

CORRESPONDENCE

Zahaby *et al.* failed to extend epinephrine facilitation of learning under anesthesia to a situation of differences in species of subjects, type of anesthetic, depth of anesthesia, type of training, and nature of the behavioral assay of learning. Moreover, authors would be alerted to the distinction between an attempted replication and an attempted extension and thus be less likely to be concerned by failures to replicate that are more apparent than real. The result would be to reduce or preferably avoid confusion and obviate the need for communications such as this letter. The focus then could be on understanding the phenomenon of learning under anesthesia.

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In Reply:—Thank you for giving us the opportunity to respond to Weinberger and Gold's letter. We apologize for not citing the article by Gold *et al.*¹ and for underestimating the durability of conditioned fear. When we stated² that "... we could not replicate the essential aspects [italics added] of one study [referring to Weinberger *et al.*]³," it was apparent that, although both groups used classic conditioning paradigms, our results were different, and we could not replicate learning and memory during anesthesia. Weinberger and Gold suggest that we should have used the term "extension" rather than "replication." We have no objection, if this leads to better clarity for the reader. Weinberger and Gold expand on the differences between the two studies, which we have cited in our paper, but these differences cannot account for, in our opinion, the startling differences in the results, *i.e.*, epinephrine enabling learning in anesthetized subjects but failing to do so in subjects receiving subanesthetic doses. Rabbits

are more resistant than rats to the effects of anesthetics; enhancement of learning and memory by epinephrine should be more apparent with subanesthetic rather than anesthetizing doses, and a shorter retention interval should favor a more durable memory.¹ Even if fear conditioning is acquired more rapidly than the nictitating membrane conditioned response, our use of six training sessions and 360 training trials *versus* 1 and 10, respectively, by Weinberger *et al.* should mitigate any contribution of the different behavioral assays of conditioning in the two studies to the differing results. Weinberger and Gold suggest that the doses of epinephrine used may explain our different findings. This is unlikely. A look at figure 5² shows that we obtained the same pattern of enabling effects of epinephrine doses as Weinberger *et al.*, *i.e.*, 0.01 mg/kg epinephrine producing a better effect on learning than 0.1 mg/kg. Therefore, the use of larger doses could not have improved our results. We also had limited preliminary

results using Sus-Phrine epinephrine, which suggested that smaller doses of epinephrine might not be effective in enabling learning in isoflurane-treated animals.

Finally, investigators in the area of learning and memory during anesthesia stress the importance of replication of earlier studies in this field.^{4,5} To quote from a recent correspondence on the subject,⁵ "Without replication and given the number of negative findings, all evidence for memory during anaesthesia may always be interpreted as chance findings." It is, therefore, our sincere hope that Weinberger and Gold and other talented researchers will *extend* the results of the two studies referred to in these letters using a *stable anesthetic concentration of a drug currently used in clinical practice*.

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Hazard of Small-gauge Needles

To the Editor:—Awareness of needlestick hazards has led to recommendations prohibiting "two-handed" recapping of needles.¹ Despite this, healthcare workers continue to recap needles for a variety of reasons. When preparing for cutaneous anesthesia before an invasive procedure in an awake patient, the usual practice is to aspirate a local anesthetic solution into a syringe and recap the needle to ensure sterility before its use. Recapping the 25- or 26-G needle used to administer cutaneous local anesthetic appears to be associated with an unusual form of needlestick injury.

A pilot survey of 100 anesthesiology residents revealed that approximately 50% of respondents reported needlestick injuries produced when small-gauge needles pierced the cap during two-handed recapping (*ASA Newsletter*, October 1992). A subsequent survey covering blood-borne exposures was distributed to 67 anesthesia residency training programs. From September 1992 through February 1993, 912 surveys were returned from 26.8% of residents in 51 residency programs. These data indicated that 456 residents (50% of all respondents) had experienced needlestick injuries from a small-gauge needle piercing the cap, and 122 (122/456, 27%) had injuries with contaminated small-gauge needles.

To determine why small-gauge needles (25- or 26-G) frequently penetrated the cap during recapping, a laboratory simulation was devised to compare the force required to cap two brands of small-gauge needles with that necessary to pierce the needle caps. A spring scale was modified with a Luer-lock adaptor, and a recorder was connected to measure the maximum force applied as a 25-G (Sherwood Medical) or 26-G needle (Becton Dickinson) was pushed into its cap. First, the force required to cap the needles was measured with the needles properly seated in the cap. These measurements were compared to measurements obtained when the needle pierced *the side of the cap*. The readings on the scale (ounces) were recorded

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for each trial, and the two measurements with each brand of needle were compared using a *t* test. (The measurement of ounces is directly related to the force applied to the needle.)

The mean "force" required to properly cap the 26-G needle was 41.5 ± 5.0 (mean \pm SD) ounces ($n = 10$), which was not significantly different from that required to pierce the cap, 41.9 ± 2.0 ounces. Therefore, when a practitioner applied the appropriate force to properly recap the 26-G needle, it would be sufficient to pierce the cap.

Subsequent to the time of the resident survey, Becton Dickinson began manufacturing and distributing a cap with a different composition for their 26-G needles. When similar testing was performed on the newer version of the cap, it was found that the force required to pierce the cap was 66.7 ± 4.1 ounces ($n = 10$) whereas that necessary to appropriately seat the needle in the cap was 30.8 ± 1.3 ounces ($P < 0.0001$). The change in design had resulted in a needle cap that requires a greater force to pierce than to properly apply the more "puncture-resistant" needle cover. With similar testing of the 25-G needle the force required to pierce the cap, 34.6 ± 5.2 ounces ($n = 8$), was significantly greater ($P < 0.0001$) than that necessary to seat the needle in the cap, 17.1 ± 2.2 ounces.

Historically, needle caps or shields were intended only to maintain sterility of the needles during transport from the manufacturer and not a safety device to prevent needlestick injuries during multiple uses. The initial cap material permitted the 26-G needle to penetrate it at a force that did not differ from that used routinely for recapping. By requiring a greater force to pierce the cap, the new construction of the Becton Dickinson product should result in a decrease in needlestick injuries *via* this mechanism and is comparable to the cap on the Sherwood Medical 25-G needle.

The best approach for preventing needlestick injuries is to avoid