dose of morphine that gave approximately the same degree of support. Thus codeine 9.6 mg/kg gave very little support and was approximately equivalent to 0.46 mg/kg morphine.

Non-opiate drugs were able to attenuate the abstinence syndrome to a varying degree, but by consideration of the total behavioural pattern, these drugs could be distinguished from opiates.

Full details of the results (which are only summarized in Table 1)—including the time course of appearance of the various parameters measured—will be presented at this demonstration.

A simple device for measurement of respiratory rate in the mouse

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This technique allows a rapid and accurate measurement of respiratory rate in the mouse. The animal's snout is held into the barrel of a 5 ml plastic syringe cut to a length of 2 cm. A bead thermistor, heated to ≏10°C above ambient temperature, is fitted into the luer inlet/outlet of the syringe thus sensing change in temperature due to breathing (see Figure 1). The electronic unit contains circuitry which shapes and filters the signal derived from the thermistor to produce an on/off cycle for each respiratory cycle. This operation is independent of rate and depth of respiration. The operation of this circuitry is signalled by a flashing indicator. Pressing the 'start' button then initiates the digital part of the circuit. After this initiation, the first signal from the thermistor starts, and the eleventh stops, a counter which is clocked by 10 ms pulses derived from the a.c. mains. On the eleventh count, a digital display illuminates and reads, actually the number of clock pulses received in ten respiratory cycles but, effectively, the mean respiratory interval in milliseconds. This reading remains displayed until the next measurement is initiated by again pressing the 'start' button. An

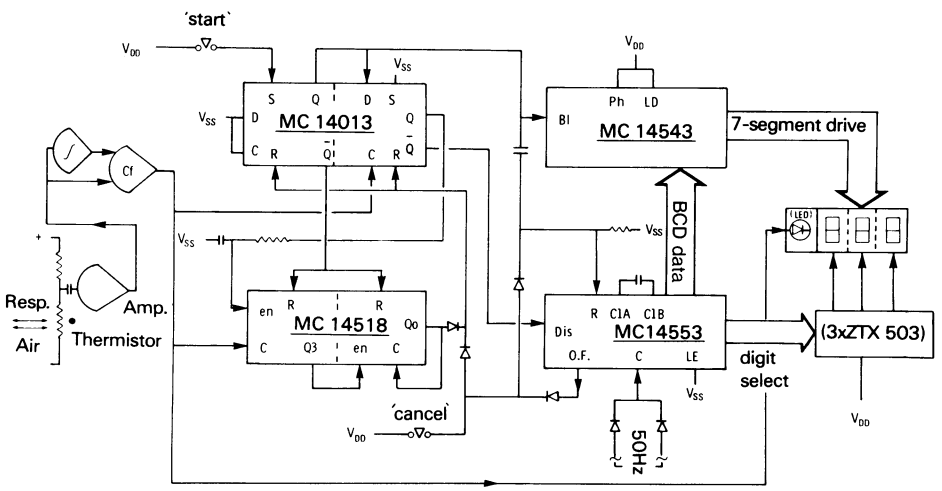

Figure 1 Circuit diagram for measurement of respiratory interval in mice. Motorola CMOS Integrated Circuits: MC 14013, dual D type flip-flop; MC 14518, dual BCD counter; MC 14543, BCD-seven segment driver; MC 14553, 3-digit BCD counter.

additional 'cancel' button enables any reading to be aborted and the counters to be re-set to the initial condition.

The mean respiratory interval obtained with 50 untreated mice was 281 ± 4.96 ms (mean ± s.e. mean). This corresponds to a mean respiratory rate of 213/minute. For most purposes pre- and post-drug respiratory intervals are recorded and it is therefore not necessary to convert the respiratory interval to a rate/minute.

Simultaneous recording of electrical and mechanical activity from intestinal and vascular smooth muscle

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The simultaneous measurement of mechanical and intracellular electrical activity of smooth muscle is difficult because the cells are small and easily damaged during microelectrode impalement. Mechanical activity may increase cellular damage and also result in electrode displacement.

A method for the long-term recording of mechanical and intracellular electrical activity has been described by Golenhofen & v. Loh (1970). With this technique, the section of the preparation to be impaled is stretched to limit movement whilst the remainder is held under normal tension and this allows continuous recordings of up to 60 min to be made (Golenhofen & Weston, 1975). However, a limitation of this method is that once the preparation is attached to its holder, no further adjustment of the degree of stretch can be made. Modified holders for intestinal and vascular smooth muscle have now been developed to overcome this limitation (Figure 1).

The conical holder (Figure 1a) was developed primarily for use in portal vein and is inserted into the hepatic end of the vessel. The vein is then removed from the animal and placed in Krebs solution at 37°C. The tissue is observed under a binocular microscope and if movement in the region to be impaled is visible, the degree of stretch can be increased by turning the screw (s) until movement is reduced. Finally, the tissue is tied to the holder at the groove (g) using fine thread. The other holder (Figure 1b) is designed for use with flat sheets of muscle e.g. guinea-pig taenia coli. Here the tissue is tied to the holder and subsequent adjustment of stretch made again by adjustment of screws (s).

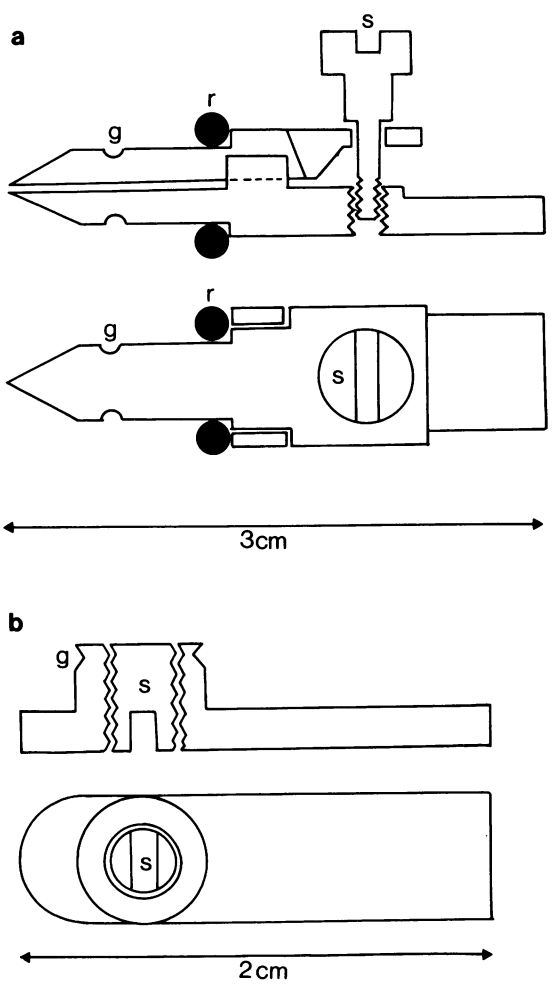

Figure 1 Tissue holders for the simultaneous recording of mechanical activity and transmembrane potential of smooth muscle cells. s=screws for adjustment of tissue stretch, r=rubber ring holding jaws of cone closed, g=grooves to accommodate tissue-fixing thread.