dential address for 1902, by Captain F. W. Hutton, F.R.S., dealt with evolution and its teaching. We have also received a copy of the Walker memorial volume published by the Royal Society of Tasmania, and containing the papers on early Tasmania read before the Society during the years 1888–1899 by the late Mr. J. B. Walker, vice-chancellor of the Tasmanian University.

THE report of the U.S. National Museum for the year ending June 30, 1901, has just reached us from the Smithsonian Institution. Part i. of the volume (of 452 pages) contains the report of the assistant secretary and the reports of three head curators, a list of accessions to the museum, and a bibliography of the publications of the museum. The second part will, however, prove of more general interest, consisting as it does of five lavishly illustrated articles. These contributions are, first, a report describing the exhibit of the U.S. National Museum at the Pan-American Exposition at Buffalo in 1901, by Messrs. F. W. True, W. H. Holmes, and G. P. Merrill. This report is illustrated by seventy-two full-page plates, which it would be difficult to improve. Mr. W. H. Holmes also describes the flint implements and fossil remains from a sulphur spring at Afton, Indian Territory, this article being accompanied by twenty-six plates; and the same author deals with the classification and arrangement of the exhibits of an anthropological museum. Mr. Walter Hough discusses archæological field work in N.E. Arizona, and gives an account of the Museum-Gates Expedition in 1901, and with this monograph there are 101 plates, some of which are beautifully coloured. The last contribution is by Mr. J. B. Steere, and is a narrative of a visit to Indian tribes of the Purus river, Brazil.

A QUANTITATIVE study by Dr. Paul von Schroeder (described in the *Zeitschrift für physikalische Chemie*) of the setting and swelling of gelatin has led to some interesting observations, which not only throw light on the phenomena of gelatinisation, but also form an important addition to our knowledge of reversible chemical changes. It appears that gelatin solutions undergo two types of change, a non-reversible hydrolysis by which the setting power of the solution is permanently impaired, and a reversible change as the result of which the jelly melts when heated and slowly solidifies when cooled. The setting power of a solution is accurately indicated by its viscosity. If after rapidly cooling from 100° the viscosity is measured at 25°, a low value is obtained which gradually increases until, if the decomposition of the gelatin has not proceeded too far, it culminates in the setting of the whole mass. By measuring the increment of viscosity during one hour it is possible to predict whether the solution will set in the course of the next twenty-four hours. The reverse process by which the gelatin swells and then dissolves in water presents similar points of interest. Gelatin saturated with water has a higher vapour-pressure than water itself, and loses weight in a saturated atmosphere; the difference of vapour-pressure is, however, very minute, and may be compared with that which exists between drops of different sizes, and causes the larger drops of a fog to grow at the expense of the smaller particles.

AT a meeting of the Institution of Civil Engineers on December 15 several aspects of the important question of water supply were discussed. Prof. J. Campbell Brown read a paper on deposits in pipes and other channels conveying potable water. Analyses were given of incrustations on iron pipes, showing that these incrustations were due to oxidation of the iron of the pipes, whether widespread or in nodules, and that they were not limited to acid waters, but were common to acid, alkaline, and neutral waters. Investigations were recorded showing that slimy deposits on the inner surface of pipes, &c., were produced by gelatinous and filamentous iron-organisms which grew and extracted iron from the water, and died at one end while they grew at the other. Solid rock particles were entangled in this slime, and binoxide of manganese was deposited by chemical action, and this also was entangled in the mass of the gelatinous iron-organisms. Messrs. Osbert Chadwick and Bertram Blount introduced the subject of the purification of water highly charged with vegetable matter, with special reference to the effect of aëration. They showed that the purification of tropical waters was very difficult; they had found that treatment with iron was efficacious, but the treatment must be more thorough than with ordinary water-supplies. The character of these waters charged with vegetable matters rendered the removal of the iron difficult. Systematic aëration, so as to ensure an abundant supply of oxygen, was requisite. An apparatus had been devised in which the water was caused to flow through perforated plates, emerging in streams of small diameter and exposing so large a surface per unit volume of liquid that rapid absorption of oxygen from the air was made certain.

THE additions to the Zoological Society's Gardens during the past week include two Malabar Mynahs (*Poliopsar malabaricus*) from India, presented by Mr. A. F. Vine; two South Albemarle Tortoises (*Testudo vicina*) from the Albemarle Islands, presented by the Captain and Officers of H.M.S. *Amphion*; two Hybrid Parrakeets (between *Palaeornis eximius* and *Psephotus haematonotus*), four Limbless Lizards (*Pygopus lepidopus*) from Australia, deposited.

