separated by ultracentrifugation so they were thought not to be polymers. The solubilities were almost identical. The fractions could not be separated by starch column electrophoresis or subfractionation with cationic detergents. In the same report, 25 of 43 members of a family had bifid albumins. These were not associated with disease. The heterozygous state was transmitted as a codominant characteristic with complete penetrance. The anomaly was believed to be a mutation of the gene responsible for albumin synthesis. Anomalous albumin B was thought to have tyrosine, cysteine and lysine residues substituted for an equal number of carboxyl residues in normal albumin A.

In another report[4], a family was followed for 4 generations: the bifid albumin occurred as a dominant heterozygous character. In 3 successive generations, an unusual skin condition was observed in 3 of the 7 members of a family believed to be suffering from the protein dyscrasia. However, the other 4 members with bifid albumins had no dermatological condition.

The only other animal[5] in which this condition has been found is the chicken. Inbred Brown Leghorns, White Leghorns and Rhode Island Reds were examined and found to have 2 types of albumin patterns. Results of breeding experiments were consistent with a simple Mendelian inheritance of the 2 albumins and the 2 minor components. The author believed that the genetical relationship implied a chemical similarity between the albumins. A histidine residue was thought to be involved, since they migrated at different rates below a pH of 8 but at the same rate at pH's above 8.

The bifid albumins from a 15-week-old baby[6] could not be separated on Sephadex G-100 but could be separated by preparative polyacrylamide disc-electrophoresis. There was no difference found in the amino acid composition of the 2 albumins. There appeared to be no hereditary trait associated with this condition in this child or any clinical abnormality.

In another case[7], bifid albumins were demonstrated in serum, cerebrospinal fluid and urine of an epileptic girl as well as in 15 of the 36 investigated relatives.

Recently a bisalbuminemia was found in a chicken-quail hybrid[8]. This was considered to be a case of heterosis with the offspring having the 2 parental antigenic specifications. In the present case of the dolphin, an attempt is being made to characterize the 2 albumins both chemically and serologically. This is an interesting case of an anomaly with a very characteristic marker that might be useful from a breeding standpoint.

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Variation in the importance of acoustic stimuli in *Drosophila melanogaster* courtship[1]

L. Eastwood and B. Burnet

Department of Genetics, University of Sheffield, Sheffield S10 2TN (England), 9 October 1978

Summary. There is genotype-dependent variation in the importance to females of the courtship song relative to other male generated courtship stimuli.

Averhoff and Richardson[2,3] claim that auditory cues are non-critical in the courtship and mating of *Drosophila melanogaster*. This view has been criticized by Bennet-Clark, Dow, Ewing, Manning and von Schilcher[4] who cite evidence to the contrary. The antenna of *Drosophila* acts as an auditory receptor[5]. Movement of the funiculus is detected by Johnston's organ situated near the articulation with the pedicel. The branched arista, attached rigidly to the funiculus, serves to increase the surface receptive to air displacement. Amputation of the arista reduces the movement of the funiculus induced by air displacement and effectively deafens the fly[6]. The reception of auditory stimuli by the female may be blocked by this means, or by mutations causing loss of the female's aristae[7]. Alternatively the production of auditory signals may be suppressed by amputation of the male's wings[8]. The basis of Averhoff and Richardson's assertion in respect of auditory stimuli is that the male flies from which they had amputated the wings nevertheless mated successfully.

The courtship of *D. melanogaster* consists of a set of integrated behavioural elements[9,10], and males of different inbred lines differ in the proportion of courtship time spent in performing the individual elements of their courtship display[11]. The results reported here show that females differ in their readiness to mate when deprived of auditory stimuli during courtship.

Materials and methods. 3 inbred strains of *D. melanogaster* were used, Oregon-K, Pacific and Novosibirsk. Stocks were maintained and observed at a constant temperature of 25 ± 1 °C. The flies were sorted by sex within 12 h of eclosion and both aristae of half of the females of each genotype were removed using fine jewellers forceps. The aristae were removed cleanly, close to the funiculus, which was not damaged. 50 operated and 50 intact females of

Competitive matings between intact control and operated flies

Female	Male	n	Successful matings in 30 min	χ^2	p
Intact aristaless	Intact	75	67 intact 8 aristaless	46.4	<0.001
Intact	Intact wingless	50	29 intact 21 wingless	1.28	n.s.

