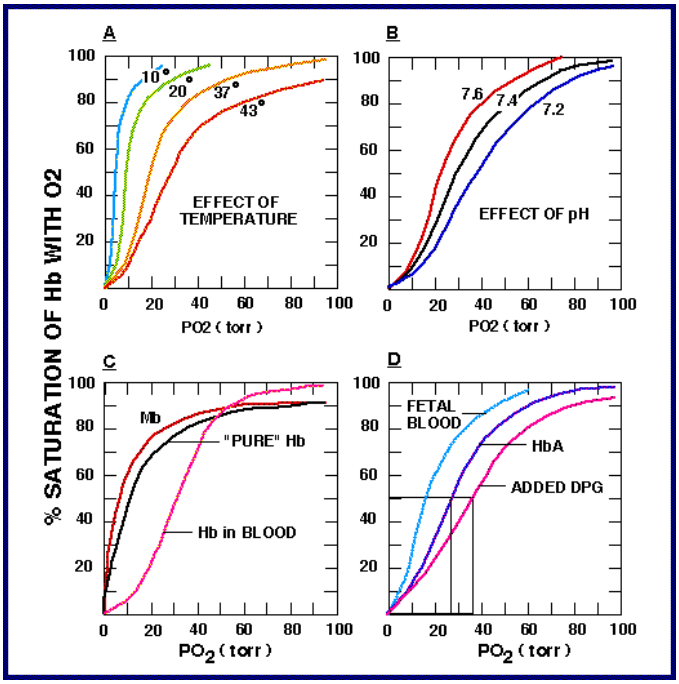
# ABG Analysis & Temperature

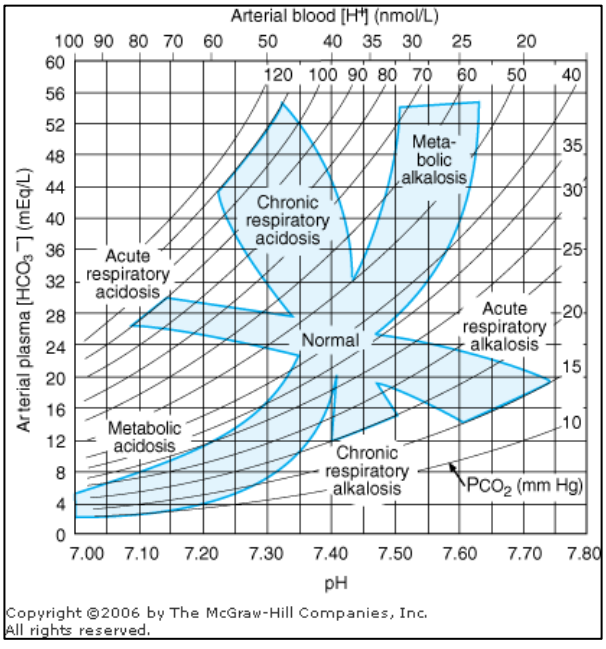
**Anesthetic Pearls:** Anesthetic Implications of Temperature on ABG Analysis

The solubility of a gas, ion dissociation, and hemoglobin function are <u>all</u> temperature dependent and therefore arterial blood gas analysis is a temperature dependent process as well. As temperature decreases, the solubility of a gas increases thereby keeping fewer molecules in the gas phase and thus exerting a lesser gas partial pressure.




For example, in vivo, the $PaO_2$ and $PaCO_2$ are less in a hypothermic patient than in a normothermic patient. The standard sampling electrode used in blood gas analysis is heated to 37°C. Therefore, if you take a blood sample from a hypothermic patient and heat it up to 37°C, the analysis of $PaO_2$ and $PaCO_2$ would be falsely elevated because at higher temperatures, more molecules would be in the gas phase thereby increasing the partial pressure of the gas and thereby leading to a <u>falsely low (acidotic) pH</u>.

It is important to keep these principles in mind when making clinical management decisions based on arterial blood gas analysis. Another essential concept in this analysis are the oxy-hemoglobin dissociation curves that show by increasing the temperature causes a decrease in the affinity of hemoglobin for oxygen (increases the $P_{50}$ value). The <u>Bohr Effect</u> shows that blood acidity affects the affinity of hemoglobin for oxygen; therefore if there is increased acidity (pH), there is a decrease in the affinity of hemoglobin for oxygen (increases the $P_{50}$ value). The following table demonstrates the effect of variant temperatures on ABG values.




| Patient Temp | In Vivo | In Sampling Bath at 37°C |
|---|---|---|
| < 37°C | Decreased $PaO_2$, $PaCO_2$<br>Increased pH | Falsely elevated $PaO_2$, $PaCO_2$<br>** Falsely low pH |
| > 37°C | Increased $PaO_2$, $PaCO_2$<br>Decreased pH | Falsely low $PaO_2$, $PaCO_2$<br>** Falsely elevated pH |