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An Apparatus for Recording the Activity of Small Terrestrial Animals

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INTRODUCTION

During the past five years we have had considerable success in recording the spontaneous locomotor activity of land crabs (see Bliss, 1960; in press) by use of the apparatus described herein. Because this apparatus can readily be adapted for use with other small terrestrial animals or, following appropriate modification, for use with semi-terrestrial and aquatic forms as well, we are presenting this detailed description.

In the development of this apparatus, we acknowledge the contributions of Dr. Wilbur H. Sawyer, who suggested its original basic design; Mr. Robert Chapman, who designed and constructed the Plexiglass activity chambers and the system of recording lever and pen; Mr. Herman Otto, who made certain modifications in the activity chambers; Mr. Rudolph Bonen, who provided advice and assistance regarding electrical circuits; and Dr. John Gorrell, who offered suggestions of various sorts from time to time. We also gratefully acknowledge the support of the National Science Foundation through research grants NSF G-4006 and NSF-G11254.

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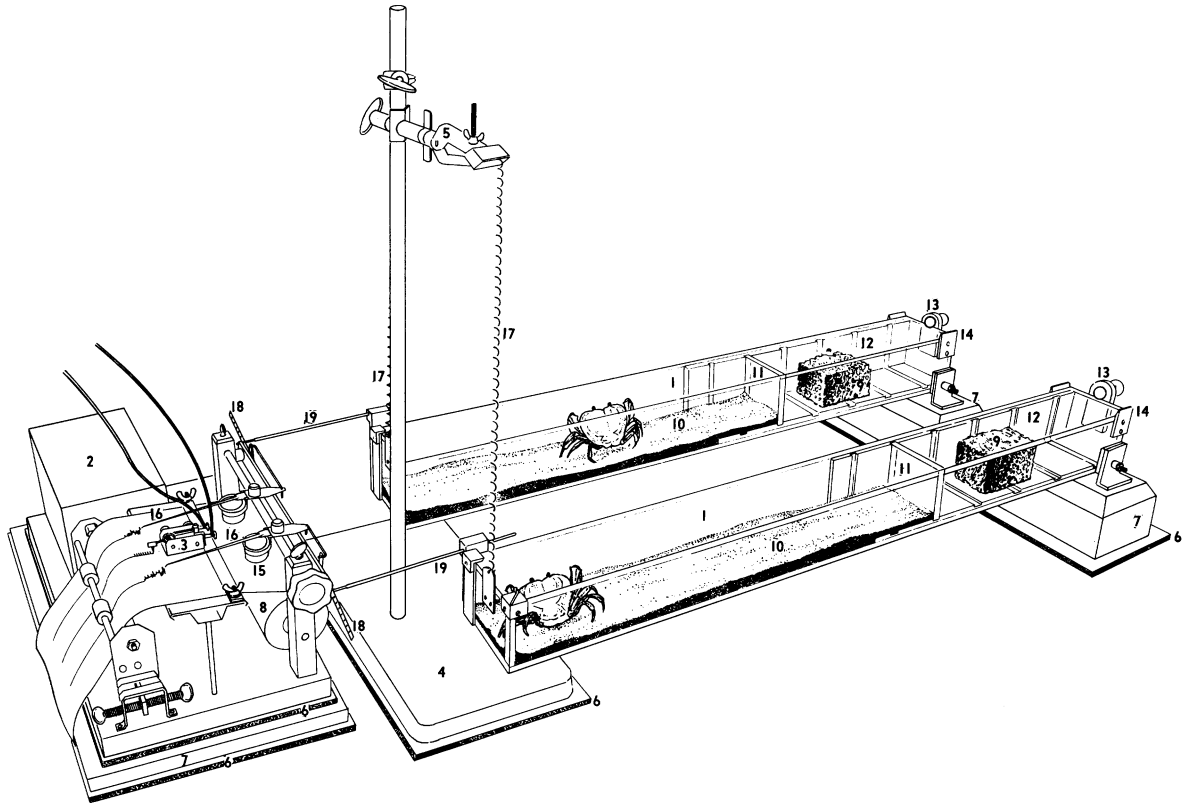

FIG. 1. The recording apparatus. 1. Activity chamber. 2. Gorrell Junior Rekorder, Type "B." 3. Harvard signal magnet. 4. Support stand. 5. Clamp. 6. Sponge rubber. 7. Wooden block. 8. Roll of charting paper. 9. Damp sponge. 10. Damp sand. 11. Vertical divider. 12. Holder for vertical divider. 13. Spring clamp. 14. Cover guide. 15. Ink reservoir. 16. Recording pen. 17. Steel spring. 18. Recording lever. 19. Connecting rod.

