two Gold Pheasants (*Thaumalea picta*) from China, a Pheasant (*Phasianus colchicus*), five Barn Owls (*Strix flammea*), British, purchased; a Japanese Deer (*Cervus sika*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

COMET BORRELLY-BROOKS (1900 *b*).—Several observations of this comet are announced. The comet is at present easily seen with a small telescope, but is becoming fainter.

Ephemeris for 12h. Berlin Mean Time.

1900.	R.A. h. m. s.	Decl. ° ′	Br.
Aug. 9 ...	3 11 45 ...	+61 11·9 ...	0·91
10 ...	15 14 ...	63 37·6 ...	87
11 ..	19 12 ...	65 56·8 ...	83
12 ...	23 41 ...	68 9·4 ...	79
13 ...	28 47 ...	70 15·6 ...	75
14 ...	34 46 ...	72 15·3 ...	71
15 ...	41 48 ...	74 8·6 ...	67
16 ...	3 50 8 ...	+75 55·7 ...	0·63

During the week the comet passes rapidly northwards from α Persei, across into Camelopardus, and then near the boundary of this constellation and Cassiopeia. Its path is at present so nearly linear that it may be found by sweeping along the direction formed by the stars π, κ and α Persei.

EPHEMERIS OF COMET 1894 IV. (SWIFT).—Mr. F. H. Seares sends the following search ephemeris for the assistance of interested observers:—

Ephemeris for 12h. Berlin Mean Time.

1900.	R.A. h. m. s.	Decl. ° ′
Aug. 8 ...	15 57 20 ...	−24 32·8
12 ...	15 59 31 ...	36·0
16 ...	16 2 10 ...	40·2
20 ...	16 5 17 ...	45·4
24 ...	16 8 50 ...	51·4
28 ...	16 12 50 ...	−24 58·1

VARIABLE STARS IN CLUSTERS.—*Harvard College Observatory Circular* (No. 52) contains the results of the measures of a set of photographs of the star cluster Messier 3 (N.G.C., 5272). This object is so low in the sky at Arequipa, and the stars so faint, that satisfactory photographs of it could not be obtained with the 13-inch Boyden refractor with exposures less than 90m. The rate of increase of the light of many of these stars is extremely rapid, and in order to determine such change with the greatest precision, it is necessary to have photographs taken with short exposures. Accordingly, at Prof. E. C. Pickering's request, Prof. J. E. Keeler has taken a series of excellent pictures of the cluster with the 3-foot Crossley reflector of the Lick Observatory The first of these had an exposure of 60m., while twenty-four others were obtained with exposures of 10m. each. Prof. Bailey has examined these photographs very carefully, devoting attention specially to three of the variable stars. It has previously been stated (*Circular* No. 33) that the proportion of variable stars is greater in this cluster than in any other object of the same class.

The periods of the three variables were found to be: No. 11, 12h. 12m. 25s.; No. 96, 12h. 0m. 15s.; No. 119, 12h. 24m. 31s. The variations were recorded for intervals of 5m., and are given in a table. From this it appears that the total increase of light takes place in the case of No. 11, within 70m.; No. 96, within 60m.; and No. 119, within 80m. The greatest rapidity of increase of light occurs in the star No. 96, which increases during 5m. at the rate of at least 2·5 magnitudes per hour, and during 30m. at the rate of more than 2·0 magnitudes per hour. This rate of change appears to be the most rapid of any known variable. The Algol variable U Cephei, which perhaps undergoes the most rapid change of any variable *not* found in clusters, changes at the rate of about 1·5 magnitudes per hour during about 30m. of its period. In all these stars the rate of change is relatively slow near the beginning and end of the period of increase. In No. 96 the increase is about *ten* times as rapid as the decrease. Generally speaking, the lengths of period and form of light curves of these three stars are similar to those of the variables in the clusters Messier 5 and ω Centauri (*Astrophysical Journal*, vol. x. p. 255).

RECENT INVESTIGATIONS ON RUST OF WHEAT.

