XIV. "Account of the Construction of the New National Standard of Length, and of its principal Copies." By G. B. Airy, Esq., F.R.S., Astronomer Royal. Received May 2, 1857.

(Abstract.)

The author premises that the work to which this account relates was executed almost entirely by Mr. Baily and Mr. Sheepshanks. He then proceeds with the Account, which is divided under nine Sections.

Section I. contains the History of the British and of some Foreign Standards, and of the methods of using them in Base-measures and Pendulum-measures, anterior to the legalization of the Imperial Standards by the Act of Parliament of 1824; the definition of the Standard of Length by that Act; and the provision for its restoration in case of loss. The first record cited is that of the laying down of the English Standard Yard on the Royal Society's brass bar, described in the Philosophical Transactions, 1742–3; then allusion is made to the comparisons by Graham, Maskelyne, Ray, Shuckburgh, those of the Base du Système Métrique, and those by Kater (1818 and 1821). The Sections of the Act of Parliament of 1824, which define the British Yard and prescribe the method for restoring it in case of loss, by reference to the length of the Seconds' Pendulum, are cited.

Section II. gives some description of the Comparisons of Standards made between the passing of the Act of 1824 and the appointment of a Commission for consideration of Standards after the destruction of the Imperial Standard in 1834; with remarks suggested by the advance of collateral theory and experiment in that interval. Extracts are given from Kater's papers of 1826, 1830, and 1831, in which new difficulties were described and new constructions planned to obviate them. Allusion is made to the characteristics of the principal Base-measures in Britain and on the Continent. The constructions of the Ordnance Standard Bars and of the Royal Astronomical Society's Tubular Scale are described, and reference is made to the accounts of their comparisons. Bessel's measure of the seconds' pendulum, Bessel's construction of the Prussian 3-foot

standard, and Bessel's and Sabine's investigation of the atmospheric correction to the vibrations of the pendulum, are noticed. The result of the Astronomer Royal's inquiry into the points of support of a bar proper for preventing extension of its upper surface by its flexure is given. The state of the science of Standards in the year 1834 is then described as follows. It had been shown that it was imprudent to trust to points or lines traced on the surface of a bar, and therefore, supposing the Standard to be a line-measure, only two lines or points ought to be used, sunk to the middle of the bar's thickness. It had been shown that it was imprudent to lay the bar upon a table or upon fixed supports of any kind, and therefore the bar must be stiff enough to bear to be supported upon a few points at which rollers could be conveniently applied. It had been shown that the physical reference provided in the Act of Parliament of 1824 was erroneous in one particular and doubtful in another; and, as it seemed likely that similar uncertainties might be found in any other physical reference, the conviction was gradually rising that it would be better to trust, for restoration, to attested copies of the Standard. The question of the propriety of adopting line-measure or end-measure for the National Standard, which in this country had been practically decided (without a single opposing instance as regarded accurate standards) in favour of line-measure, had again been raised by Bessel's adoption of end-measure.

On 1834, October 16, occurred the fire at the Houses of Parliament, in which the Standards were destroyed.

Section III. records the appointment of the Treasury Commission of 1838, its proceedings and Report; the appointment of the Treasury Commission of 1843, and its proceedings to the death of Mr. Baily in 1844. The Report of the first Commission recommended the adoption of a material Standard, without any reference to physical experiment; and recommended that four copies should be made, of which one should be immured in a wall of a public building, that the new Standard should, by means of bars which had been compared with the old Standard, be made as nearly as possible equal in length to the old Standard, and that the superintendence of the construction should be entrusted to a Committee. These recommendations were adopted by the Lords Commissioners of the Treasury, and led to the appointment of the second or Superintending Committee, and

to the appointment of Mr. Baily as immediate manager of the work. Mr. Baily made experiments on the fitness of different alloys, and fixed upon a hard bronze or gun-metal as best for the Standards. He then repeated some of Kater's experiments; made experiments on the thermometrical expansion of different metals; compared the various bars on which the restoration of the Standard must depend; and proved that the Royal Astronomical Society's tubular scale was not worthy of entire credit as a means of restoring the length of the old Standard. Mr. Baily's death interrupted these inquiries. Generally, however, it appeared that it would be very undesirable to refer in any degree to Shuckburgh's scale (adopted by Kater as the Scientific Standard), inasmuch as there was no security whatever that, in retaining documentary or numerical expressions of measure founded on this scale, we were referring to a consistent system; that the old legal Standard was, through a sensible range, indeterminate; that the new Standard must be firm in its structure; that firm comparing-apparatus must be used, and that new thermometers must be constructed.

