induced to take human blood on seven occasions only, details of these cases being given in the following table:

Number of <i>C. pipiens</i> Females in- duced to bite.	Date (1931).	Time of Day.	Temp. (Cent.).	Percentage Humidity.
1	June 26	4.15 P.M.	18°	—
2	July 22	5.0 P.M.	19°	80
2	„ 23	5.30 P.M.	20°	75
1	Aug. 27	9.30 A.M.	17°	78
1	„ 28	6.0 P.M.	18°	79

In all our experiments, the mosquitoes (whatever their species) were fed in front of a large window facing east. The female *C. pipiens* which bit on Aug. 27 did so in bright sunshine.

It may be noted that, according to Stitt,² the yellow fever mosquito, *Aedes argenteus*, may take its first meal of blood in the daytime, but all its subsequent bites are made during the night. This peculiarity is certainly *not* a characteristic of any of the British species with which we have experimented.

Early in May last we collected a number of *C. pipiens* females shortly after the conclusion of hibernation. In those which had obviously fed recently we found, on dissection, the oval, nucleated blood corpuscles pertaining to birds. The adults which appeared to have fed less recently were set aside for oviposition. One of these, after ovipositing, was induced to take two (daylight) meals of human blood, separated by an interval of eleven days; it was found dead, however, two days later. Although fully gorged after the first of these meals, no further oviposition took place and no fat-body accumulated; the insect being found in an emaciated condition when dissected. The ovaries, though not exhausted, had undergone no development.

Of a number of *C. pipiens* females collected during the latter half of last month, eight were found to be gorged with avian blood.

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J. STALEY.

British Mosquito Control Institute,
Hayling Island, Sept. 20.

¹ NATURE, Sept. 3, p. 366; 1932.

² Stitt, E. R., "Bacteriology, Blood-Work and Animal Parasitology", 1920.

Vectors of Mediterranean Kala Azar

It has been previously shown¹ that both *Phlebotomus perniciosus* and *P. major* give high infection rates when fed on Chinese hamsters infected with *Leishmania infantum*. In the case of *P. perniciosus* it was also shown that if the epipharynx is infected flagellates are deposited during the act of feeding. Further work showed that flagellates from *P. perniciosus* when introduced into the skin of susceptible animals (*Cricetulus griseus* and *Citellus citellus*) produce visceral leishmaniasis. It was therefore concluded that *P. perniciosus* is a vector of Mediterranean kala azar.

Transmission by *P. perniciosus* cannot explain the whole of Mediterranean kala azar, for in material collected from Macedonia by officers of the R.A.M.C. during the War we did not find a single specimen of *P. perniciosus*, neither did we find this species in endemic foci in Syria.

On a recent trip through Greece no specimens of *P. perniciosus* were found, but in the neighbourhood of Argos, a heavy centre of infantile kala azar, and in Athens, where both infantile and canine kala azar occur, *P. major* was found to be common. Because of the purely nocturnal activity of *P. major* and its

extreme photophobia after feeding, this species has been previously overlooked in Greece.

It was thought advisable to compare *P. major* and *P. perniciosus* as hosts of *L. infantum*. *P. major* is very rare in Malta, but is common in a limited area near Catania in Sicily. A dog naturally infected with kala azar in Malta was taken to Catania, and wild specimens of *P. major* and *P. perniciosus* were allowed to feed on the animal. Out of 31 specimens of *P. major* 25 became infected, while only 33 out of 119 specimens of *P. perniciosus* became infected. The behaviour of the flagellates in the two species was identical. It therefore appears that *P. major* is a better carrier of Mediterranean kala azar than *P. perniciosus* (assuming the identity of canine and infantile kala azar).

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¹ Proc. Roy. Soc., B, 108; 1931.

The Expanding Universe

IN NATURE of July 2, Prof. Milne has published a very simple and attractive explanation of the phenomenon that has given rise to so much speculation among recent cosmogonists. The sole defect in his clear analysis is that the material particles that form the universe are taken initially to have been enclosed in some finite space, but without mutual action, or even collisions. I should like to bring to the notice of those interested that the last restriction may be easily removed.

Sundman, in his remarkable work on the three-body problem, showed certain general characteristics of the three-body system to persist under Newtonian laws of motion: that if the total energy is greater than that obtained by approach from infinity, under the mutual forces of attraction alone, then at least one of the three bodies will be ejected to infinity. Further, if the energy is less than this critical value and the particles at any time happen to be closer together than a certain determinate distance, the recession to infinity will again take place.

The importance of this lies in that the results can be immediately extended to the *n*-body problem, as has been demonstrated by Birkhoff, Chazy, Koopman, and others. By studying the Lagrangian *R* function formed by the products of the masses with the squares of their mutual distances, it can be proved as before that two groups of the particles are to be distinguished: a slower set and a faster receding set; this, provided that the constant of energy is greater than a critical value, or in the contrary case, the *R* function is sufficiently small at some time, a considerable number of the particles thus being very close together; regardless of the distribution in space or velocity. The further remarkable fact is that this characteristic of exterior motion seems to persist even for more general laws of force than that of the inverse square of the distance, provided that, for attractions, the force vanishes at infinity; certainly for laws of the inverse cube type, and some others.

Lastly, collisions present no difficulty, as the case of elastic rebound can be regularised for double collisions as for triple collisions by the method of Sundman, and collisions of order higher than two will be very rare indeed. This, with the case of Newtonian dynamics, is enough to show the generality of Prof. Milne's remarks. For the relativistic case, the results should be approximated, provided only a finite dissipation of the energy of the system takes place during