoological, botanical, mineralogical, numismatic, and other collections. But in NATURE, which has so powerfully advocated the necessity of promoting original research in this country, I should expect, more than anywhere else, to find a due appreciation of the noble work which is being carried out by the British Museum trustees, and by the staff of eminent scientific and literary men who are employed under their direction in promoting almost every branch of literature and science. We have heard many complaints of the apathy displayed by Government in the promotion of science. The existence of the British Museum is the best answer to that complaint. As regards those branches of science which demand the use of large collections, it may be regarded as the great national laboratory; and if scientific men do not make adequate use of it, that is their fault and not that of the trustees.

W. STANLEY JEVONS

[Our opinion of the immense importance to research of the collections of the British Museum is quite in accordance with the above letter of our esteemed correspondent, and if he will read the article again he will see nothing in it to indicate any difference of opinion. Indeed we regard the positions of the scientific men in the British Museum as positions of endowed research, and positions, moreover, which have amply justified it, miserable as the amount is in many cases. Our objection is to the existence of trustees not represented by a Minister, and to the action of the trustees, who have not expanded the area of the utility of the collections, and who have cared so little for the men of science working under them and the collections themselves that the former are underpaid and the latter are much less useful than they might be. Mr. Jevons concedes the whole point when he refers to the money so properly spent at South Kensington; for had the British Museum been under the same Minister, money would have been spent there too. The money must be spent unless we are to sink to the level of—well, let us say Morocco; and it is to prevent this that the proposed transfer has been suggested.—ED.]

#### On the Equilibrium of Temperature of a Gaseous Column subject to Gravity

IN NATURE, vol. viii. p. 486, Mr. Guthrie asks the question, "Is there no possibility of testing the nature of thermal equilibrium of a column of still air?" I think to this question an

answer may be given, which, though indirect and imperfect, will perhaps decide the controversy on the above subject.

If gravity causes in the temperature of a gaseous column the difference, which Mr. Guthrie thinks it does, that difference must be in proportion to the height of the column, and in inverse proportion to the specific heat of the gas. Hence it follows that, if two equal columns of different gases, both under the same thermal influence, are joined at their lower parts by a thermo-electric pile, the side of this pile, which is surrounded by the gas with the highest specific heat, must be constantly cooler than the other side. The result of my experiments respecting this, is the confirmation of Mr. Guthrie's opinion. The description of these experiments, and a theoretical treatise on the subject, have been in the hands of Prof. Poggendorff since the beginning of last June, and will be published in an early number of his *Annalen*.

I hope that my experiments will induce others to try them in the same or in another manner, in order to bring the question concerning the influence of gravity on the thermal equilibrium to a final decision. Should it prove in favour of Mr. Guthrie's theory, as I believe it will, this theory, represented till now only by a very small minority, although it was broached twenty years ago by Waterston,\* will give rise to results† which may perhaps clear up many of our ideas about Kosmos.

The argument which Prof. Clerk-Maxwell has brought against Mr. Guthrie in NATURE, vol. viii. p. 85, does not appear to me to be generally correct. He says:—"In a given horizontal stratum of a gaseous column subject to gravity, a greater number of molecules come from below than from above to strike those in the stratum, because the density of the gas is greater below than above. Certainly the number of molecules, which enter into such a stratum during a certain time, depends upon the density of the gas, but besides this, it depends upon the probability of entering into it, which exists for each molecule. Now, this probability is not only dependent upon the distance of a molecule from the stratum, upon its velocity, its direction and its encounters with other molecules, but also upon the very fact of its being above or below the stratum.

Gravity continually tends to diminish the distance between any horizontal stratum and each molecule which is above the stratum, and continually tends to increase the distance between the stratum and each molecule which is below. Hence it follows that the probability of entering into the stratum will be greater for a molecule which is above than for one below, if, in the case of both, all other circumstances are equal. For example, consider two molecules, which in a given moment move with the same velocity and in the same direction on the two sides of the stratum; if this direction is horizontal like the stratum, and if in the given moment the distances of the molecules from the stratum are both very small, in the next moment the molecule above the stratum will have entered into it, while that one below will have removed from it.

In the case of the density being greater below the stratum than above, more molecules would enter it from below, if gravity did not exist. But under the influence of gravity, the effects of the difference in density can be balanced by those of the above-mentioned difference in the probability, which exists for each molecule of entering into the stratum during a certain time. I even consider this last difference to be the dynamical cause of the difference in density.

Westend, near Berlin, Oct. 20

G. HANSEMAN

#### Periodicity of Rainfall

As far as my own figures are concerned, the reply to Mr. Meldrum's question is very easily afforded. I agree with him that it is undesirable to use averages deduced from groups of stations variable both in the number and locality of their components. The observations which I quoted were those of a single station, Halton, St. Philip, Barbadoes.

With respect to the general question, I regret being unable to share Mr. Meldrum's evident enthusiasm, and that a very different opinion has been published in the *Zeitschrift*, by Dr. Jelinek, one of the most eminent meteorologists of the present day. It may be convenient to some readers to be informed that an abstract of Dr. Jelinek's article is given in "British Rainfall, 1872," together with a general *résumé* of the state of the question up to the date of its publication.

Camden Square, Nov. 1

G. J. SYMONS

\* In "On Dynamical Sequences of Kosmos."

† I have expounded some of these results in an abstract mechanical form in "Die Atome und ihre Bewegungen" (Cöln Lengfeld'sche Buchhandlung, 1871).