blood meals for oviposition (Hubert *et al.*, 1954). It would be interesting to observe the results from crossing the California autogenous strain with the Montana or other anautogenous strains. At the present time, it is not certain that the autogenous strain is genetically different from other populations of *C. tarsalis*.[5] Duplication of the rich diet provided in the culture of our colony might result in the development of autogenous characteristics by other strains. Experimental comparisons are planned to determine if there are separate strains as in *C. pipiens* or if this is purely a dietary effect.

SUMMARY. In a cage colony of *Culex tarsalis* maintained at Bakersfield, California since 1952, autogenous characteristics were detected in 1957. A sub-colony has been maintained for about six generations in a four-month period with no food provided the adults except corn syrup and apple slices. There are some indications that autogenous development of ova may occur occasionally in wild populations of *C. tarsalis* in Kern County, California.

[5] After preparing this manuscript we received word from Dr. Jowett Chao that he has observed autogeny in a colony of *C. tarsalis* maintained at the Department of Zoology, University of California at Los Angeles. Dr. Chao's observations are reported in an accompanying article.

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AN AUTOGENOUS STRAIN OF *CULEX TARSALIS COQ* [1]

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Since Roubaud's proposal of the term "autogeny" (1929) in connection with the *Culex pipiens* complex, several cases of autogeny in mosquitoes have been reported. According to Spielman (1957), at least 20 species have been recorded in which autogenous individuals were observed. These are (Spielman, personal correspondence): *Aedes atropalpus* Coquillett, *A. caspius* Pall., *A. scutellaris* Walk., *A. concolor* Taylor, *A. communis* (De Geer), *A detritus* (Haliday), *A. aegypti* (Linn.), *Culex pusillus* (Macq.) Story, *C. molestus* Forsk, *Culiseta longiareolata*

[1] This investigation was aided in part by a Grant E-87 to Dr. G. H. Ball, from the National Institute of Allergy and Infectious Diseases of the National Institute of Health, U. S. Public Health Service, and by a Grant 254 from the Board of Research, University of California.

(Macq.), *C. subochrea* Edw., *C. inornata* (Will.), *Uranotaenia unguiculata* Edw., *Anopheles pictipennis* Phil., *A. claviger* Meig., *A. plumbeus* Steph., *A. atroparvus* (Thiel), *A. crucians* Wiedemann, *Opifex fuscus* Hutton, and *Tripteroides tasmaniensis* (Strickland). Although possibly autogenous strains in other species of mosquitoes have been found, to the best of our knowledge, there is no published record of autogeny in *C. tarsalis*.

When this report was nearly complete, it was learned through correspondence with Dr. R. E. Bellamy that an autogenous strain of *C. tarsalis* had been isolated almost simultaneously in their laboratory at Bakersfield, California (Bellamy and Kardos, 1958). It is not surprising that both discoveries occurred at the same time, since our present colony was initially received (1954) from the one maintained in Dr. Bellamy's laboratory. However, since the methods of rearing in the two laboratories are not entirely the same, and the studies have had slightly different approaches, it is believed that two reports will give a more complete picture of autogeny in *C. tarsalis*.

Our present colony of *C. tarsalis* was established in October 1954 from two dozen egg rafts mailed to us through the courtesy of Dr. Bellamy. No new wild specimens have been added and there has been no sign of diminishing population. After the first 3 generations in a large cage (24" x 36" x 72" high) with controlled light, the adults were able to mate and lay viable eggs after a blood meal in small cages (17" x 17" x 36" high and 12" x 12" x 36" high) without any further light control, an adjustment which has been reported by Hubert, Rush, and Brennan (1954). All the subsequent generations were raised under the latter condition.

The cages were kept in a room at about 80° F. and were supplied with moisture from a cloth wick drawn out from a water bottle. The adults were fed on apple slices, except when canaries were used for blood meals, which was done at irregular intervals for the purpose of obtaining fertile egg rafts. The larvae were fed on fresh yeast with occasional addition of Purina chow. The autogenous strain, now in its fifth generation, has been handled in the same manner, except that it does not require any blood meal for the production of viable eggs.

On September 21, 1955, 10 small egg rafts were found in a cage of adult *C. tarsalis* which had emerged around September 10 and had not had a blood meal. It was estimated that 150 larvae hatched, about 90 of which were reared to adults. The time from egg to the appearance of adults was 16 days. On the assumption that this autogenicity was due to a prolonged September hot spell, the adults were removed to an incubator at 91° F. for a second generation. In 15 days, however, all the adults died without laying any eggs.

The second appearance of autogenous eggs was observed in November 1955, but the resulting adults were too few in number to establish a successful sub-colony. There was no finding of autogeny throughout the year 1956. In November 1957, however, again 2 autogenous egg rafts were found; one on the 10th, and the other on the 13th. Each raft contained about 50 eggs, of which more than half were hatched. Taking this as the first autogenous generation, the subsequent generations were found on December 3 and 26, and on January 15 1958, with exactly 23 days between one generation and the next, except for the most recent complete (4th) generation, in which case the period was shorter by two days.

In all, 13 egg rafts were counted, with an average of 62 eggs per raft, and a range of 40 to 86. Hatching was 76.5 percent, ranging from 60 percent to 100 percent. Not included in the above figures were 4 rafts that failed to hatch; containing 41, 58, 61, and 94 eggs respectively. It is assumed that egg rafts failing to hatch were laid by unmated females, the same

incidence have also been found after a blood meal in the nonautogenous[2] strain.

The times required for the development of corresponding stages in the life cycle were about the same for the autogenous and nonautogenous strains. In both cases, the eggs and pupae took 2 days each, larvae took 11 to 15 days, and the males emerged one to 2 days earlier than the females. In the nonautogenous strain, the females took from 3 to 7 days to deposit eggs after a blood meal; and the period from blood meal to the appearance of the adult males was about 23 days, which was shorter by two days than that of the Rocky Mountain Laboratory colony (Brennan and Harwood, 1953).

However, the autogenous strain females laid fewer egg rafts, each raft contained fewer eggs, and the percentage of hatching was lower. In the nonautogenous strain, each female generally laid one egg raft after a blood meal, without which no eggs were laid at all, and each raft contained an average of 153 eggs, ranging in number from 101 to 191. Hatching averaged 88 percent, with a range of 71 percent to 92.6 percent.

It is evident that the number of eggs per raft in both our autogenous and nonautogenous strains is much lower than that found at Bakersfield by Bellamy and Kardos. This may be due to the differences in the food given to the larvae and the adults, to other differences in laboratory procedure, or to changes in the populations which have developed in the different environments.

An interesting finding in the autogenous strain was that the females laid very large egg rafts after a blood meal. The number of eggs in all the good sized rafts was above 200, the largest being 273, which was more than that of the largest raft of the nonautogenous strain. However, the percentage of hatching of these eggs was very low, ranging from 33 percent to 43 percent, less than half of those laid autogenously.

SUMMARY. A laboratory colony of *Culex tarsalis* Coq., maintained in Los Angeles since 1954, has been found capable of reproducing without a blood meal. As of the present date (February 15, 1958) an autogenous strain has been maintained since November 10, 1957, and is now in the fifth generation. A comparison is made of the biology of the autogenous and of the nonautogenous strains.

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[2] The term "nonautogenous" in this paper refers to the strain originally obtained in October 1954 and maintained since that time in this laboratory on blood meals. Inasmuch as autogeny occurred in September 1955, November 1955, and November 1957, it is possible that the autogenicity has been present for some time, but hidden in the nonautogenous strain.