for this Society to interfere or decide on the priority and rank of the competitors. But though unmarked by any tangible memorial of our approbation, the names of Biela, Clausen, and Gambart, will not the less be cherished among us, and enrolled by posterity in the choicest and most permanent annals of Astronomical celebrity.

It is, however, for labours of a very different kind that our medals are this day to be conferred. Labours, if less brilliant, yet more vital; if less associated with lofty speculations on the nature of the universe, yet more intimately linked with the practical uses of this world. The first award of your Council is that of a gold and silver medal, respectively, to your late excellent President Mr. Baily, and your indefatigable Secretary Mr. Stratford, for their joint labours in the construction of the Catalogue of 2881 principal fixed stars, which forms the Appendix to the second volume of the Memoirs of this Society.

A catalogue of stars may be considered in two very distinct lights, either as a mere list of objects placed on record, to fix on them the attention of astronomers, and to afford them matter for observation, or as a collection of well-determined zero points, offering ready means of comparing their observations with those of others, and of detecting and allowing for instrumental errors. In this light only I shall now consider it as chiefly of importance to the practical astronomer. It is for his uses that an amount of pains, labour, and expense, both national and individual, has been bestowed on the perfection of such catalogues, which, on a superficial view, must appear in the last degree lavish, but which yet has been no more than the necessity of the case demands. If we ask to what end magnificent establishments are maintained by states and sovereigns, furnished with master-pieces of art, and placed under the direction of men of first-rate talent and high-minded enthusiasm, sought out for those qualities among the foremost in the ranks of science:—if we demand *cui bono?* for what good a Bradley has toiled, or a Maskelyne or a Piazzi worn out his venerable age in watching? the answer is,—not to settle mere speculative points in the doctrine of the universe; not to cater for the pride of man, by refined inquiries into the remoter mysteries of nature,—to trace the path of our system through infinite space, or its history through past and future eternities. These indeed are noble ends, and which I am far from any thought of depreciating; the mind swells in their contemplation, and attains in their pursuit an expansion and a hardihood which fit it for the boldest enterprise.—But the direct practical utility of such labours is fully worthy of their speculative grandeur. The stars are the land-marks of the universe; and amidst the endless and complicated fluctuations of our system, seem placed by its Creator as guides and records, not merely to elevate our minds by the contemplation of what is vast, but to teach us to direct our actions by reference to what is immutable in his works. It is indeed hardly possible to over-appreciate their value in this point of view. Every well-determined star, from the moment its place is registered, becomes to the astronomer, the geographer, the navigator, the surveyor,—a point of departure which can never deceive or fail him,—the same for ever

and in all places, of a delicacy so extreme as to be a test for every instrument yet invented by man, yet equally adapted for the most ordinary purposes; as available for regulating a town clock, as for conducting a navy to the Indies; as effective for mapping down the intricacies of a petty barony, as for adjusting the boundaries of transatlantic empires. When once its place has been thoroughly ascertained and carefully recorded, the brazen circle with which that useful work was done may moulder, the marble pillar totter on its base, and the astronomer himself survive only in the gratitude of his posterity: but the record remains, and transfuses all its own exactness into every determination which takes it for a groundwork, giving to inferior instruments, nay even to temporary contrivances, and to the observations of a few weeks or days, all the precision attained originally at the cost of so much time, labour, and expense.

To avail ourselves of these records, however, we must first have the means of disentangling the observed places of the stars at any moment, from the regularly progressive effect of precession, and from a variety of minuter periodical inequalities arising from the nutation of the earth's axis, and from the aberration of light, of which the genius of theoretical, no less than the industry of practical, astronomers has at length succeeded in developing the laws, and fixing the amount, so as to leave little probability of any material change being induced by future researches.

