These relations are derived from the equation W = Mg, the source of all confusion in Dynamics, and it is gratifying to find from Prof. Mendenhall that a crusade against it is in progress in America.

It is needless to repeat here the objections against this equation, but it is easy to see how it arose.

Mathematicians now measure mass in pounds, so that the mass of a body is the number of pounds of matter in the body (*the weight* in the vernacular); and the equation W = Mg means that the weight of M pounds is Mg poundals, according to their definition that "the weight of a body is the force with which it is attracted by the earth"; but this was not so originally.

Early writers on Dynamics, before Gauss invented the absolute unit of force, always employed the statical gravitational unit, and then if a weight of W pounds was acted on by a force of P pounds, the equation of linear motion was $\frac{W}{g}\frac{d^2x}{dt^2} = P$.

To avoid the necessity of writing and printing $\frac{W}{g}$, it was replaced by the letter M, and called the *mass*; the unit of mass being thus g pounds. But now the invariable quantity, the mass, is measured in terms of a variable unit, while the variable unit of force is the attraction of the earth on a 1-pound weight.

Although such words as "a force equal to the weight of the mass of 10 pound weights" do not occur in Prof. MacGregor's book, they are strictly derived from his own definitions; and so is the following, "the weight of 32 pound weights on the Earth is at the surface of Jupiter a force of 71 pounds' weight." I bring forward these illustrations to show that the fine distinction between "10 pound weights" and "10 pounds' weight" is not workable; and to show that the addition of the word *weight* to *pounds* does *not* convey the idea of *force* in ordinary language, and is not clear even in the language of the precisionists.

Nor can the equation $p = gpz$ in Hydrostatics be defended, as capable of expressing a pressure in pounds on the square foot (or more commonly on the square inch); for, if Prof. MacGregor applies this equation to a numerical example, he will find himself dividing by g in one operation, only to multiply by g in the next. The unreal character of these changes of units is apparent when we come to numerical examples; the defect of our dynamical teaching is that the student is so rarely brought before a practical numerical illustration on a large scale.

The rest of Prof. MacGregor's remarks I must answer very briefly, for fear of occupying too much space.

The *kilometre* was designed to be the centesimal minute of latitude, to replace the *geographical or sea mile*, which is the sexagesimal minute of latitude; the quadrant of the earth is therefore 10,000 kilometres, or 10^9 centimetres, and $90 \times 60 = 5400$ geographical or sea miles.

The cosmopolitan unit of speed at sea is the *knot*, which is a *velocity* of one geographical mile an hour; if 10 knots, spaced about 50 feet apart, pass over the taffrail in half a minute, the vessel is said to be going 10 knots. All civilized nations measure speed at sea in *knots*, in French *nœuds*, German *knoten*, Dutch *knoopen*, Italian *nodi*, Spanish *nudos*, &c. In precision *knots an hour* is on a par with *atmospheres per square inch*.

It is unfortunate that we have not yet reached uniformity in the use of the words *elongation* and *extension*. The French treatises, and our practical writers, Rankine, Unwin, &c., use *tension* and *extension*, *pressure* and *compression*, to denote simple longitudinal stresses and their corresponding strains; the ratio of *tension* to *extension*, or of *pressure* to *compression*, being the *modulus of elasticity*. This variation in terminology must be settled by some arbitrator, say Prof. Karl Pearson.

In conclusion, speaking on behalf of engineers and practical men, I beg to say that the treatment of the subjects of weight, mass, and force, in our ordinary text-books of Mechanics, is by no means clear or satisfactory, and requires careful revision.

Woolwich, May 4. A. G. GREENHILL.

Density and Specific Gravity.

IF Mr. Cumming's definition of *specific gravity* be accepted, the confusion, already serious enough, in the minds of beginners in physics between mass and weight will be much increased. Surely the best and clearest definitions of *density* and *specific gravity* are those given in Glazebrook and Shaw's "Practical Physics," p. 105. These make *density* a quantity having dimensions in mass and space, and *specific gravity* a pure number. There are many advantages in defining *specific gravity* as a ratio, and not the least among them is that the numbers in tables of specific gravities are independent of any system of units, while in a table of quantities having dimensions the numbers given depend on the system of units used. Thus the *density* of platinum would have to be given in an English table as 1343·75 pounds, or in a metrical table as 21·5 grammes. Again we should lose the very useful analogies between the definitions of *density* and *thermal capacity* and *specific gravity* and *specific heat*, to which I drew attention in a letter to NATURE, vol. xxxiii. p. 391.

