blue and 4 ml. acidic saline excreted adrenaline 0.31 ± 0.03 μg/kg and noradrenaline 1.30 ± 0.08 μg/kg (values not corrected for losses in recovery).

Cocaine (15 mg/kg), piperoxane (4 mg/kg) or phenoxybenzamine (4 mg/kg) further increased the excretion of adrenaline and noradrenaline, but a significant increase was not obtained with desipramine (15 mg/kg). Reserpine (1 mg/kg given intravenously immediately before the collection of urine) caused a 5-fold increase in the excretion of adrenaline, but the output of noradrenaline was reduced.

It appears that tests for anti-inflammatory activity that stress the animals, are liable to give false positive results with substances which potentiate and/or release endogenous catecholamines.

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The effects of isoprenaline, atropine and disodium cromoglycate on ciliary motility and mucous flow measured *in vivo* in cats

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Lung clearance mechanisms, such as ciliary motility and mucous transport, form an essential part of the body's defence against air pollutants. We have used the method of Dalhamn (1960), originally devised for studying tobacco smoke and toxic gases, to examine the effect of isoprenaline, atropine and disodium cromoglycate, which are administered therapeutically by inhalation, on ciliary motility and mucous transport in the trachea of anaesthetized cats *in vivo*.

After dissecting the trachea free, a small " window " was cut in the ventral surface so that the inner ciliated surface could be viewed using a Leitz 'Ultrapak' microscope. The trachea was made air tight by means of a special rubber tube and bellows linking the trachea with the lens of the microscope, so that the ciliated surface could be seen through the " window." The advantage of this method is that there is minimal disturbance of intratracheal conditions. The animal breathes normally and heats and humidifies the respiratory air.

Cell debris and air bubbles, trapped in the mucous blanket, were used as markers to measure directly mucous flow rate. Ciliary movement could be seen on the edge of a highlight caused by the reflection of incident light by the cilia. This movement was filmed with a high-speed cine camera through the microscope at 200 frames/sec.

Projection of this film at normal speed enabled counts of ciliary beat rate to be made. The compounds were applied topically to the surface of the ciliated epithelium in 0.01 ml. saline (0.9%) delivered from a micrometer syringe through the rubber connection. Readings of ciliary activity and mucous flow route were taken 10 and 20 min before application of physiological saline alone or containing test compound and at 10, 30 and 60 min afterwards.

We found that isoprenaline (25 μg) increased the mucous flow (from 13 to 23 mm/min) and the ciliary rate (from 960 to 1,120 beats/min). Maximum responses were observed at 10 min. Atropine (0.25 μg) decreased the mucous flow (13 to 7 mm/min) and the ciliary activity (860 to 635 beats/min); maximum effects were seen at 30 min. Saline (0.9%) alone had little effect on mucous flow (14.3 to 12.4 mm/min) or ciliary rate (802 to 793 beats/min). Disodium cromoglycate (500 μg) was similarly innocuous (mucous flow 12.1 to 10.4 mm/min, ciliary rate 836 to 781 beats/min, $P>0.05$). Atropine had similar effects in the standard method of frog's oesophagus *in vitro*. Isoprenaline, however, had no action in this preparation in concentrations up to 10^{-4} g/ml.

The increase in mucous flow rate and ciliary activity produced by isoprenaline may contribute to its beneficial properties in that in addition to its bronchodilator action, it may increase the rate of lung clearance of mucus.

We thank Professor Tore Dalhamn for discussions on the various technical aspects involved in the method.

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A simply constructed, low-cost mechano-electrical transducer

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A transducer is described which has the advantages of thermal stability and low cost not found with semiconductor type strain gauges. The transducer has been

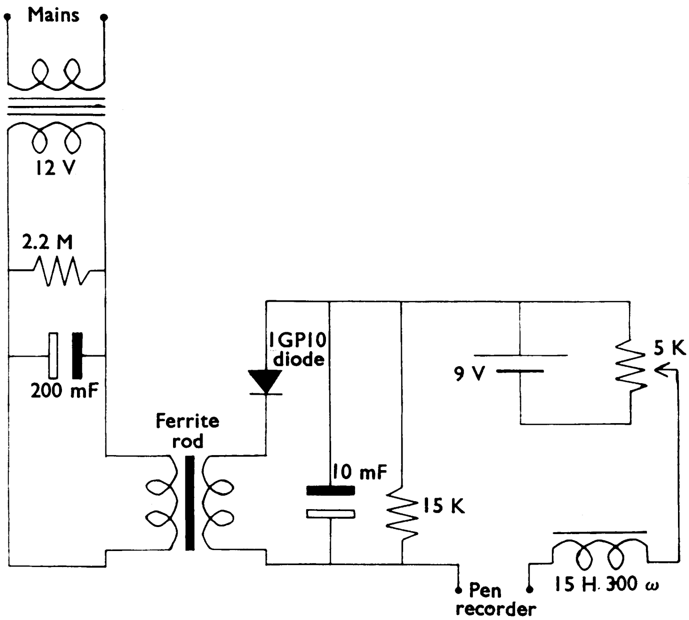

FIG. 1. Electrical circuit.