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## Evidence that nitrous oxide can maintain anaesthesia after induction with barbiturates

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Russell (1973) has shown that nitrous oxide alone cannot induce satisfactory anaesthesia in cats.

In H. B. Barlow's Laboratory at Berkeley, before nitrous oxide was used with muscle relaxants, three cats were prepared under short-acting barbiturate (sodium thiamylal: approximately 25 mg/kg) as if for electrophysiological recording, and allowed to breathe normally 75–80% $N_2O$/20–25% $O_2$ through a tracheal cannula. Blood pressure and reflex responses were monitored for 24 hr. There was no indication of pain, only a weak withdrawal reflex and no organized struggling against the stereotaxic instrument. Nitrous oxide was subsequently used with relaxants.

We repeated these experiments with some refinements. Three cats were prepared under short-acting barbiturate (Brietal sodium: approximately 30 mg/kg, given I.V., as required, over about 1·5 hr). Each cat was then paralysed by continuous infusion of Flaxedil (7·5 mg/kg.hr) and artificially ventilated with 80% $N_2O$/19% $O_2$/1% $CO_2$. The electroencephalogram, electrocardiogram and expired $P_{CO_2}$ were monitored throughout the ensuing neurophysiological experiment. Maximum $P_{CO_2}$ was held at 4%.

Apart from a reduction in e.e.g. spindling there was no discernible change throughout the 30–32 hr of the experiments. Even a firm pinch to the forepaw failed to desynchronize the e.e.g. However, desychronization did occur if the concentration of $N_2O$ was reduced to 65% but did not if it was raised again to 80% (Fig. 1).

After 28–29 hr relaxant infusion was stopped: 1–2 hr later each cat was able to breathe the $N_2O$ mixture for itself. In this unparalysed state the animals were still adequately anaesthetized, having very little spontaneous movement and only a weak withdrawal reflex (Fig. 1E). Finally, after 30–32 hr, a light dose of Brietal (3 mg/kg) did not affect the e.e.g. although larger doses did cause barbituarate spindling.

We conclude that, after 1·5 hr of surgical anaesthesia maintained with Brietal, 80% $N_2O$ can *maintain* anaesthesia for neurophysiological experiments. However, 65% $N_2O$ is definitely inadequate and e.e.g. monitoring is essential.

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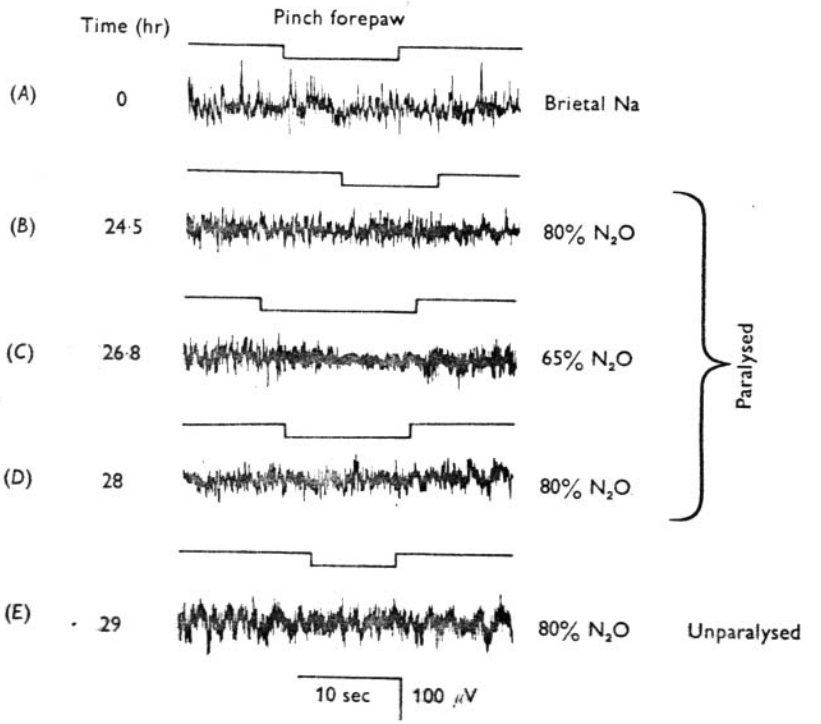


Fig. 1. (*A*) E.e.g., showing barbiturate spindling, immediately before terminating intravenous infusion of Brietal sodium, with the cat breathing naturally. The e.e.g. was recorded from two stainless-steel screws inserted into the skull over the occipital cortex. The marker above each record shows a period of sharp pinching of the right forepaw. The scales at the bottom of the figure are time and amplitude calibrations.

(*B*) E.e.g. 24·5 hr after switching to 80 % $N_2O$ and paralysing the cat by relaxant infusion.

(*C*) E.e.g. 26·8 hr after paralysis but with the $N_2O$ concentration reduced to 65 %. The pinch produced clear desynchronization.

(*D*) E.e.g. at 28 hr, 1 hr after raising the $N_2O$ to 80 % once again. Pinching now produced no desynchronization.

(*E*) E.e.g. at 29 hr, 1 hr after terminating the relaxant infusion. The cat was breathing the 80 % $N_2O$ mixture for itself with no artificial respiration.

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## REFERENCE

RUSSELL, W. J. (1973). *J. Physiol.* **231**, 20–21*P*.