of the August Perseids. It is rather an event with possibilities which cannot be definitely predicted because it is affected by irregularities not fully understood. Usually it must be confessed that the shower provides few meteors and disappointment. However, meteoric astronomers anticipate its brilliant revival at any time, and watch the spring skies with a keenness which merits success.

The meteors are due on the night of April 21, when the moon will be at her last quarter, and does not rise until nearly an hour after midnight. But it will be advisable to watch on the preceding night also, and the hours after midnight are likely to be the most productive, the radiant point at 271°+33° being at a much greater altitude than in the evening hours. The really active stage of the shower is limited to a few hours, but the whole duration is much longer, and certainly extends from April 18, when radiation is from 266°+33°, to April 26, when it has advanced to 278°+33°.

UNIFICATION OF THE ASTRONOMICAL AND CIVIL DAY.—The Lords Commissioners of the Admiralty have given instructions to the Superintendent of H.M. Nautical Almanac Office that in the Almanac for 1925 the day shall be considered as beginning at midnight, to make the astronomical agree with the civil day. This change has been resolved on after consultation with the Royal Astronomical Society, which issued a circular to the superintendents of the ephemerides of other nations and to the representatives of other bodies asking for opinions and suggestions. It appears that the change is to be made chiefly in the interests of seamen, who will find it more convenient to have the same time system in use for purposes of navigation and for ordinary life on board ship. It may be remembered that a vigorous attempt to secure this unification of the civil and astronomical day was made about the year 1885.

THE EVOLUTION OF BINARY SYSTEMS.—Mr. J. H. Jeans, in the Monthly Notices of the Royal Astronomical Society for December, 1918, examines some of the problems of double-star orbits. While in the solar system the angular momentum is too small for the system to have broken up through rotation, in the majority of binary systems it is too large for this to have happened. Tidal action cannot increase the latus rectum by more than some 60 per cent. in the case of equal masses (Russell). Large alterations of latus rectum, and hence of period, cannot, therefore, arise from the mutual action of the stars. Either the periods have retained approximately their present values throughout the star's career (this hypothesis is rejected), or there must have been sensible disturbances from other stars. This leads Mr. Jeans to the interesting conclusion that the stellar system was initially of about 1/1000 of its present volume. He suggests that the outward movement may still be in progress, and notes the observed excess of positive radial velocities as evidence of this. In its earlier compressed condition mutual encounters of stars would have been frequent. Incidentally, he finds 0·637 as a mean value of eccentricity of orbits as produced by encounters. This accords well with observed facts.

It is advisable to direct attention to one sentence of the summary. Mr. Jeans says:—"The dwarf M stars have velocities which show no preference for particular directions in space, and there seems to be no correlation between the magnitude of their velocities and the parts of the universe they occupy." But, in fact, we are acquainted only with those dwarf M stars that are in close proximity to the sun; for such stars are intrinsically so faint that they do not appear in our catalogues at all if they are distant.

AERIAL PHOTOGRAPHY.

PHOTOGRAPHY from the air reached a wonderful degree of excellence during the war, as is demonstrated by the pictures that have been published and shown at various exhibitions; but for obvious reasons the instruments used for this work have only quite recently been made public. The experts who have compared the various lenses suitable assure us that those made by English opticians were found to be not only equal to those of Zeiss and Goerz, but markedly superior to them. With regard to cameras, the editor of the *British Journal of Photography* has had an opportunity of seeing the whole range of cameras used by the Royal Air Force, and describes them in an article in his journal of March 21. Within a few months of the beginning of the war the value of aerial photographs began to be recognised, and specially made cameras were first used early in 1915. The first camera was of a very primitive type, and fitted with a Mackenzie-Wishart adapter for 5×4 plates. Early in 1916 a magazine-changing arrangement was used with the plates in metal sheaths, the foremost—that is, the lowest—plate being pushed sideways after exposure into the receiver by a horizontally moving metal plate. So far the cameras were of wood, but in 1917 a metal camera was introduced, and the changing done by pulling a cord instead of pushing a metal plate.

The next improvement (early in 1917) was to provide a mechanical method of changing, the motive power being produced by a small propeller, which was brought into action by simply releasing a Bowden lever, the shutter being automatically actuated at the same time and by the same means. In 1918 this camera was further improved in several ways. The shutter was made replaceable by another, if necessary, as on account of derangement, and lenses of focal lengths from 4 in. to 20 in. might be used on the same camera. Among other patterns was one, first used in 1916, which would take a continuous series of photographs, up to 120, on a roll of film. The exposures were made automatically at intervals corresponding with a certain number of revolutions of the propeller, and by means of a small supplementary lens each negative had recorded on it the height of the machine and its compass bearings. Major C. W. Gamble, of the R.A.F., in a lecture before the Optical Society on March 13, after describing the various cameras used, said that, although the most rapid plates were desirable so that exposures might be made late in the day and when the light was poor, it was found that the density-giving capacity of the plate was of at least equal importance. As time progressed the tendency was to use panchromatic rather than orthochromatic plates, and, finally, three-fourths or more of the plates used were panchromatic, a suitable light-filter being employed.

NEW KNOWLEDGE OF A PUZZLING GROUP OF GYMNOSPERMS.