The calculations, however, required for this purpose, if instituted for each particular star at the time it is wanted, are so numerous and troublesome as to become a very serious evil; the effects of which have been severely felt in Astronomy in the discouragement it has offered to the reduction of observations, owing to which the labour of many an industrious observer's life has been in great measure thrown away. Indeed a lamentable picture might be drawn of the waste of valuable labour traceable to this cause. The want of tables, therefore, to facilitate the reduction of particular stars was early felt. I shall not, however, enter into any historical detail of the attempts hitherto made from time to time to supply this desideratum. A well-drawn up and concise account of them is given in Mr. Baily's Preface to the Catalogue, which renders superfluous all I could say on the subject. Indeed, useful as they have been, and considerable as has been the pains bestowed on them, they are all so far surpassed by this work of Mr. Baily, that it ought rather to be considered as belonging to a new class, than to be compared in any way with the preceding ones, which must eventually all be superseded by it.*

It is time now to speak more particularly of the Catalogue itself. Its whole plan and arrangement, the selection of the stars, the preparation and revision of the formulæ, the choice of the coefficients,

* From this sentence, however, I ought to except special tables for the daily reduction of a certain number of select stars, whose use is no way superseded by the general Catalogue, being destined for continual, as the latter is only for occasional, reference.

and the discussion of the terms to be retained or rejected, we owe to Mr. Baily, who has stated every particular relating to it in a most elaborate Preface, which may indeed be regarded as a compendium of all that is known on the subject of the corrections, and is remarkable at once for its precision and perspicuity. A great portion of the computation has been gratuitously performed by Mr. Stratford, checked by a computer engaged for that purpose. From this very severe labour, however, he was unfortunately compelled to desist, I regret to say, by ill health, and his place supplied by a professional computer: but the hardly less laborious task of comparing and checking the computations of his assistants, and, what is as important in all such cases as accuracy of computation, the careful superintendence of the press, and repeated revision of the whole work, has entirely devolved on him; and never, I must say, was task performed with more diligence and exactness.

The selection of the stars has been made from the Catalogues of Flamstead, Bradley, Lacaille, Mayer, Piazzi, and Zach, so as to include all stars down to the 5th magnitude, wheresoever situated in the heavens,—all of the 6th within 30° of the equator, and all the stars to the 7th magnitude inclusive, within 10° of the ecliptic. Almost all of them, however, are to be found in the Catalogues of Bradley or Piazzi, from which they have been reduced to 1830, (the epoch adopted) by formulæ given by Bessel. Their number is so considerable, that in whatever part of the heavens we may be observing, one or more are sure to be within a moderate distance; so that no one provided with this Catalogue can possibly be at a loss for a zero-point to check his observations, and ascertain the state of adjustment of his instrument. To its convenience and utility, in this respect, I can speak from individual experience. It is indeed become my sheet anchor, and has infused into a series of observations wholly dependent on such aid, a degree of exactness which, without it, I should hardly have expected to attain.

The formulæ employed for calculating the corrections are almost entirely those of Bessel, who has laboured with such diligence and perseverance on this department of Astronomy, as to make the subject almost his own. In adopting them, however, Mr. Baily has taken nothing for granted, even from such high authority. He has gone over the whole subject anew; and the slight inaccuracies which he has detected and corrected in several of the results of this profound geometer, although almost insensible in a numerical point of view, are valuable, as proving at once the general accuracy of his investigations, and the minuteness of the scrutiny they have undergone.

The most delicate part of the whole operation, however, was the choice of the several coefficients, which, if erroneously assumed, would render the whole subsequent work of no value. In making this assumption, Mr. Baily has exercised a degree of judgment which I feel convinced will unite the suffrages of astronomers. Taking a comprehensive view of the results afforded by all former investigations, he has uniformly adhered to the principle, to steer

clear of extreme quantities, and to adopt only such as not only rest on the greatest number of the best observations, but agree in their values nearly with the average of all. Thus, in the case of the aberration, the value adopted is the mean of the almost miraculously coincident results of Brinkley and Struve, and agrees within two-hundredths of a second with that of the extreme values assigned by Bradley and Bessel. I have much satisfaction in being enabled to state, that this value has been recently confirmed within a very minute fraction of a second, by the praiseworthy zeal and industry of Mr. Richardson of the Royal Observatory, who has compared, for this purpose, upwards of 2000 observations, made with the two mural circles of Jones and Troughton; so that this datum may be regarded as one of the best established in Astronomy. In the same cautious manner has Mr. Baily proceeded with the other coefficients. That of precession he has taken entirely from Bessel's elaborate investigations compared with those of Laplace, in which the only remaining source of uncertainty is that arising from our ignorance of the mass of Venus; the influence of which cannot possibly produce an error, however, of a tenth of a second in the precession. The nutation he has taken, as it results from Dr. Brinkley's observations, which (like his aberration) justify this partiality by holding almost exactly an average value among all the different results of Bradley, Mayer, Maskelyne, Laplace, and Lindinau, and can hardly be considered as more than a tenth of a second in error.

