Drapeau, Mark D., and Anthony D. Long. 2000. The Copulatron, a multi-chamber apparatus for observing *Drosophila* courtship behaviors. *Dros. Inf. Serv.* 83: 194-196.

The Copulatron, a multi-chamber apparatus for observing *Drosophila* courtship behaviors.

Drapeau, Mark D., and Anthony D. Long. Department of Ecology and Evolutionary Biology, University of California, Irvine, CA, 92697.

When studying behaviors, an experimenter should control as many aspects of the physical environment as possible. This is because behaviors, in general, are especially sensitive to the environment, making them relatively difficult to study. In addition, courtship and mating behaviors are difficult to study because by definition they involve studying the interaction between two sets of behaviors – those of males and those of females. Hence, the simplest case is that of a single male courting a single female. Recently, we have become interested in studying such 1_:1_ behavioral interactions, and we designed an apparatus within which we can observe numerous such interactions while at the same time controlling many aspects of the environment. This apparatus, called the "Copulatron", also has additional helpful features, which are outlined below. Its primary advantage is that it offers multiple identical mating chambers, unlike many mating arenas described in the literature, which have only a single chamber (*e.g.*, Elens and Wattiaux, 1964; McRobert and Tompkins, 1985; Welbergen, 1991). Having multiple chambers is advantageous for experi-ments where high sample sizes are needed, such as in the field of quantitative genetics.

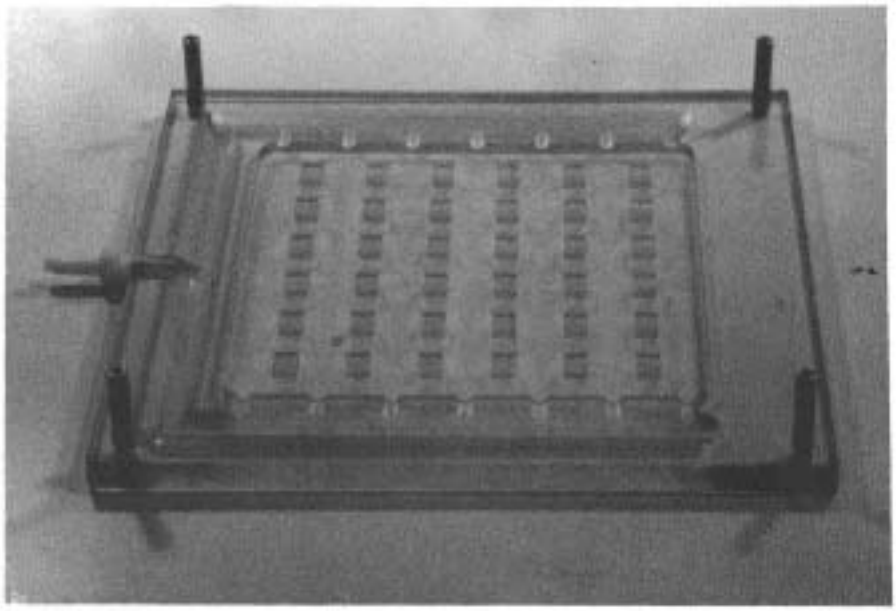

Figure 1. Top view of the Copulatron base. The Copulatron is 11" × 11" square. Note the four metal posts at the corners, which the other pieces of the Copulatron are fitted over. The interior of each post is grooved so that a screw can be fitted through all pieces of the Copulatron and screwed into the base (see Figure 3). Note also the lightly-colored plastic spout on the left, which allows CO_2 to flow into the chambers through the base. Finally, note the 36 cubic columns on the base of the Copulatron, which provide overall support for the upper structure.

We designed an apparatus which met the following design require-ments: (1) multiple identical small chambers within which mating could occur and be observed either by eye or with the aid of a video camera, (2) chambers which could hold fly media such that flies could be left in chambers to

recover from handling for 24 hours, or even more, without starvation, (3) partitions to separate males from females during such recovery periods, and (4) ease of retrieving flies after an experiment for freezing and later molecular analysis.

