

as gravitation, and to avoid it on the earth is impossible; and with this conclusion vanishes all hope of a perpetual motion machine. If we are inclined to regret this fact, a little reflection on what would occur if friction ceased to act may not be uninteresting, for the whole face of Nature would be at once changed, and much of the dry land, and, even more rapidly, most of our buildings, would disappear beneath the sea. Such inhabitants as remained for a short time alive would not only be unable to provide themselves with fire or warmth, but would find their very clothes falling back to the original fibre from which they were made; and if not destroyed in one of the many possible ways—such as by falling meteors, no longer dissipated by friction through the air, or by falling masses of water, no longer retarded by the atmosphere and descending as rain—would be unable to obtain food, from inability to move themselves by any ordinary method of locomotion, or, what would be equally serious, having once started into motion, from being unable to stop except when they came into collision with other unhappy beings or moving bodies. Before long they, with all heavier substances, would disappear for ever beneath the waters which would now cover the face of a lifeless world.

We turn to the motion of planetary bodies—is that perpetual? At first, everything seems to show that it is. The earth with its mass of 3000 trillion tons turns with a speed which enables a student to go bare-headed a good many miles without catching cold in the act of saluting a Professor, for a long time defied all attempts to detect in it loss of speed; but with the friction of the tides continually at work such loss must take place, and now it is pretty certain from the calculations of Adams, the astronomer, that the earth loses about an hour in 16,000 years, and is coming to rest, though it must be admitted rather leisurely. So, also, the hurrying up of the comets as they go round the sun is possibly accounted for by a retarding action in space which makes it necessary for them to try and make up, as it were, for lost time; and in fact the general arguments in the present day are in favour of what Sir Isaac Newton believed—that the motions of all bodies in space are suffering retardation, and that their velocity is becoming less and will ultimately cease.

Perpetual motion, then, is impossible. By no means. We have duly considered motion of matter in its visible and mechanical form, and if the foregoing remarks are true, then in this form assuredly it is; but there is, as we have seen, the great fact of indestructibility of energy, and the greatest generalization of the present century is that which accounts for the disappearance of energy in the form of mechanical and visible motion by showing that an exactly equal amount appears in the form of molecular and invisible motion. To this all outward motion tends, and friction is the agency by which the change is effected. Down to a certain point the change can be effected in either direction, and the heat-engine converts molecular motion into mechanical, again to be reconverted into molecular motion in all its working parts, as well as in connection with the useful work it does. This stage reached, there is no process known to us by which the cycle can be continued, and the term "degradation," in the sense of having gone down a step, but nevertheless a step which can never be reclaimed, is applied to the tendency of energy to assume molecular form by dissipation over a larger mass of matter, so that its effect is less intense, though equal numerically in amount. To this all Nature tends, and beyond this point we cannot go. Here, at any rate, the motion is perpetual, but it is motion that tends to approach a state unsatisfactory to the instinct of the human mind. Great intellects, such as Rankine and Siemens, have striven to conjecture ways at present unknown to us by which the energy now spreading itself over the vast expanse of

space may be gathered again and regenerated, so that we may look forward not to the lowest but to the highest form of motion as that which, passing through all its cycles, shall last for ever.

THE CHAIR OF DARWINISM IN PARIS.

ONE of the most interesting evidences of the differing results of municipal organization in foreign countries, as compared with those resulting from such organization in our own, is the news that the Municipal Council of Paris intends to found (in connection with the Sorbonne, or the Jardin des Plantes, or the Collège de France, we do not know which) a Chair of Philosophical Zoology, with a special view to the propagation of the doctrine of evolution as elaborated by Darwin. It appears that the official naturalists in France—those holding the leading professorships and museum appointments—have not hitherto been very friendly to Darwinian doctrine. The Municipal Council of Paris has recognized the fact that there is an undesirable hostility to Darwin's views amongst the official group, and actually proposes to remedy the evil results of this hostility by establishing a new Chair, destined to give fair play and a full hearing to the new philosophy. It is as though the Corporation of London should propose to build and endow a laboratory of physiological experiment or of bacteriology. The imagination recoils before the task of picturing Mr. Alderman Greenfat expounding to his colleagues the importance to the community of scientific research, and carrying with him a large majority in favour of a scientific enterprise hitherto neglected and even penalized by middle-class authority.

There is very little doubt as to who is the fittest man in France at this moment to hold such a Chair as that which is now to be created. M. Giard, for many years Professor of Zoology at Lille, and only this year called to a similar Chair in Paris, has not only been the first in France to teach from an official position the doctrine of evolution in zoology, but has made many most valuable researches himself, and has created a school amongst whom are the ablest of the younger French zoologists. Every embryologist knows the works not only of Alfred Giard, but those of his pupils Barrois, Halley, Monnet, and others. Alfred Giard had to submit to some painful remonstrances, and to imperil his official career as a Professor of Zoology in France, when he determined to break with the traditions of his eminent master, Henri de Lacaze Duthiers, and to boldly accept Darwinism and the methods of the modern English and German school. It is therefore only right that his name should be the first to be considered in relation to the new Chair in Paris, and we have no hesitation in saying that, should he be appointed, a man will have been secured as the first occupant of a difficult position whose qualifications render it certain that he will not only do credit to himself, but will justify, by his successful teaching, the enlightened, patriotic, and high-minded initiative of the Municipality of Paris.

E. R. L.

NOTES.

ON the 3rd of this month there passed away a Scottish parish minister, who though not himself a scientific man has come in contact with three successive generations of men of science whom the love of travel or of geology has led to the picturesque island of Skye. The Rev. Dr. Donald Mackinnon was the third of his family who have been ministers of the parish of Strath. His grandfather was appointed to the incumbency in 1777, and held it for forty-nine years. His father took the office in 1826, and held it for thirty years, until he himself succeeded to it in 1856. The parish has thus been presided over by the same family for the long period of 110 years. Unfortunately none of