Transition to SI Units

At its October 1990 meeting the Scientific Publishing Committee explored the use and prevalence of Système International (SI) units for reporting measures of clinical and laboratory data. The committee since has sanctioned the use of SI units in the American Heart Association (AHA) journals.

The SI, an update of the metric system, is the outcome of a century of effort to provide a common system of measurement between nations and among the sciences. To promote its use, which can reduce the present confusion about measurements, the World Health Assembly in 1977 recommended the use of SI units in medicine.

The SI base units are the meter, kilogram, second, ampere, kelvin, candela, and mole, respectively representing length, mass, time, electric current, temperature, luminous intensity, and amount of substance. By multiplying a base unit by itself, or by combining two or more basic units by multiplication or division, many units can be formed, known as SI-derived units. Examples of derived units are the square meter, cubic meter, mole per cubic meter, pascal (Pa), and joule (J).

Exceptions to the rule for SI unit conversion as currently applied to biomedical sciences include blood pressure, oxygen pressure, and enzyme activity. Retained as presently used are temperature, the pH scale, and the use of liter for volume. Table 1 illustrates the measurements excluded from SI unit conversion.

In the AHA journals, an average article contains few items that need conversion. Often the same conversion is made over and over in a manuscript and takes little extra effort. It is our belief that, in return for a small effort, the AHA can take a large step, along with many other international and domestic journals, toward perpetuating a common system for reporting medical and scientific measurements. The SI unit is to be used in text, followed by the presently used measurement in parentheses.

The accompanying conversion table (Table 2) lists the measurements most commonly used in the AHA journals and their corresponding SI units. A review of this table may serve as an introduction to the forthcoming transition to SI units.

### Table 1. Measurements Currently Not Converted to Système International (SI) Units in Biomedical Applications

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Current Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pressure</td>
<td>mm Hg</td>
</tr>
<tr>
<td>Oxygen pressure</td>
<td>mm Hg</td>
</tr>
<tr>
<td>Enzyme activity</td>
<td>IU</td>
</tr>
<tr>
<td>H+ concentration</td>
<td>pH</td>
</tr>
<tr>
<td>Temperature</td>
<td>°C</td>
</tr>
<tr>
<td>Volume</td>
<td>L</td>
</tr>
</tbody>
</table>

### Table 2. Examples of Measurement Conversions to Système International (SI) Units for American Heart Association Journals*

<table>
<thead>
<tr>
<th>Current Unit</th>
<th>Conversion Factor</th>
<th>SI Unit</th>
<th>Normal Laboratory Values†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M (molar)</td>
<td>1 mol/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mM</td>
<td>1 mmol/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>torr</td>
<td>1 mm Hg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>atm</td>
<td>101.325 kPa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hematocrit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>0.01 No units</td>
<td>36-54</td>
<td>0.36-0.54</td>
</tr>
<tr>
<td>Red blood cell count</td>
<td>10^9/mm³</td>
<td>4.0-6.0</td>
<td>4.0-6.0</td>
</tr>
<tr>
<td>White blood cell count</td>
<td>/mm³</td>
<td>5000-10 000</td>
<td>5.0-10.0</td>
</tr>
<tr>
<td>Cholesterol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mg/dL</td>
<td>0.02586 mmol/L</td>
<td>&lt;200</td>
<td>&lt;5.20</td>
</tr>
<tr>
<td>Sodium ion (Na⁺)</td>
<td>1 mmol/L</td>
<td>135-145</td>
<td>135-145</td>
</tr>
<tr>
<td>Potassium ion (K⁺)</td>
<td>1 mmol/L</td>
<td>3.5-5.0</td>
<td>3.5-5.0</td>
</tr>
<tr>
<td>Calcium ion (Ca²⁺)</td>
<td>0.5 mmol/L</td>
<td>4.5-5.5</td>
<td>2.25-2.75</td>
</tr>
<tr>
<td>Energy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calories</td>
<td>4.2 J</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conductance</td>
<td>1 mho</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*For a brief discussion of the development and use of SI units, see World Health Organization: The SI for the Health Professions, Geneva, Switzerland: World Health Organization, 1982. For a convenient list of commonly used laboratory measurement conversions to SI units, see "SI unit implementation—the next step" (editorial) in JAMA (1988;260:73-76).
†For illustration only; normal values may vary by laboratory.
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