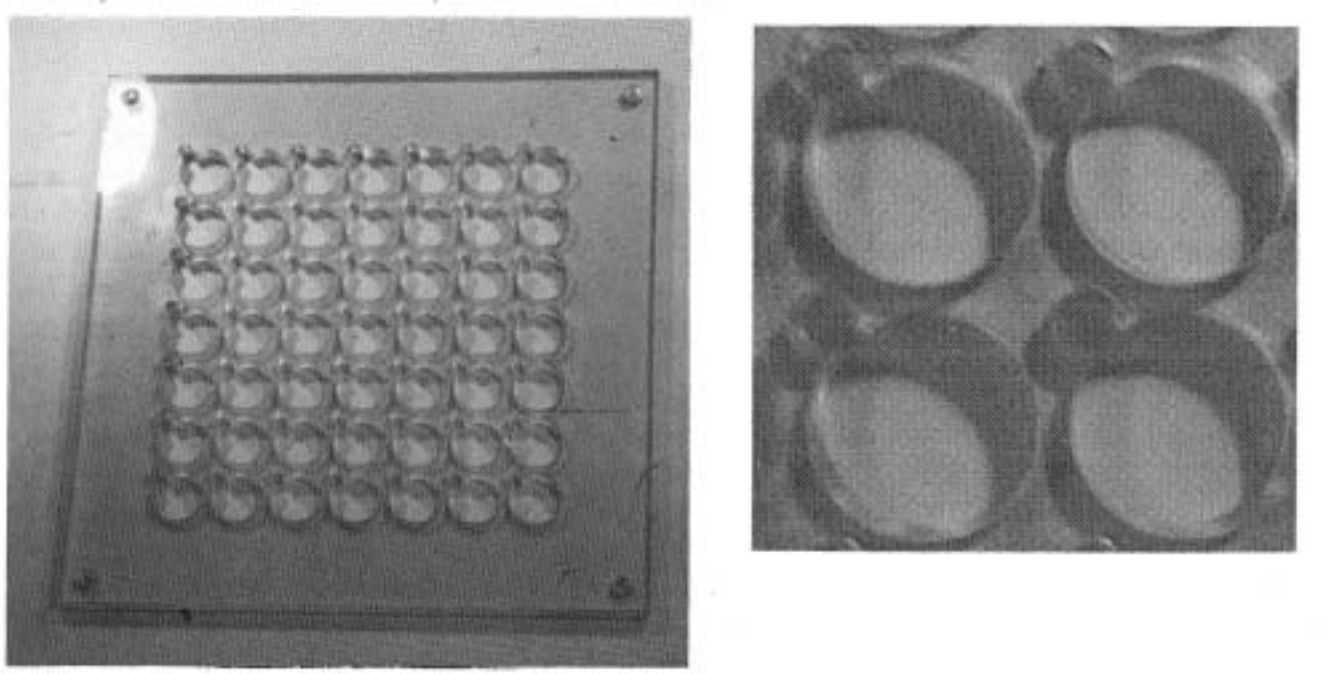

Figure 2. A, Top view of one of two pieces of the Copulatron which contain the mating chambers. Note the four holes in the corners which allow the metal posts from the base to be fitted through (see Figure 1). The smaller inner holes allow extra screws to be utilized. The piece is 11" × 11" square. B, Close-up view of four mating chambers from Figure 2A. Note the small antechamber, within which fly media can be placed. The diameter of each mating chamber is approximately 1-inch, and the diameter of each antechamber is approximately 1/4 -inch.