THE abundance of large fronds in Rhætic, Jurassic, and Wealden rocks, closely resembling in habit those of some recent Cycads, and the occurrence of hundreds of petrified trunks in Jurassic and Neocomian strata in North America and, in smaller numbers, in many other parts of the world, have led palæobotanists to speak of these periods as the "age of Cycads." It is, however, a remarkable fact that the reproductive shoots of these Cycad-like plants differ very widely from the corresponding organs in the true Cycads; had we possessed no knowledge of the vegetative organs, the reproductive shoots would

not have been styled cycadean. The differences between the reproductive organs of the recent and extinct forms find expression in the reference of the Jurassic and Lower Cretaceous plants to a separate group, Bennettitales, the existing cycadean genera being included in the Cycadales.

Dr. Marie C. Stopes has recently made two important contributions to our knowledge of the Bennettitales in a paper published in vol. ccviii. of the Philosophical Transactions of the Royal Society, containing descriptions and many admirable illustrations of a new species of seminiferous cone and a cone-bearing stem. The new cone, named *Bennettites albianus*, was discovered in the Gault of Folkestone by Mr. G. C. Walton. A French specimen of Bennettites was described some years ago by Prof. Lignier from beds in Normandy, believed by him to belong to the Gault, but with that exception all Bennettitean cones are from Jurassic or Wealden strata. The preservation of the English species is unusually good; the type-specimen is a portion of the broad domical apex of a cone about 120 mm. in diameter, containing several hundred seeds, many of them with embryos. In general plan it agrees with previously described Bennettites cones; each seed is closely invested by seven interseminal scales, with expanded and laterally confluent truncate apices, forming a strong protective covering to the surface of the "fruit." It is suggested that the lacunar tissue surrounding the stalks on which the erect exalbuminous seeds are borne, and the tubular cells of the arillus-like basal cup in which each seed is embedded, drew up and retained water like the water-storage tissue of a bog moss, thus keeping the interior of the fruit moist. It is pointed out in support of this ingenious view that the seeds are deficient in vascular-conducting tissue.

The careful and detailed investigation of the complex structure of the seeds does not afford support to the view advanced by some writers that the Bennettitean seed agrees closely with that of Gnetum, nor are any new facts brought to light which favour an alliance between Bennettites and the Angiosperms.

It is probable that the plant which bore the cone described by Dr. Stopes was one of the latest representatives of the Bennettitales; the habit and the anatomical characters of the vegetative organs were, in the main, retained by the Cycads as we know them to-day—a small group, for the most part tropical in their distribution, and probably of comparatively recent origin. On the other hand, it has yet to be shown that the complex reproductive shoots of Bennettites gave rise to any direct descendants.

The thorough examination by Dr. Stopes of the Lower Greensand stem named by Carruthers *Bennettites maximus* shows that it agrees anatomically with other species except in the absence of any undoubted secretory cells in the ground-tissue of the stem and leaf-bases. The abundance of thick-walled, pitted cells, or "transfusion elements," which physiologically may represent secretory cells, is a characteristic feature. The most important point made by the author is that *Bennettites maximus* bore bisporangiate cones similar to those described by Wieland from America, and differing from the apparently unisexual cones previously recorded from Britain. A. C. SEWARD.

EDUCATION AND SCIENCE IN THE CIVIL SERVICE ESTIMATES.

THE Estimates for Civil Services for the year ending March 31, 1920, amount in Class IV. (Education, Science, and Art) to 41,251,610*l*. The following are among the Estimates:—

United Kingdom and England.

Service	1919–20	Compared with 1918–19 Increase
	£	£
Board of Education ...	31,353,111	12,243,406
British Museum	209,714	83,572
Scientific investigation, etc.	113,974	59,733
Department of Scientific and Industrial Research ...	242,815	94,465
Universities and Colleges, United Kingdom, and Intermediate Education, Wales	945,700	624,000
Universities, etc., special grants	500,000	470,000
Scotland.		
Public education	4,677,220	1,635,675
Ireland.		
Public education	2,721,356	519,752
Intermediate education ...	90,000	—
Science and art	190,498	27,105 Decrease
Universities and colleges ...	85,000	11,350

Details of some of these Estimates of particular interest to men of science are as follows:—

SCIENTIFIC INVESTIGATIONS, ETC.

	£
Royal Society:	
(i) Grant in aid of (*a*) scientific investigations undertaken with the sanction of a committee appointed for the purpose (4000*l*.) and (*b*) scientific publications (1000*l*.)	5,000
(ii) Grant in aid of salaries and other expenses of the Magnetic Observatory at Eskdalemuir	1,000
Meteorological Office	47,000
Royal Geographical Society	1,250
Marine Biological Association of the United Kingdom	1,000
Royal Society of Edinburgh	600
Scottish Meteorological Society	100
Royal Irish Academy	1,600
Royal Zoological Society of Ireland	500
British School at Athens	500
British School at Rome	500
Royal Scottish Geographical Society	200
National Library of Wales	8,900
National Museum of Wales:	
Grant in aid of the expenses of the museum	4,000
Special building grant in aid	20,000
Solar Physics Observatory	3,000
School of Oriental Studies	4,000
North Sea Fisheries Investigation	1,250
Imperial Mineral Resources Bureau	11,000
Edinburgh Observatory	1,974

SCIENTIFIC AND INDUSTRIAL RESEARCH.

	£
Salaries, wages, and allowances	11,870
Travelling and incidental expenses	1,500
Grants for Investigation and Research:	
(1) Grants for investigations carried out by learned and scientific societies, etc. ...	13,570
(2) Grants for investigations directly controlled by the Department of Scientific and Industrial Research	55,000
(3) Grants to students and other persons engaged in research	25,000
(These grants will be distributed by a Committee of the Privy Council, on the recommendation of an Advisory Council, to promote the development of scientific	