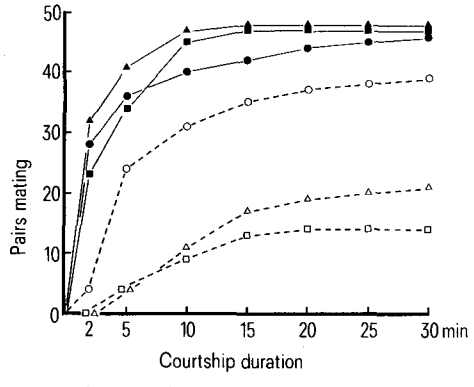
each genotype were paired individually with an intact male of their own strain 3-5 days after eclosion. Pairings were made in opaque plastic cells (19 mm diameter, 7 mm deep) fitted with transparent lids. Flies were transferred to the cells without anaesthetization. Courtship duration was timed from the male's first vibration bout until copulation, or for a period of 30 min.

The Novosibirsk strain was used for competition experiments. Aristae were removed from half of the females. The wings of half of the males were removed leaving only a stump. Flies were stored until 3-4 days of age. The competition experiments were as follows: 1 aristaless female and 1 intact female with 1 intact male (N=75); 1 intact female with 1 intact and 1 wingless male (N=50). There were thus 3 flies in each mating cell.

Results and discussion. The cumulative number of pairs of flies copulating within 30 min of the beginning of courtship are shown in the figure. The time to copulation of intact pairs is similar for all 3 strains, but there is considerable variation between genotypes in the receptivity of aristaless females. All females lacking aristae are less receptive than their intact sibs but the difference is not so marked in the Novosibirsk strain. Few deafened Novosibirsk females mate within two min of courtship but nearly half have mated by 5 min. In the Oregon-K and Pacific strains less than half of the deafened females have mated after 30 min of courtship although the intact females are as receptive as intact females of the Novosibirsk strain.

As Novosibirsk females appear to be less dependent than others on auditory stimuli competition experiments were carried out. The paradigms are given in the methods section. The results are shown in the table. When confined with a single male an intact female nearly always mates before an aristaless one. Wingless males are almost as successful as winged males in mating with an intact female. The difference is not significant.

Mating speed, which is an important component of fitness in *Drosophila*, comprises 2 major components; courtship latency, and the duration of courtship[10]. Shorey and Bartell[12], and Averhoff and Richardson[2], have shown convincingly that airborne chemosignals produced by female flies play a role in controlling the initiation of male courtship. More recently Eastwood and Burnet[13] described evidence suggesting that the production of such pheromones may depend on the physiological state of the female, and that there are genetic differences between males in their responses to them. Averhoff and Richardson[3] also claim that pheromones emitted by males are necessary for stimulating females to acceptance but the evidence so far is slight.



Courtship duration for intact males courting aristaless females (open symbols) and intact females (filled symbols). Circles = Novosibirsk, triangles = Oregon, squares = Pacific.

Courtship latency is terminated when the male begins his courtship, a prominent feature of which is the wing display when the male produces his courtship song[14]. These auditory signals have a dual function; for stimulating the female to her threshold of acceptance for copulation, and in enabling her to recognise a male of her own species. As shown here, females deprived of their sense of hearing do not mate as rapidly as intact females. This agrees with other evidence using arista mutants[7]. However, auditory signals cannot be the sole means by which a female is stimulated, otherwise aristaless females would not mate at all. There can be little doubt that the differences in the relative importance of auditory stimuli between the 3 wild type strains studied here are genetic in origin, and this suggests that disparity between the conclusions of different authors about the relative importance of auditory stimuli for female receptivity may arise from differences in the types of strain they happen to have chosen for their experiments. Even in a strain in which auditory stimuli seem least important their role is not negligible. Mating takes place more rapidly when females are able to perceive them and in a competitive situation it is the females which can hear that are first to mate. Averhoff and Richardson[2] are therefore correct in their assertion that auditory cues are not essential for *D. melanogaster* to mate, but the present experiments show that females deprived of such stimulation are likely to be at a considerable disadvantage. The outcome of the experiments in which winged and wingless males are competing for an intact female is in agreement with Averhoff and Richardson[2]. Neither male appears to be at a disadvantage, but this does not provide evidence against the primacy of the role of auditory stimuli. Both males are courting together, and the winged male is providing the wing vibration stimuli required by the female. Whichever male happens to be closest to the female's genitalia will usually be the first to attempt to copulate after the female has received sufficient wing vibration stimulation to reach her acceptance threshold. Hence the wingless males may appear to be as successful as the intact males in this situation.

These results show that auditory stimuli are important in promoting the rapid mating of *D. melanogaster* females. The severity of the effect of deafening females varies amongst genotype groups but, even in the strain least affected, deafened females are at a considerable disadvantage in competition with normal females. In this sense the ability of males to transmit and females to perceive auditory signals has a direct relationship to fitness.

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