OUR ASTRONOMICAL COLUMN.

RADIAL VELOCITIES OF β AURIGÆ.—M. G. A. Tikhoff, of the Pulkowa Observatory, has recently concluded a research on the relative velocities of the spectroscopic binary β Aurigæ, and publishes his results in No. 3916 of the *Astronomische Nachrichten*.

The forty-one plates on which the results are based were obtained by M. Belopolsky, nineteen during the early part of 1902 with a Rutherford spectroscope, and twenty-two at the end of 1902 and the beginning of 1903 with a new Töpfer three-prism spectrograph. The relative velocities of the components are given in a table, which also shows the exact time at which the plates were taken and the interval since the last conjunction, and they show a maximum of 228 km. per second, on March 24, 1902, to zero.

The curve obtained on plotting these results gave 3d. 23h. 30·4m. as the period, and it also indicates that the system is not only a binary one, as announced by Prof. Pickering in 1890, but is made up of more than two bodies. This is confirmed by the spectrogram obtained on January 21, 1903, in which the line Hγ is made up of four components, indicating the existence of four separate bodies with different velocities.

M. Tikhoff has arrived at the conclusion that the system is made up of two pairs, each pair consisting of a star giving strong lines and another giving weak lines, and each element making a complete revolution about the centre of gravity of its pair in 19·1 hours. The ratio of the masses of the two groups is near unity, and the proper motion of the whole system as deduced from the magnesium lines at λ 4481 and λ 4352 is −16 km. per second. The epoch of conjunction may be taken as February, 1903, 3d. 10h. (Pulkowa M.T.).

THE "DOUBLING" OF THE MARTIAN CANALS.—In discussing the instrumentality of "contrast" in producing the duplicated appearance of Martian canals, M. E. M.

Antoniadi directs attention to some experiments made by him which showed that when single, elliptical, dark spots were examined for a long unbroken period they appeared to develop a duplication similar to that observed in Martian phenomena. He also states that Schiaparelli repeatedly saw the well-defined dark seas with lighter interiors, and when the narrower seas, such as the Mare Cimmerium, Lacus Niliacus, and Sinus Sabæus were observed steadily for a long time, they manifested a tendency to beget islands which exactly resembled in shape the areas in which they appeared. M. Antoniadi directs attention to the fact that these islands always appeared to be surrounded by "dark canals," and he has therefore arrived at the conclusion that their appearance, and the apparent "gemination" of the canals, are simply results of the physiological effects of "contrast" (*Astronomische Nachrichten*, No. 3916).

OBSERVATIONS OF LEONIDS AND BIELIDS AT ATHENS.—In a communication to the Paris Academy of Sciences, M. Eginitis, director of the Athens Observatory, records the following observations of the Leonid and Bielid showers made at Athens during November :—

Leonids.—November 14, 11h. 50m. to 18h. (Athens M.T.), twelve meteors, appearing to emanate from radiants situated at $\alpha=152°$, $\delta=+25°$, and $\alpha=156°$, $\delta=+20°$, were seen.

November 15, 9h. 50m. to 17h. 50m., 187 meteors were observed from the following radiants :—$\alpha=150°$, $\delta=+22°$; $\alpha=153°$, $\delta=+21°$; $\alpha=152°$, $\delta=+24°$.

November 16, thirty-three meteors observed, chiefly from a radiant situated at $\alpha=150°$, $\delta=+17°$.

This shower appeared to attain its maximum between 15h. and 16h. on November 15. The general colour of the meteors was red, their velocities moderately swift, and their mean brightness equivalent to the fourth magnitude.

Bielids.—A watch was kept for this shower on the evenings of November 22, 23 and 24, but no meteors were seen on November 22, possibly because the sky was very hazy.

From 7h. 46m. to 16h. on November 23, fourteen meteors were seen, chiefly emanating from a radiant situated at $\alpha=23°$, $\delta=+43°$. On November 24 eleven meteors were observed, and these indicated the existence of two radiants, one at $\alpha=26°$, $\delta=+46°$, and the other at $\alpha=26°$, $\delta=+43°$.

In general the Bielids were red in colour and equivalent in brightness to the fifth magnitude stars; they moved so swiftly that their very short paths were hardly visible (*Comptes rendus*, December 7).

THE HIGHER EDUCATION OF WOMEN.

