Were we to lose that advantage to-morrow, a large part of our population would be in want of bread within a few months, and there would hardly be an individual in the country whose wealth and comfort would not be lessened. Railway carriage is of next importance, and it is only our insular position and the small size of the country which renders it secondary. There is an impression, well or ill founded, that railway goods carriage might be conducted with more economy in England; and when an American expert comes to us to show how, in his opinion, an improvement may be made, he is worthy of our best attention.

Mr. Jefferds begins his paper by pointing out that the present build of goods trucks on English railways differs nothing in principle, and but little in construction, from the truck made by George Stevenson to carry the barrel of water required for replenishing the *Rocket's* boiler. This, perhaps, is rather an exaggerated statement, but there is more truth in it than we find it pleasant to acknowledge. In America, however, such vehicles, as we have already said, are no longer seen. "Since 1865, the railway rates of the United States have," the paper says, "been reduced fully 79 per cent.; so that the railways are now rendering for £21 the same service for which in 1865 they charged £100. The reason they have been able to make so great a reduction is that they have gradually improved their goods waggons, which would formerly carry loads of their own weight only, but will now carry three or four times as much. . . . In 1889 the average rate charged for all descriptions of goods on all the railways of the United States, including terminal charges, was only 0·488*d.* per ton mile, while the average cost to the railways was only 0·311*d.* The average dividend on highly inflated shares was 3·3 per cent." Turning to individual instances, Mr. Jefferds selects three prominent American lines—the New York Central, the Pennsylvania, and the Philadelphia and Erie. The working expenses per ton mile on these were 0·28*d.*, 0·201*d.*, and 0·176*d.* respectively. The working expenses per ton mile on our London and North-Western Railway are 0·65*d.* per ton mile, or three times as much as the great American line, the Pennsylvania. When one thinks how many millions two-thirds of the cost of goods carriage in this country amounts to, one begins to grasp the magnitude of the question. According to Mr. Jefferds, all this vast sum may be saved by the use of his carriage, although he only claims a modest 9 per cent. for his particular tube-frames.

The average Englishman often wonders how it is American farmers can send wheat right across the Atlantic and undersell British growers comparatively on the spot, and that more especially since agricultural rents have so gone down that farms can be got at purely nominal rents. Here, however, is a fact, according to Mr. Jefferds's paper, which may help to throw some light on the question:—"At the present time, for every hundred tons of grain he sends to London, a farmer living 1000 miles inland in the United States has an advantage of £30, after paying both land and ocean transit, over a farmer living at Stirling in Scotland, only 420 miles from London."

The benefits promised by Mr. Jefferds, if we use his big bogie waggons, are, indeed, immense, but the price we shall have undoubtedly to pay for these benefits is immense also. In the first place, it would be very difficult—practically, we think, impossible—to run these long waggons in mixed trains with the English trucks. The difficulties are mechanical—the principal one being the system of buffing—but we have not space to enter upon them here. Therefore these long bogies could only be brought in by a very sweeping change. What would this involve? Nearly the whole of the usual appliances on the permanent way would have to be entirely reconstructed. Sidings and platforms would be too short, points would have to be altered, locking bars and switching apparatus would have to be replaced, turntables would be too small, hydraulic hoists not sufficiently powerful, even if large enough, and weighbridges would have to be replaced, coal-tips rebuilt—in fact, English railway lines would want reconstructing so far as the appliances for dealing with goods traffic are concerned.

There is, however, another salient feature to consider before we can take Mr. Jefferds and his big bogies to our bosom.

The goods traffic of America is more in bulk than that of England, as might be expected in comparing a comparatively new and sparsely peopled country with one older and more crowded. A 30- or 40-ton waggon can be loaded at St. Louis, Chicago, or elsewhere, and sent through to New York. The journey is long enough to make a big car worth filling. In Britain the conditions are different. During the discussion, one English railway manager said the average lading of general merchandise on his line was not much above 2 tons; another, Mr. Williamson, of the Great Western Railway, gave 2½ tons as a fair average. Mr. Jefferds retorts to this that no one expects a truck to go with only one parcel; the trucks can be filled even if it takes the goods of twenty consignees to make a load. Here again another question arises—Do the Americans pay for cheapness by delay? In England a merchant or manufacturer expects goods given over to the Company one afternoon to be delivered the next day (perhaps his expectation is not always fulfilled); but in America, we are told, no such expedition is observed. May not this be due to the fact that a big waggon is often waiting for the last hundredweight or two to make up its load?