DESCRIPTION OF APPARATUS

There are two principal portions of this apparatus: a plastic activity chamber, and a Gorrell Junior Rekorder, Type "B" (Electronic Associates, Inc., Long Branch, New Jersey). The activity chamber consists essentially of a covered rectangular box constructed of quarter-inch Plexiglass, with dimensions approximating either 24 inches by 4 inches by 4 inches, or 24 inches by 3 inches by 3 inches. With the smaller dimensions, the maximal cubic capacity of the chamber is slightly more than one-half of that of a chamber having the greater dimensions.

In practice, we line up two chambers side by side, as shown in figure 1 (both chambers pictured are of the smaller dimensions). One end of each chamber is supported by an individual wooden block (8 inches by 3⅜ inches by 3⅜ inches), and the other end hangs by a steel spring from a clamp attached to a support stand. When the spring is properly adjusted, the free end of each chamber can move independently up and down in response to movements of the animal back and forth within the chamber.

An aluminum connecting rod with brass tip is mounted on the free end of the activity chamber (fig. 2D) and links the chamber with a recording lever attached to the Gorrell Junior Rekorder. A mechanism, similar in principle to one described by Brown (1954), then converts the separate vertical movements of each recording lever into horizontal movements of the individual recording pens (fig. 2A). Each pen carries a liberal supply of ink (Foxboro General Purpose Red Ink, Type 1500, Foxboro Co., Foxboro, Massachusetts) in its own light, plastic reservoir (figs. 1 and 2B).

The Gorrell Junior Rekorder provides a wide choice of speeds for drawing the paper (Simplex Charting Paper, 6 inches wide, diameter of roll 3 to 3½ inches; Electronic Associates, Inc.) past the tips of the two recording pens. We have found a speed of either 2 inches of charting paper per hour or 4 inches per hour to be most satisfactory. A signal magnet (No. 320, Harvard Apparatus Co., Dover, Massachusetts) draws a time base line on the paper and marks off selected intervals of time. We have been using an interval timer that consists of a motor-driven cam and microswitch (Industrial Timer, Model No. CM 7, Electro-Tech Equipment Co., New York, New York) to activate the signal magnet at intervals of 30 minutes. A diagram to show how such periodic activation of the signal magnet is accomplished appears in figure 2E.

Several details regarding the activity chambers are important. Since an animal can be fairly active when in a position almost directly over the fulcrum without deflecting the chamber and thus the recording pen to

