offered by neuro-physiology would appear to be more favourable in the more complete understanding of this and similar problems.

Dr. Mushin, if I remember correctly, at the meeting of the Anesthetic Section of the Royal Society of Medicine, at which this matter was considered, commented upon the fallacy of intercostal paralysis as a sign of deepening anaesthesia and mentioned that the idea was also held by Snow and Clover in the past, and thought that the sign could not be so easily dismissed on the grounds presented.

It might be stated in reply that such celebrities would have been quick to admit that the basis of their observation, founded as it was upon the anatomical convention of intercostal action, was not supported by surgical demonstration, had this been available to them.

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INTRAVENOUS PETHIDINE IN ANAESTHESIA

Sir,

Dr. Pearce's interesting paper "Intravenous Pethidine in Anaesthesia", appearing in your issue for last October, refers to a practice which is followed by many anaesthetists, but which—I submit—is wrong.

Dr. Pearce states: "In the earlier part of this series relaxants were used only when specifically indicated, but more recently they have been employed to lessen the likelihood of reflex movements occurring, as may sometimes happen in such light anaesthesia." In departing from the rigid principle of using relaxants only when specifically indicated, he is setting his foot on the downward path made slippery by the previous descent of too many anaesthetists.
Relaxants are now given, it appears, to stop reflex movements. There are two ways in which they can do this. They can depress ganglionic activity in the reflex arc, or they can paralyse the striped muscle effectors. It has been shown that d-tubocurarine, in the doses normally used, has little effect on ganglionic activity, and gallamine and decamethonium have still less, so that it is evidently only by paralysing the effectors that these reflex movements are suppressed.

But it is precisely by these reflex movements that the anaesthetist should be warned that anaesthesia is inadequate and must be deepened with a centrally acting drug. Indeed, Dr. Pearce seems to recognize this in an earlier section, when he says: "In a few cases reflex movements of the fingers occurred when the towel clips were applied, but a pause of a further minute or two, with, in a few cases, a small supplementary dose of pethidine always produced a stable anaesthetic level."

It seems to be not generally realized by the teachers of anaesthesia—or at least not generally taught—that there are three stages of curarization, though admittedly the boundary between them is not clear cut. First, there is the atony of Bremer, in which the muscle has lost its postural tone and is therefore relaxed, but in which it can contract as a result of voluntary or reflex nervous activity. Next, there is the paralysis of Vulpian, in which the muscle is toneless and will not respond to voluntary or reflex nervous activity, but will respond to electrical stimulation of the motor nerve. Lastly, there is the paralysis of Claude Bernard, in which the muscle will respond to nothing but direct stimulation of its fibres.

The first stage, the atony of Bremer, is all that the
anæsthetist needs to produce. If the patient's sensory apparatus is properly anaesthetized by centrally acting drugs, there will be no voluntary or reflex nervous activity (which would result in the release of more acetylcholine), and muscular relaxation will be complete. If the patient is not adequately anaesthetized he will be able to signal the fact to the watchful anaesthetist by "reflex movements of the fingers when the towel clips are applied", or by small movements of the mouth or eyebrows. The appropriate remedy will then be more anaesthetic (the term is intended to include pethidine), not more relaxant: though more relaxant would certainly stop the movement by producing the paralysis of Vulpian or of Claude Bernard. The amount of anaesthetic added should be no more than enough to make the sensorium insensitive to the stimulus being applied. This will not be sufficient to contribute significantly of itself to muscular relaxation.

In this way the principles of never using more of any drug than is needed to produce the required therapeutic effect, and of never using any drug without a clear and definite indication, would be honoured in the observance. It is to be feared that many anaesthetists today honour them only in the breach.

It is true that the method I advocate calls for great vigilance from the anaesthetist. That is one of its advantages. Another advantage is that it steers a course well away from the horror of the curarized but unanaesthetized patient, feeling pain but unable to protest, to which the attention of anaesthetists has already been drawn.

The argument that no demonstrable harm appears to result from the much larger doses of relaxants which are commonly given is irrelevant. The conscientious anæs-
Sir,

I am surprised that my paper dealing as it did with the use of pethidine in nitrous oxide anaesthesia, should have prompted Dr Woolmer to raise the issue of the use of excessive amounts of relaxant drugs in combination with inadequate anaesthesia.

In actual fact no mention was made in my article of the quantities used of the various relaxant drugs, but, in those cases in which they were used to limit involuntary muscle activity rather than for any specific exigency of the operation, almost without exception operations for hernia, the mean amount of gallamine used was 81 mg., and the mean duration of anaesthesia 44 minutes.

In conclusion I would refer Dr. Woolmer to the closing paragraph of that section of my paper entitled "Technique-using Muscle Relaxants". This reads "Gallamine has one minor disadvantage in that it produces a tachycardia in a high proportion of cases, thus rendering the decision as to when more pethidine will be required somewhat difficult. If, however, a hand is kept under observation, slight movement of the fingers will usually indicate the necessity".

This observation could hardly have been made on patients receiving excessive amounts of relaxant drug.

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