This judicious choice will secure the present tables from a possibility of ever sharing the fate of preceding labours of this sort. They can never be superseded by others of greater accuracy, nor fall into disuse, or grow obsolete, till the apparent places of the stars shall have become so much altered by the effect of precession as to render the computations inexact, for which a very long series of years will be required.

But the distinguishing characteristic of this work is the adoption throughout of Professor Bessel's capital improvement in the system of applying the corrections, by arranging the formulæ in such a manner that all that is peculiar to each star, and permanent in magnitude, shall stand distinctly separated from all that is ephemeral, or varying from day to day; and that in such a manner that a short ephemeral table, capable of being compressed into a single page, shall serve, not only for these stars, but for every star in the heavens. The convenience of this method, the brevity it introduces into the computations, the distinctness it gives to all the process of reduction, requiring neither thought nor memory on the computer's part, give it an incalculable advantage over every other. To reduce any observation, no other book need be opened. The work occupies four lines, and is done in half that number of minutes. If we compare this with the tedious and puzzling operation required by former processes, we shall fully agree with Mr. Baily, that "those only who are versed in such calculations can appreciate the labour, the risk of error, and the loss of time incurred in their several operations;" all which are saved by the present arrangement.

These considerations will amply justify the award of your Council in your eyes and those of the world. They will justify a great deal more. At no time was the necessity of pressing on the attention of astronomers the utility, I may say, the duty, of uniformity in their systems of reduction more urgent than at present,* when hardly a nation in Europe is unprovided with a good observatory, and when rival astronomers in all quarters of the globe are contending for the palm of accuracy and diligence. So long as they persist in continuing to reduce their observations by different systems, their merits can never be fairly compared. Each may boast the perfection of his instruments, and vaunt himself in the security of his pre-eminence. Each may promulgate his standard Catalogue, which will be adhered to in his own nation, and rejected by all others; thus dividing astronomers into sects and parties,—a state of things which ought surely not to continue. The only remedy is to agree to speak one language, to adopt one system. It matters little in the present advanced state of science, whether that system be still open to infinitesimal corrections. Let astronomers only consent to use it as, like all human works, confessedly imperfect, and in process of time to be corrected: but not at the caprice of each individual who may think one coefficient a tenth of a second too small, or another as much too great; but after full consideration, when the necessity and amount of correction shall have become certainly known and generally agreed on.

Meanwhile, a fair opportunity is offered to rival astronomers throughout the world, to try their strength, in an arena of ample extent, and where every part of the honourable contest will be brought distinctly into sight. In giving this Catalogue to the world, we invite their examination to its errors, (for such it must contain), and call on them to lend their aid to its perfection, by determining, with all the exactness their resources afford, the mean places of the stars it comprises. For this, its arrangement affords every facility, and those who observe, have no excuse for neglecting to reduce. Let us hope then, that instead of lavishing their strength in fruitless attempts to give superhuman precision to fifty or a hundred select objects, the formation of a standard Catalogue of nearly 3,000 will be deemed of sufficient importance to fix the attention of astronomers; and that not only those to whom the direction of great national observatories is confided, but even private individuals, if such there be, who feel themselves in possession of the means required, may take a share in this glorious, but at the same time arduous undertaking.

(*The President then, delivering the Gold Medal to Mr. Baily, addressed him as follows:*—)

Mr. Baily,

Accept this Medal, which the Astronomical Society bestows on you, by an award which every astronomer in Europe will confirm.

* This applies with equal or greater force to the correction for refraction; a common table for which ought to be agreed on and adhered to by all.