Section IV. records the proceedings of the Committee and of Mr. Sheepshanks (who, after the death of Mr. Baily, undertook the construction of the Standard of Length) to June 1847; the construction of new Thermometers; the erection of the massive Comparing Apparatus in the cellar of the Royal Astronomical Society at Somerset House, with a description of the Apparatus and of Mr. Sheepshanks's method of comparing.

Section V. describes the proceedings of Mr. Sheepshanks to the middle of 1850; the preparations of Thermometers; the discussion of the values of the scales compared with the old Standard; the successive adoption and rejection of "Brass 2," "Split-plug A," and "Bronze 12," as Basis for the new Standard; the final adoption of "Bronze 28;" experiments on thermometric expansion; and first suspicion of personal equation.

Section VI. gives an account of the operations of important character to the end of 1853; comparisons of a small number of bars with Bronze 28; investigation of personal equation; investigation of the effect of inside or outside position of the bar; investigation of the relative thermometric expansion of steel, wrought iron, cast iron, copper, and brass, as compared with bronze; trial and rejection of

Baily's apparatus. The whole of this work is of the most elaborate kind.

Section VII. gives the results of comparisons of numerous bars, from 1851 to 1855, and describes the grounds for suspicion of change in Bronze 28, and the removal of the suspicion. Mr. Sheepshanks's death occurred at the end of the observations relating to the suspected change; and the operations on bars, defining the yard by line-measure, were closed.

Section VIII. gives an account of the formation of End-measure Bars, which had been begun by Mr. Sheepshanks, but was completed by Mr. Simms, under the superintendence of the Astronomer Royal. The general principle is this. If two end-bars have each a defining mark almost equally distant, in the two bars, from the middle of its length; and if the two bars are placed end to end, the longer segment of the one touching the shorter segment of the other, the distance between the two lines can be compared, by microscopes, with a line-standard. If the contacts be now made by the other ends, a similar comparison can be made. If the two results be added together, we have a comparison of the sum of the entire lengths of the two end-standards with double the length of the line-standard. This operation being performed, so as to effect a comparison of the three pairs which can be made from three end-standards (the sum of each pair being compared with the double line-standard), we have three simple equations from which the lengths of the three end-standards can be deduced. The end-bars are constructed, some of bronze, some of iron or steel; but in all, the ends are of agate, ground to the curvature of a large sphere, whose centre is the middle point of the bar. The lengths of three bronze end-bars, and of four iron or steel end-bars, were determined by this process.

Section IX. gives a statement of the closing proceedings of official character, with extracts from the Final Report of the Commission, and extracts from the Act of Parliament legalizing the new Standard; a table of standard temperatures for the compared bars; and an account of the disposal of the bars. The Act of Parliament (18° and 19° Victoriæ, cap. 72) recognizes the Bar deposited at the Exchequer Office, and numbered 1, as bearing "the genuine Standard of that measure of length called a Yard," and recognizes four copies as available for restoration of the Standard in case of loss. These copies

are: No. 2, deposited at the Royal Mint; No. 3, in charge of the Royal Society; No. 4, immured in the Cill of the Recess on the East Side of the Lower Waiting Hall in the New Palace at Westminster; and No. 5, deposited at the Royal Observatory, Greenwich.

The whole number of bars accurately compared is 78. Of these, four tubular scales were not the property of the British Government; seven are end-measures; all the remainder are line-measures. They have been distributed liberally to foreign Governments and to British Offices; several, however, remain at the Royal Observatory, Greenwich, still disposable.

The whole of the documents relating to the preparation and comparison of the Standards are preserved at the Royal Observatory.

XV. "On the existence of the Decidua around the Ovum within the Fallopian Tube, in four Cases of Fallopian-Tube Conception, and on the absence of any trace of Decidua in the Cavity of the Uterus in the same Cases." By ROBERT LEE, M.D., F.R.S., Fellow of the Royal College of Physicians, London. Received May 28, 1857.

(Abstract.)

The author observes that more than two hundred years have elapsed since Riolan published a case of Fallopian-tube gestation, and that numerous cases have since been recorded in which the human ovum, after impregnation, instead of passing into the cavity of the uterus, has been arrested in the canal of the tube, and sudden death taken place from rupture of its coats and hemorrhage into the sac of the peritoneum. In none of these cases has a minute anatomical examination been made of the ova thus found in the Fallopian tubes, with the view of determining whether they have the same structure as ova found within the cavity of the uterus, or expelled from it prematurely in a healthy condition.

After referring to cases of Fallopian-tube conception published by Drs. Baillie, Denman, and J. Clarke, Mr. Langstaff, M. Breschet, and Dr. Elliotson, the author gives the details of four cases, in all of which there was no decidua found within the uterus, but the decidua,