elimination (mean 87.4 ml kg^{-1}) is only 50% of the previously recorded values (mean 157 ml kg^{-1}).[4,5] If either the previously recorded elimination rate constants *in vitro* or the distribution volumes are used, values for non-organ clearance are around 25%.

This value is more in keeping with expected values, as up to 10% of a dose of atracurium has been obtained unchanged in the urine of patients[6] and, having a molecular weight of around 1000 and being ioinized, hepatic clearance of possibly 15% would occur.

Finally, I must mention that the two-compartment model for atracurium with elimination from both compartments was first described by Ward *et al.*[7]

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In reply:—Dr. Ward challenges our conclusion[1] that more than one-half of the clearance of atracurium results from organ-based elimination. He bases his argument on the discrepancy between the *in vitro* half-lives obtained in our study (32 min) and those obtained by Hughes and Chapple[2] (25 min) and Stiller *et al.*[3] (21 min). Unfortunately, Hughes and Chapple provide no details of their experimental design other than their use of plasma (compared with our use of whole blood), so we are unable to explain the differences between their results and ours. Stiller *et al.* added atracurium to plasma maintained at 37° C and determined the concentration of atracurium during a 3-h sampling period; they do not state whether plasma *p*H was measured repeatedly during the study. When we attempted to replicate their experiment, we found that the *p*H of the plasma increased during the sampling period, as a result of a decrease in the concentration of carbon dioxide. This increase in *p*H would be expected to increase the rate of Hofmann elimination, thereby decreasing the *in vitro* half-life of atracurium to a value consistent with the shorter half-life obtained by Stiller *et al.* To simulate physiologic conditions and to prevent problems related to the instability of *p*H, we believed that it was important to maintain a constant *p*H throughout our study. Therefore, we kept the blood in a sealed vessel equilibrated with 5% CO_2 and documented that *p*H did not vary during the study period. Thus, we believe that the shorter *in vitro* half-life obtained by Stiller *et al.* resulted from the instability of *p*H in their study.

Ward is surprised that our value for V_{ss} (87.4 ml/kg) (which he incorrectly terms distribution volume for elimination) is smaller than the values for V_{area} (V_β) obtained in other studies. These terms describe different pharmacokinetic volumes and are not interchangeable. In addition, whenever the organ(s) of elmination are located within the central compartment (as we assumed in our pharmacokinetic model), V_{ss} will be less than V_{area}. In fact, we[4] reported that V_{area} for atracurium was 182 ± 12 ml/kg, a value similar to that reported by Ward *et al.*

Finally, Dr. Ward did describe a two-compartment model for atracurium. However, there are marked differences between his model and ours. Dr. Ward's model cannot be used to determine V_{ss} (or, for that matter, to fractionate clearance into its organ and non-organ components); additional problems with his model have been identified by Hull.[5] In contrast, our model, because it utilizes the *in vitro* rate constant for atracurium elimination, permits determination of these additional pharmacokinetic parameters.

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Scented Masks in Pediatric Anesthesia

To the Editor:—I read with interest Yamashita's recent correspondence entitled "Fruit-flavored Mask Induction in Children."[1] I would caution clinicians about aerosolizing fruit flavors into the inhalational gas mixtures in the manner that these authors suggest. I have included a list of the common ingredients of fruit flavors used in this country to scent pediatric masks (Lorann Oils, Inc.) (Table 1). Aerosolizing a compound with up to 15 ingredients (cherry) may not be ideal.

TABLE 1. Ingredients in Fruit Flavor Extracts*

Cherry	
Benzaldehyde Propylene Glycol Acetal	Ethyl Isobutyrate
Propylene Glycol Acetal	Ethyl Vanillin
Benzaldehyde	Alpha Ionone
Vanillin	Anisyl Acetate
Tolyaldehyde	Frambinone
Heliotropine	Maltol
Amyl Acetate	Red #40
	Blue #1
Grape	
Methyl Anthranilate	Gamma Undecalactone
Ethyl Butyrate	Ethyl Alcohol
Amyl Acetate	Propylene Glycol
Citral	Polysorbate 80
Orange Oil	Red #40
Vanillin	Blue #1
Watermelon	
Ethyl Acetate	Methyl Eugenol
Butyl Heptanoate	Lemon Oil
2,6 Dimethyl 5-Heptenal	Methyl Heptin Carbonate
Amyl Acetate	Ethyl Caprate
Ethyl Isovalerate	Ethyl Caprylate
Iso Amyl Valerate	Ethyl Alcohol
Ethyl Pelargonate	
Strawberry	
Propylene Glycol	Acetic Acid
Aldehyde C-16	Diacetyl
Alcohol 12%	Orange Oil
Ethyl Vanillin	Triacetin
Ethyl Acetate	Red #40

* Lorann Oils, Inc., Lansing, MI 48910.

The issue of the safety in aerosolizing fruit extracts into anesthesia breathing circuits involves the toxicologic, allergic, and airway irritant potential of their chemical ingredients. While there is very little data in this area, there does exist some evidence to suport a cautionary note about this practice.

From the toxicologic standpoint, the industrial toxicology literature does cite some evidence for concern. Ethyl acetate (threshold limit value of 400 ppm in air) has caused renal hyperemia, CNS depression, and respiratory tract irritation.[2] In addition, amyl acetate (threshold limit value of 100 ppm in air) has shown renal, hepatic, and CNS toxicity.[2] Propylene glyocol is known to be associated with lactic acidosis.[3]

The glycols have been associated with allergic contact reactions.[4] Even without an overt allergic potential, patients with allergic histories (*i.e.*, hay fever, eczema) or reactive airway disease may not benefit from the intrinsic irritant properties associated with inhaling many of these chemicals.

Rather than direct aerosolization of these extracts, it seems safer to either apply small quantities to the face mask in the traditional manner, or to use a specifically designed face mask which has the technology of scent release from the polymer base. Such a scented mask is easier and safer, yet still achieves the advantages of scenting pediatric masks to camouflage the pungent odors of inhalational agents and to improve patient acceptance. Scented pediatric anesthesia masks are available from King Systems Corporation.*

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