The fact is, the question wants treating quantitatively, and for this purpose a vast mass of statistics must be accumulated; for Mr. Jefferds has only touched the fringe of the question. The arguments he has advanced are, however, sufficiently powerful to have made out a very strong *primâ facie* case—most distinctly a case for inquiry. The railway authorities of this country are the only persons who can supply the details by means of which the problem can be adequately discussed.

The discussion on Mr. Jefferd's paper occupied the greater part of the two evenings of the meeting. Mr. Addy's paper on milling cutters was, however, read and discussed. The author gave analyses of the steel used for the purpose, which appeared to approximate closely to razor steel, and by means of wall diagrams explained the mechanical principles which he considered should govern the construction of milling tools, and the machines in which they are used. Without the aid of these diagrams it would be impossible to make the subject clear, and for these we must refer our readers to the volume of the Transactions. The discussion which followed the reading of the paper turned chiefly on the speeds of cutting by milling in use respectively in this country and America; the fact that the American machinists are in advance of us in this respect being fully acknowledged by those present.

The next meeting of the Institution will be held in London early next year.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Vice-Chancellor, the Marquis of Hartington, LL.D., of Trinity College, Lord Walsingham, M.A., of Trinity College, Dr. Morgan, Master of Jesus College, Dr. A. S. Lea, Prof. Browne, Prof. Liveing, Prof. Foster, Albert Pell, M.A., of Trinity College, J. D. Dent, M.A., of Trinity College, W. Aldis Wright, M.A., of Trinity College, L. Ewbank, M.A., of Clare College, F. Whitting, M.A., of King's College, R. F. Scott, M.A., of St. John's College, J. R. Green, M.A., of Trinity College, have been appointed a Syndicate to consider the subject of the letter, dated July 25, 1890, addressed by the President of the Board of Agriculture to His Grace the Chancellor, on the subject of Agricultural Education in the University, and to report to the Senate before the end of the Lent Term, 1891.

At the annual election, on November 3, three Fellowships out of five were awarded to students of Natural Science:—Mr. R. A. Sampson, B. A. (Third Wrangler, 1888, First Smith's Prizeman, 1890), Lecturer in Mathematics at King's College, London, for researches in Hydrodynamics; Mr. L. E. Shore, M.A., M.B., B.C. (First Class Natural Sciences Tripos, 1884–85), (Senior Demonstrator of Physiology in the University, for researches in Physiology; E. H. Hankin, B.A. (First Class Natural Sciences Tripos, 1888–89), Junior George Henry Lewes Student in Physiology, for researches in Bacteriology.

Mr. Walter Heape, M.A., of Trinity College, has been elected to the Balfour Studentship in Animal Morphology, in succession to Mr. William Bateson, Fellow of St. John's College.

Mr. E. E. Sikes, Scholar of St. John's College, has been appointed by the Vice-Chancellor to hold the Newton Studentship at the British School of Archæology in Athens.

The Board for Biology and Geology propose to take power to appoint to the University Table of the Marine Biological

Laboratory at Plymouth, a student of either sex not a member of the University, failing a suitable University applicant.

The proposed new statute affecting the contributions to the University of financially depressed Colleges, passed the Senate on October 30, by 72 votes to 30. The opposition was headed by Prof. Humphry, Prof. Liveing, and Mr. W. N. Shaw. Under the new statute, which has yet to receive the consent of the Queen in Council, depressed Colleges may withhold part of their contribution to the University, and, instead thereof, elect University teachers to Fellowships.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, October 27.—M. Hermite in the chair.—Observations of the planet Venus at Nice Observatory, by M. Perrotin. (See Our Astronomical Column.)—On the reduction to the canonical form of differential equations for the variation of arbitrary constants in the theory of movements of rotation, by M. O. Callandreau.—The neutral meridian of Jerusalem-Nyanza, proposed by Italy to fix the universal hour, determined by its horary distance from 120 observatories, by M. Tondini. A list is given of the time-intervals of sixteen important observatories from the Jerusalem meridian, which cuts the equator about 75 kilometres east of Lake Nyanza. This list is part of a larger one giving the latitudes and time-intervals of 120 observatories from the same meridian. —On the developments in series of the integrals of certain differential equations, by M. R. Liouville.—Periodic visibility of interference phenomena when the light source is limited, by M. Ch. Fabry.—Thermo-electric researches, by MM. Chassagny and Abraham. It is well known that if thermo-electric couples be formed from three metals, A, B, and C, the electromotive forces obtained at a given temperature in each case may be expressed by the following equation :—

$$E(AC) = E(AB) + E(BC).$$

The authors have found the following results in some researches on this relation :—