THE adequate provision of secondary and higher education for English girls and women is to be regarded as one of the accomplishments of the latter half of the nineteenth century. In 1850, for instance, the popular idea here and elsewhere was that women were intellectually incapable of benefiting by higher instruction. To quote Dr. Leslie Waggener, of the University of Texas, "it was seriously questioned whether the 'female' mind could untangle the intricacies of pure mathematics, could appreciate the abstruse speculations of metaphysics, or could follow, step by step, the inductions of a scientific investigation." Fifty years' experience has, however, demonstrated the complete fallacy of this preconception. Speaking at the Cambridge University Extension summer meeting in 1900, Mrs. Henry Sidgwick, principal of Newnham College, said of higher education for women, "I do not think its desirability is any longer seriously doubted by anyone who has looked into the facts, and whose opinion on the question is worth considering." Similarly, President Eliot, of Harvard College, in an address in 1896, referring to the university over which he presides, remarked, "it is a quarter of a century since the college doors were opened to women. Since that time, where girls and boys have been educated together, it has become an historical fact that women have made rapid strides, and captured a greater number of honours in proportion to their number than men."

So complete a change of opinion on a subject of such importance as the suitable education of the larger half of the human race deserves attention, and the steps in the movement which has resulted in the recognition of the claims of women at most universities throughout the world, supply a profitable study for all students of educational problems. A comparison, too, of the present provision of university courses for women with their complete non-existence in 1850 should serve to cheer those men of science and others who are endeavouring to improve our national education in other directions. It is gratifying, in beginning a brief historical summary of the growth of the movement to provide secondary and higher education for women, to be able to state that among the first efforts in this direction were those made in England. The absence of public secondary schools for girls in this country, and the impossibility of obtaining really educated governesses, were the causes which led the late F. D. Maurice and others to work with the Governesses' Benevolent Institution to improve matters, and the labours of these pioneers led to the establishment, in 1848, of Queen's College, London, the original object of which institution was to train women teachers. In the following year Bedford College, London, was founded, and so successful has it been that it is now one of two colleges for women which are constituent colleges of the reconstructed University of London. A good start having been made, the movement grew and ere long flourished greatly in several localities. The North London Collegiate School for Girls was established by Miss Frances Buss in 1850, and the Ladies' College at Cheltenham in 1853. The thorough education of the daughters of middle-class families had become sufficiently general in 1863 to convince the University of Cambridge of the advisability of at least trying the experiment of admitting girls to the local examinations conducted by them in various centres throughout the country, and in 1865 girls were formally admitted. Then came the Schools Inquiry Commission of 1864, which, after sitting for three years, reported at the end of 1867. Ladies were called upon by the Commission to give evidence as to the provision for the secondary education of girls, and, to quote Mrs. Henry Sidgwick again, "The assistant commissioners, who had examined and reported on the condition of secondary education in various districts, gave a deplorable account of the insufficiency of the girls' schools, and of the immense difficulty of finding any adequately-educated female teachers for them." In 1872, the National Union, under the presidency of Princess Louise, was started to reform girls' education. This association soon established the Girls' Public Day Schools Company, and at present, this company alone, has 34 schools, about 7000 pupils, and about 600 teachers of different grades.

This cursory glance at the history of the attempts made to supply English girls with secondary education is necessary, because the need created by the establishment of these schools for highly qualified women teachers directed attention to the necessity for the provision of higher education at English colleges and universities, a need which had hitherto been completely ignored. The recognition of the claims of women to as much education as they desire has in England been brought about gradually, and it will be convenient to indicate the more important steps taken since the foundation of Queen's College, London, in 1848, and then to outline, as exactly as possible, the present state of things in other countries. It will simplify matters, too, to deal with different countries separately, and to take the universities of Great Britain and Ireland first, and in most detail.

GREAT BRITAIN AND IRELAND.

Special lectures for women were started in connection with the University of Cambridge in 1870. Girton College was incorporated at Cambridge in 1873, though it had been in existence at Hitchin since 1869, and from its inauguration had prepared its students for the examinations of Cambridge, where women were first informally examined for the previous examination in 1870, and for the tripos examination in 1872. Girton was "designed to hold in relation to girls' schools and home training a position analogous to that occupied by the universities towards the public schools for boys." In 1871, a house of residence for women attending university lectures was opened in Cambridge, and this institution became known, in 1875, as Newnham Hall, and was constituted a college in 1880. In the same year as Newnham College was incorporated, the uni-