Prof. Carey Foster seems to think it would be useful to have a table telling us the force with which unit volume of any body is attracted towards the earth, and that this should be called a table of *absolute* specific gravities. But I fail to see any advantage in this, for it is adding a totally new definition to be remembered, and one which would certainly create confusion in a beginner's mind; and the objection applies to this, that the numbers given would depend on the system of units used, to say nothing of the value of gravity at the place for which the table was calculated. Supposing even that the latter were ignored, it is not more troublesome to convert, with the aid of the known weight of unit volume of water, the specific gravity of any material into the weight of a given volume of it, than to convert a number given in one system of units into the number representing it in the system we may happen to be using.

If we are to take Mr. Cumming's definition as he expresses it, I would submit that a pound avoirdupois is a quantity of matter and not a force; and to say that the specific gravity of water is 62·5 *pounds avoirdupois* is simply taking the density of water and calling it specific gravity. *Pace* Mr. Greenhill and the engineers, it is hard enough to eradicate the notion that the quantity of stuff in a body and the force with which it is pulled towards the earth are one and the same without having the task made more difficult by our definitions.

50 City Road, E.C. HARRY M. ELDER.

The Cornish Blown Sands.

IN the description of the raised sea beach at Newquay, which Sir Henry De la Beche has given in his "Survey of Devon and Cornwall," he makes no reference to a curious feature observable in a part of the beach, and to which I should like to direct attention, with a view to obtaining some explanation of the cause of its formation. As far as I know, the appearance is only to be found at one spot, on what is known as Little Fistrel, to the westward of the town. It consists of a number of *cylinders* of indurated sand, separated from each other by thin walls, often only an inch or two thick, and forming the base of the cliff or bank, which is perhaps 10 or 15 feet high at the place. These cylinders rest upon a bed of rock (argillaceous slate?), which runs down from the bottom of the bank to the sea in a series of shelving ledges. The cylinders, which are locally known as *Pixie Holes*, weather out from the bank, but unfortunately few or none of them are now to be seen in a perfect state, their walls having been broken down by people scrambling up the bank, and also by quarrying operations, which I learn have recently been carried on close by. I am told that formerly the cylinders were very perfect, and often of large size; I myself have seen them, fifteen or sixteen years ago, standing up like little towers along the base of the cliff, and I have often sheltered myself perfectly from a shower of rain by standing in one and covering myself with my umbrella. I have recently had a photograph taken of the best group to be found, and a copy of this, together with a piece of the wall of one of the cylinders, is with Mr. Goodchild, of the Geological Survey, Jermyn Street, who will show it to anyone interested in the matter; the size of one of the cylinders photographed is 51 inches deep and 28½ inches in diameter.

R. H. CURTIS.

[The sand in question is well known to geologists as an example of blown sand agglutinated into a compact stone by carbonate of lime derived from the solution of calcareous organisms, which here on the surface consist largely of land-snails. The tubular cavities are no doubt due to the removal of the calcareous cement by percolating water, and are thus of the same nature as the pot-holes in chalk, and the cavernous holes and tunnels in hard limestone.—ED.]

Self-Induction in Iron Conductors.

MR. SUMPNER quotes (NATURE, May 10, p. 30), in support of the idea that iron conductors may have less self-induction than copper ones of the same dimensions, a suggestion of mine that for very feeble magnetizing forces, iron may be diamagnetic That suggestion was confessedly speculative ; its basis was the notion that the Weber-Ampere electro-magnetic molecules suffer something akin to static friction when the process of magnetization attempts to bring them into alignment. Since it was thrown out, Lord Rayleigh has proved that the susceptibility of iron is constant, and has a fairly high positive value, for magnetic forces ranging from 0·03 to 0·04 C.G.S. downwards. Below the lowest force he has investigated, it is still conceivable that there may be a change in the susceptibility, but it is extremely improbable. In all likelihood, Lord Rayleigh's straight line in the curve of B and H or of I and H extends back to the origin. This at least is certain, that if there is any region at the beginning of magnetization within which the permeability is less than unity, or even no more than unity, it must be so infinitesimally narrow that its existence has no practical interest. For such magnetic forces as act on a lightning-conductor when a discharge is passing, iron is, beyond any question, strongly paramagnetic, and the self-induction with the iron conductor consequently greater than with the copper. J. A. EWING.

Dundee, May 11.

Notes on the Reproduction of Rudimentary Toes in Greyhounds.