Couples.	Electromotive Forces. Calculated.	Observed.
Iron-Copper	0·0010925 volt	0·0010926 volt.
Iron-Platinum	0·0016842 ,,	0·0016842 ,,
Copper-Platinum	0·0005917 ,,	0·0005917 ,,

—Electrolysis of aluminium fluoride by igneous fusion, by M. Adolphe Minet. The author has previously shown that he had produced aluminium by electrolyzing its fluoride. He now describes the composition and properties of the bath used, and the relation between the constants of the current and those of the electrolyte—(1) when the salts which make up the bath are chemically pure; (2) when the electrolyte is mixed with other salts.—On amylamines, by M. A. Berg.—On the arteries and veins of nerves, by MM. Quénu and Lejars.—On the changes of colour of the common frog (*Rana esculenta*), by M. Abel Dutartre.—On the anatomy of the grasshopper and lizard, by M. Ch. Contejean.—The rot of the heart of the beetroot, by M. Prillieux.—Seismic motions at Chili: earthquakes of May 23, 1890, by M. A. F. Nogués. Of the eighteen movements recorded, five took place during the spring in the southern hemisphere, one in the summer, four in autumn, and eight in winter. Of the six of which the direction of motion has been exactly determined, three had an east to west direction, one south-west to north-east, one from north to south, and one from south to north.—Experiments on sedimentation, by M. J. Thoulet.—Theory of sedimentation, by M. A. Badoureau.

DIARY OF SOCIETIES.

LONDON.

THURSDAY, NOVEMBER 6.

LINNEAN SOCIETY, at 8.—A Contribution to the Study of the Relative Effects of different parts of the Solar Spectrum on the Assimilation of Plants: Rev. Prof. Henslow.

CHEMICAL SOCIETY, at 8.—The Magnetic Rotation of Saline Solutions: Dr. W. H. Perkin.—Note on Normal and Iso-propylparatoluidine: E. Hori and H. F. Mosley.—The Action of Ammonia and Methylamine on the Oxylepideus: Dr. F. Klingemann and Dr. W. F. Laycock.—Condensation of Acetone Phenanthraquinone: G. H. Wadsworth.

FRIDAY, NOVEMBER 7.

GEOLOGISTS' ASSOCIATION, at 8.—*Conversazione.*

SATURDAY, NOVEMBER 8.

ROYAL BOTANIC SOCIETY, at 3.45.

ESSEX FIELD CLUB (at Loughton), at 7.—Essex Meteorological Records: Rev. T. A. Preston, (Communicated, with some Notes on Dr. Derham's Early Records, by Prof. G. S. Boulger.—Some Notes on Dipsacus sylvestris and D. pilosus, and their Natural Relationship: J. French.

SUNDAY, NOVEMBER 9.

SUNDAY LECTURE SOCIETY, at 4.—Why and how we Eat our Dinner (with Oxy-hydrogen Lantern Illustrations): Dr. Andrew Wilson.

TUESDAY, NOVEMBER 11.

MINERALOGICAL SOCIETY, at 8.—Anniversary Meeting.—Election of Officers.—Twins of Marcasite in Regular Disposition upon Cubes of Pyrites: Dr. C. O. Trechmann.—Tetartohedrism of Ullmannite: H. A. Miers.—Notes on Cassiterite: R. H. Solly.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Steam on Common Roads: John McLaren.

WEDNESDAY, NOVEMBER 12.

GEOLOGICAL SOCIETY, at 8.—On the Porphyritic Rocks of the Island of Jersey: Prof. A. De Lapparent. (Communicated by the President.)—On a New Species of Trionyx from the Miocene of Malta, and a Chelonian Scapula from the London Clay: R. Lydekker.—Notes on Specimens collected by W. Gowland in the Korea: T. H. Holland. (Communicated by Prof. J. W. Judd, F.R.S.).—Further Notes on the Stratigraphy of the Bagshot Beds of the London Basin (North Side): Rev. A. Irving.

THURSDAY, NOVEMBER 13.

MATHEMATICAL SOCIETY, at 8.—The Influence of Applied on the Progress of Pure Mathematics: the President.—Spherical Harmonics of Fractional Order: R. A. Sampson.—Proofs of Steiner's Theorem relating to Circumscribed and Inscribed Conics: Prof. G. B. Mathews.—On an Algebraic Integral of Two Differential Equations: R. A. Roberts.—Some Geometrical Theorems: Osher Ber.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.

FRIDAY, NOVEMBER 14.

ROYAL ASTRONOMICAL SOCIETY, at 8.

CONTENTS.