creasing the duration of anesthetic exposure and manipulation solely in order to obtain data on abnormally prolonged induction–delivery intervals? (page 492).

Finally, nowhere is it indicated to what extent, if any, the patients were informed of the contemplated studies, the risks to themselves, and their unborn infants, or whether consent to the studies was in fact obtained.

In view of the above considerations, I believe that the investigations were unnecessary in terms of the likelihood of developing new information, that any new information which might have been obtained would not have represented a significant contribution to health care, the studies were improperly designed and the results inadequately evaluated, and that it was unethical to subject the mothers and infants to the increased risks involved even if properly informed consent were obtained. I strongly urge that ANESTHESIOLOGY insist on compliance with ethical standards for human experimentation in all investigations accepted for publication.

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EDITOR'S NOTE

The Editorial Board has not found it easy to establish an all-inclusive policy regarding the publication of papers in which human experimentation is involved. As this matter has been aired, our task has been made easier by the investigator's assumption of the basic responsibility for proper conduct in this sphere. We, too, accept the responsibility. We are helped in our resolve to support the basic principles of ethics in human experimentation by letters such as that of Dr. Fletcher and that of Dr. Beecher, published in the March issue of the Journal.

The Bohr Equation

To the Editor:—In a recent article (ANESTHESIOLOGY 31: 575, 1969), Kuwabara and Duncalf have revised Enghoff's modification of the Bohr equation,

$$\frac{V_D}{V_T} = \frac{Pa_{CO_2} - P\bar{E}_{CO_2}}{Pa_{CO_2}}$$

to account for the fact that when the physiologic shunt is greater than 20%, the Pa_{CO_2} will be significantly different from Pc_{CO_2} to make the standard Bohr equation give a falsely high V_D/V_T.[1]

The final result,

$$V_D/V_T = \frac{\left(P\bar{v}_{CO_2} - \frac{P\bar{v}_{CO_2} - Pa_{CO_2}}{1 - \dot{Q}_s/\dot{Q}_t}\right) - P\bar{E}_{CO_2}}{P\bar{v}_{CO_2} - \frac{P\bar{v}_{CO_2} - Pa_{CO_2}}{1 - \dot{Q}_s/\dot{Q}_t}}$$

although mathematically correct, is cumbersome and difficult to commit to memory. To overcome these objections I present the following modification of their derivation. Starting with their same assumption:

$$Pa_{CO_2} = \dot{Q}_s/\dot{Q}_t P\bar{v}_{CO_2} + (1 - \dot{Q}_s/\dot{Q}_t) Pc_{CO_2} \quad (1)$$

Rearranging:

$$P_{c\bar{c}O_2} = \frac{P_{aCO_2} - \dot{Q}_s/\dot{Q}_t P\bar{v}CO_2}{1 - \dot{Q}_s/\dot{Q}_t}$$

The Bohr equation where $P_{c\bar{c}O_2}$ is used for P_{aCO_2}:

$$\frac{V_D}{V_T} = \frac{P_{c\bar{c}O_2} - P\bar{E}CO_2}{P_{c\bar{c}O_2}} \quad (2)$$

Substituting for $P_{c\bar{c}O_2}$:

$$= \frac{\dfrac{P_{aCO_2} - \dot{Q}_s/\dot{Q}_t P\bar{v}CO_2}{1 - \dot{Q}_s/\dot{Q}_t} - P\bar{E}CO_2}{\dfrac{P_{aCO_2} - \dot{Q}_s/\dot{Q}_t P\bar{v}CO_2}{1 - \dot{Q}_s/\dot{Q}_t}} \quad (3)$$

Rearranging:

$$= \frac{P_{aCO_2} - \dot{Q}_s/\dot{Q}_t P\bar{v}CO_2 - P\bar{E}CO_2 + \dot{Q}_s/\dot{Q}_t P\bar{E}CO_2}{P_{aCO_2} - \dot{Q}_s/\dot{Q}_t P\bar{v}CO_2}$$

Finally, we have the revised deadspace equation:

$$\frac{V_D}{V_T} = \frac{P_{aCO_2} - P\bar{E}CO_2 - \dot{Q}_s/\dot{Q}_t (P\bar{v}CO_2 - P\bar{E}CO_2)}{P_{aCO_2} - \dot{Q}_s/\dot{Q}_t P\bar{v}CO_2} \quad (4)$$

This form of the equation closely resembles the original Bohr equation and should permit easy determination of deadspace (V_D) in the presence of shunts ($\dot{Q}_s/\dot{Q}_t$) greater than 20% of cardiac output.

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To the Editor:—We would like to thank Dr. Waltuck for confirming the mathematical accuracy of our modification of Enghoff's modification of the Bohr equation. We agree with him that our revision is cumbersome and difficult to commit to memory. Unfortunately, his rearrangement has not resolved these limitations and, although superficially it may appear easier to use, it actually involves one additional mathematical step for its final solution (2 multiplications, 4 subtractions and 1 division, compared with 4 subtractions and 2 divisions with our equation). In our equation the component which is equivalent to $P_{c\bar{c}O_2}$ is located in the same positions as P_{aCO_2} in the familiar Enghoff's modification of the Bohr equation. This symmetry between the two equations is not apparent in Waltuck's rearrangement which, incidentally, bears no obvious resemblance to the original Bohr equation. In practice we use a small computer to calculate V_D/V_T so that the exact arrangement of the terms is unimportant.

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Safety and Performance of Anesthesia and Ventilatory Equipment

To the Editor:—In response to widespread interest in the safety and performance of anesthetic and ventilatory equipment, expressed by anesthesiologists, by congressmen, and by the FDA, the American National Standards Association's Sectional Committee Z-79 has formed subcommittees to work on performance standards.

At a recent panel discussion at the N.Y.S.S.A., PGA, "Problems with Anesthesia and Ventilatory Equipment," under the chairmanship of Eugene L. Nagel, M.D., 48 questions were received from the audience reporting serious problems that had arisen with such items as endotracheal tubes and cuffs, vaporizers, gas pipelines and fittings, flowmeters and ventilators.

Our engineering colleagues on the Subcom-