AT the present writing, I have under my observation a fine male, light clay-coloured, smooth haired greyhound, which at certain intervals well illustrates the reproduction of the rudimentary digits of its feet, after they have been accidentally amputated. To-day this dog has growing on the inner aspects of both its fore and hind feet, and situated some 9 centimetres above the soles, on each limb, a strong rudimentary toe. If we choose, say, this toe on the right hind foot as an example of them all, we find it to be loosely attached, rather more than a centimetre long to the base of the claw, which latter is large and strong, powerfully curved, and fully as big as any of the claws on the foot-phalanges. I further find that this toe has a well-marked pad on its under side, but careful examination fails to detect any bone in the proximal joint, from which I also infer that the ungual phalanx likewise lacks one, though this is not so easily determined without cutting through the horny theca forming the claw. About four months ago this dog was coursing hares over the prairie of this region, which chances to be overgrown with a stiff growth of sage-brush, about 2 feet to 3 feet high. The wiry stems of this plant, as the dog bounded among them, snipped off all four of these rudimentary digits, close down to the leg in each case, as nicely as though it had been done with a knife, leaving linear wounds about half a centimetre long. Now, instead of the lips of these wounds healing across, as one would naturally suppose they would, they immediately form the basis, in each case, for the growth of another rudimentary clawed toe, fully as perfect as the one which originally sprang from the same site. These subsequent growths take about three months to attain their full size again, when they are very likely to be removed by a similar process, and once more grow out as before, and so on indefinitely.

From several points of view, this case, as occurring in a vertebrate so high in the scale as a dog, has interested me very much indeed, and I further find that it is no uncommon thing to meet with greyhounds that have never possessed these rudimentary pollices and halluces, and it is fair to presume that in this race they are gradually disappearing.

R. W. SHUFELDT.

Fort Wingate, New Mexico, March 28.

Dreams.

IN discussing the differences between dreams and real life, Schopenhauer expresses the opinion that the distinction between these two activities of our representative power consists merely in the possibility of the representations of real life being connected in an uninterrupted successive series, while dreams resemble the separate pages of a book torn asunder, and put together again in complete confusion. Some personal observations of my own do not quite agree with this view. I have watched my dreams for some years, and have remarked that many of them are connected with one another in separate series. It happens to me very often that my dreams consist of a series of representations logically developed (although sometimes the logic is absurd) from other series of representations dreamed long before. It would be interesting to know if anyone else has observed anything of this kind. A. BIALOVESKI.

Oostkamenogorsk, Western Siberia, April 6.

"Antagonism."

MR. COLLINS (NATURE, May 3, p. 7) claims that Mr. Herbert Spencer anticipated Sir Wm. Grove and Prof. Huxley in the expression of the idea of *antagonism*. I think that priority to all of them must be given to the author of Ecclesiasticus in the Apocrypha, who says (chap. xlii., verse 24), "All things are double, one against the other. He hath made nothing imperfect." THOMAS WOODS.

Parsonstown, May 13.

SUGGESTIONS ON THE CLASSIFICATION OF THE VARIOUS SPECIES OF HEAVENLY BODIES.[1]

V.

Classification into Species.

WE are now in a position to apply all that has gone before in a summarized statement of the various spectral changes, including those connected with hydrogen, which take place not only in these objects studied by Dunér, but in those others to which I have referred as forming the true beginning of the group.

The following statement, however, must not be taken as anything else than a first approximation to the real criteria of specific differences. I am convinced that further thought is required on it, and that such further thought will be well repaid.

The Sequence of the Various Bands in the Spectra of the Elements indicated by Bodies of the Group.

In comparing the spectrum of an element which has been mapped in the laboratory with the absorption bands in the spectrum of a "star," we need only consider those bands and flutings which stand out prominently and are the first to flash out when there is only a small quantity present. Thus, in the flame spectrum of barium there is an almost continuous background of flutings with a few brighter bands in the green, and it is only important to consider the *bands*, as the flutings would mainly produce a general dimming of the continuous spectrum. In order to show at a glance what portions of the spectrum of an element it is most important for us to consider in this discussion, I have reconstructed the map of low-temperature spectra which I gave in my previous paper, with reference to those elements which are indicated in the spectra of bodies of Group II. Five orders of intensities are represented, the longest lines, flutings, or bands being the brightest. The lines, flutings, or bands in the lowest horizon, in the case of each element, are those which are seen at the lowest temperature, and which are the first to appear when only a small quantity of substance is present. Those in the upper horizons are the faintest, and are only seen when the temperature is increased, or a considerable amount of the substance is volatilized. The map shows that if there are any indications of magnesium, for instance, in bodies of low temperatures, the fluting at 500 will be seen, possibly without the other flutings or lines. The first indications of manganese will be the fluting at 558, and so on. Again, on account of the masking effect of the spectrum of one element upon that of another, we may sometimes have an element indicated in a star spectrum, not by the brightest band or fluting in its spectrum, but by the second or even third in brightness ; this, of course, only occurs when the darkest band falls on one of the brightest flutings of

[1] The Bakerian Lecture, delivered at the Royal Society on April 12, by J. Norman Lockyer, F.R.S. Continued from p. 35.