RUST, or mildew, is familiar to the agriculturist as a disease destructive to wheat and other cereals, and to the botanist as the subject of important researches relating to fungi. It was known in times of antiquity, as shown by numerous references indicating its destructiveness. Virgil says, "Soon, too, the corn gat sorrow's increase, that an evil blight ate up the stalks" ("Georgics," i. 150–1). In Britain, it is stated that "mildew of wheat-plants has been known for over 300 years, according to the records" ("Report on Mildew on Wheat Plants, 1892," Board of Agriculture, 1893, p. 25). Shakespeare ascribes it to "the foul fiend Flibbergibbet" (*King Lear*, Act iii. Scene 4). The works on husbandry of Hartlib (1655) and Jethro Tull (1731) refer to it. The connection of rust of cereals with a specific fungus is generally ascribed to Fontana (1767), and Persoon, after further investigation, in 1797 named the fungus *Puccinia graminis*. An account of rust, with illustrations of the *Puccinia*, by Sir J. Banks in 1805, is apparently the first important paper on the rust and its fungus in Britain. Since then the epidemic has been the subject of many papers, and of, at least, three organised inquiries. The historical side of the subject is conveniently summarised by Worthington G. Smith ("Diseases of Crops," London, 1884, Chapter xxv.), by C. B. Plowright ("British Uredineæ and Ustilagineæ," London, 1889, p. 46), and in the Board of Agriculture report ("Report on Mildew on Wheat Plants, 1892," Board of Agriculture, 1893, p. 25).

Rust of wheat occurs throughout Britain, especially in the wheat-growing districts, and forms of it are found on oat, barley, rye, and almost all grasses The losses from the form on wheat, reported to the Board of Agriculture in 1892, vary from nine to sixteen bushels per acre of crop. Rust-epidemics have been the subject of special attention in Europe, more particularly in Sweden, Germany, France and Austria. A rust conference was formed in 1890 for Australasia, and still continues to meet. In the United States of America, the Department of Agriculture sanctions the statement that "the damage to wheat and oats from rust in this country probably exceeds that caused by any other fungous or insect pest, and in some localities is greater than that caused by all other enemies combined" (Carleton, M. A., "Cereal Rusts of the United States," U.S. Department of Agriculture, *Bulletin* 16, 1899). In India and Japan, substantial losses are ascribed to this disease.

The remedy for this epidemic is a difficult problem, and the aim of recent research has been, in the first place, to obtain a true conception of the fungus causing it. The facts leading up to recent investigations may be briefly reviewed. It is an old and deep-rooted belief amongst growers of wheat that the rust of their crops is influenced by the neighbourhood of barberry bushes. Evidence of this is seen in certain old enactments enforcing destruction of the barberry; for instance, that passed by a parliament at Rouen in 1660, and others included in the Province Law of Massachusetts (America) between 1738 and 1761. Sir Joseph Banks, in his paper (1805), holds the same opinion.

In 1841 Prof. J. S. Henslow (*Journal* of the Royal Agricultural Society, vol. ii. 1841) suggested that the yellow summer rust of wheat, and the black mildew which comes later, are stages in the life of one and the same fungus. Passing over many papers discussing these relationships, we come to one by De Bary published in 1865 ("Untersuchungen üb. Uredineæ." *Monatsber. d. Berlin Akad.*, 1865). From his experiments De Bary concludes, that the yellow summer rust (*Uredo linearis*, Persoon) on *Gramineae*, the black autumn rust (*Puccinia graminis*, Persoon) also on *Gramineae*, and the rust on barberry (*Aecidium berberidis*, Persoon) with its associated "spermogonia" stage, are phases in the life-history of the same fungus, for which the name *Puccinia graminis* is retained. In other words, that three (or four) recognised species of fungi are one and the same. At the same time a new phenomenon in the life of fungi was revealed, namely, that there existed parasitic fungi which required two host-plants in order to develop the forms of reproduction included in their life-cycle; this De Bary named metœcism or (as better known in Britain) heterœcism. The life-history of *Puccinia graminis*, as defined by De Bary, is given in all our text-books. Uredospores (see Fig. 1) are produced on wheat and other *Gramineae* throughout the summer, and infect the same group of host-plants; the

© 1900 Nature Publishing Group