We fabricated the Copulatron pieces out of plexiglass, except where noted. The base is 11" × 11" square and 1 cm thick (Figure 1). We wanted the base to be in essence a large CO_2 platform, such that we could pump CO_2 through it into the mating chambers at the end of an experiment in order to anesthetize the flies and subsequently easily retrieve them for freezing. We drilled tunnels through the plexiglass while leaving "support beams" which supported the rest of the Copulatron. These tunnels ultimately culminate in a spout, which can be attached to a hose, which can be attached to a CO_2 tank. Four metal "posts" with entry points for screws are attached to the four corners of the base. A thin surface of porous polyethylene is then fitted over the four posts. This allows the CO_2 to pass through into the mating chambers. Next, two identical pieces were made (Figure 2). Each was 11" × 11" and 1 cm thick. 49 circular chambers were then drilled through each such that they matched up with each other on the two pieces. Each hole is approximately 1" diameter. Next to each 1" mating chamber, a _ inch-diameter "antechamber" was drilled such that its edge slightly overlapped that of the main 1" chamber. These _ inch chambers are the chambers which can hold fly media. Each of these two square pieces also has a hole drilled in each corner which is aligned with each of the four base posts. Finally, two narrow pieces are fitted over the two matching 11" × 11" pieces, each over two base posts. These each have a groove on the inside so that they can hold a thin sheet of glass, which covers the 49 chambers. The entire apparatus is fitted together through the base posts by the use of 4 washers and 4

screws (Figure 3). We utilize a heavy-duty darkened plastic sheet fitted between the two middle pieces in order to separate males from females during recovery periods. This film is often lubricated in order to facilitate removing it at the start of an experiment, because antechamber-based food will tend to stick to the film.

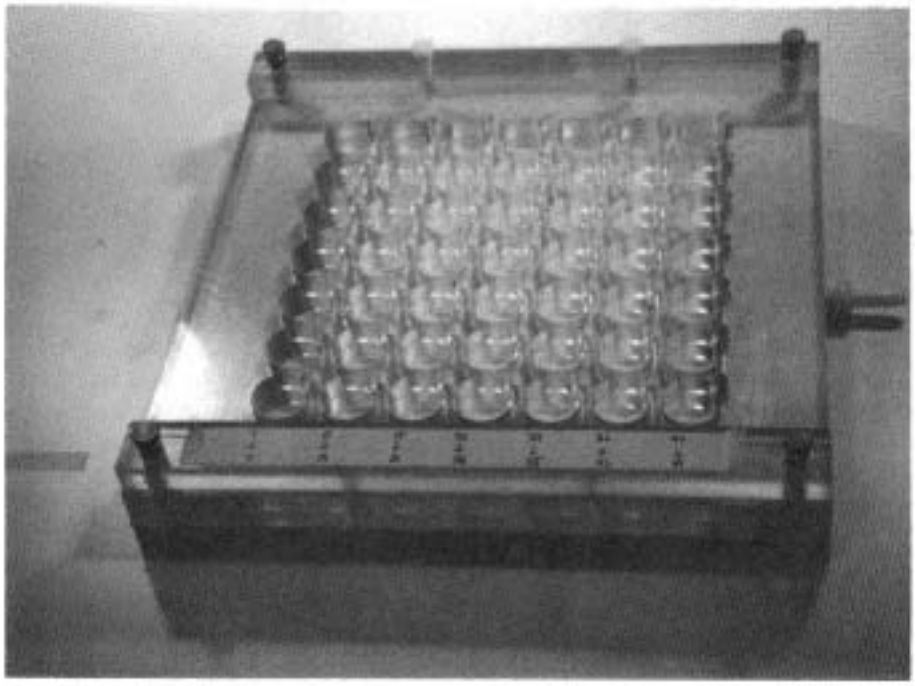

Figure 3. The fully-constructed Copulatron (minus top glass sheet).

Many variations on the device described here can be constructed. For instance, the Copulatron could be made larger so as to incorporate more chambers, or the middle pieces could be made thicker or thinner depending on the experimenter's target chamber size. A gadget like the Copulatron should prove useful for studying courtship or other behaviors of not only *Drosophila*, but also other insects. With some ingenuity, it could also be slightly modified to incorporate experiments on host-parasite interactions, for instance.

Acknowledgments: We thank the NIH for funding which made this project possible, and Rudy Limburg in the Biological Sciences Machine Shop at the University of California – Irvine for assisting with design and construction of the Copulatron.

References: Elens, A.A., and J.M. Wattiaux 1964, Dros. Inf. Serv. 39: 118-119; McRobert, S.P., and L. Tompkins 1985, Dros. Inf. Serv. 61: 194; Welbergen, Ph. 1991, Dros. Inf. Serv. 70: 262-263.