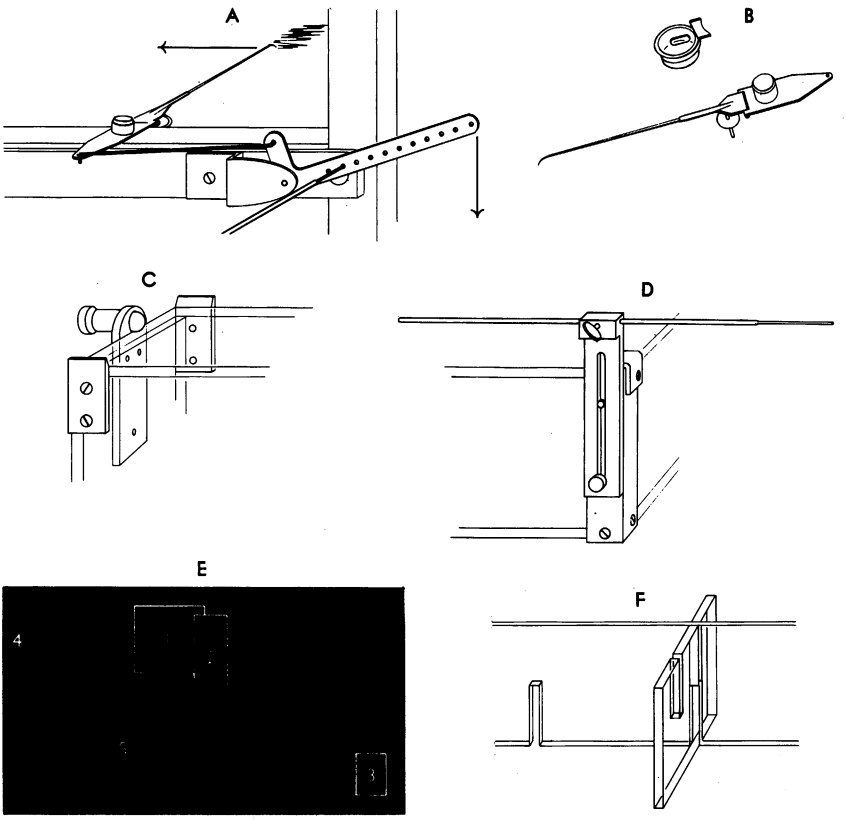

FIG. 2. Details of the recording apparatus. A. Mechanism for converting vertical movement of activity chamber and recording lever into horizontal movement of recording pen. B. Recording pen and ink reservoir (not attached). C. Spring clamp and side guides for holding cover of activity chamber. D. Adjustable holder containing connecting rod that links activity chamber to vertical recording lever; behind holder, a clamp for securing cover to activity chamber. E. Diagram showing means whereby signal magnet is periodically activated: 1. Motor-driven cam. 2. Microswitch. 3. Signal magnet. 4. Line power supply (110 volts A.C.). 5. Power supply to signal magnet (5 volts D.C.). F. Adjustable dividers for varying the usable portion of an activity chamber.

any large extent, we use a Plexiglass vertical divider to restrict the animal to the two-thirds of the activity chamber farthest from the fulcrum (fig. 1). This divider is movable, being supported by a Plexiglass frame allowing a choice of five different positions for the divider. In activity chambers of the larger dimensions, we use vertical dividers that run not only across the chamber but also along its length (fig. 2F). By proper placement of

these dividers, we can reduce the usable space of a large chamber so markedly that it becomes in effect a much smaller activity chamber.

A Plexiglass cover is firmly secured on each activity chamber by means of two fixed clamps at the free end of the chamber (one such clamp appears in fig. 2D) and a spring clamp and two cover guides (fig. 2C) at the end of the chamber over the fulcrum. During use of the chamber, a damp sponge rests in the portion of the chamber nearest the fulcrum, and damp sand is present in the section containing the animal (fig. 1). The cover of the chamber has two small holes so arranged that incoming air flows over the damp sponge, thereby gaining moisture. For the well-being of land crabs, high relative humidity is essential.

SUMMARY

An apparatus that has been used for recording spontaneous locomotor activity in land crabs is described. This apparatus seems adaptable for use with other small terrestrial animals and also, with modification, for use with semi-terrestrial and aquatic forms. Basically, the apparatus consists of a Plexiglass rectangular activity chamber (24 by 4 by 4 inches or 24 by 3 by 3 inches) with Plexiglass cover and with divider to keep the animal in the two-thirds of the chamber farthest from the fulcrum. A longitudinal divider can further reduce the usable space of the chamber for work with very small animals. The chamber is attached to a wooden block at one end and hangs suspended by a steel spring at the other end. Movements of the animal within the chamber displace the free end of the chamber and the displacements are registered on a Gorrell Junior Rekorder through recording lever and pen. A signal magnet, activated through an interval timer, marks 30-minute intervals on a time base line.

LITERATURE CITED

Bliss, Dorothy E.

1960. Locomotor activity of land crabs during the premolt period. Science, vol. 132, pp. 145–147, figs. 1, 2.

[In press.] Neuroendocrine control of locomotor activity in the land crab, *Gecarcinus lateralis*. Mem. Soc. Endocrinol., no. 12.

Brown, Frank A., Jr.

1954. Simple, automatic, continuous-recording respirometer. Rev. Sci. Instruments, vol. 25, pp. 415–417, figs. 1–4.