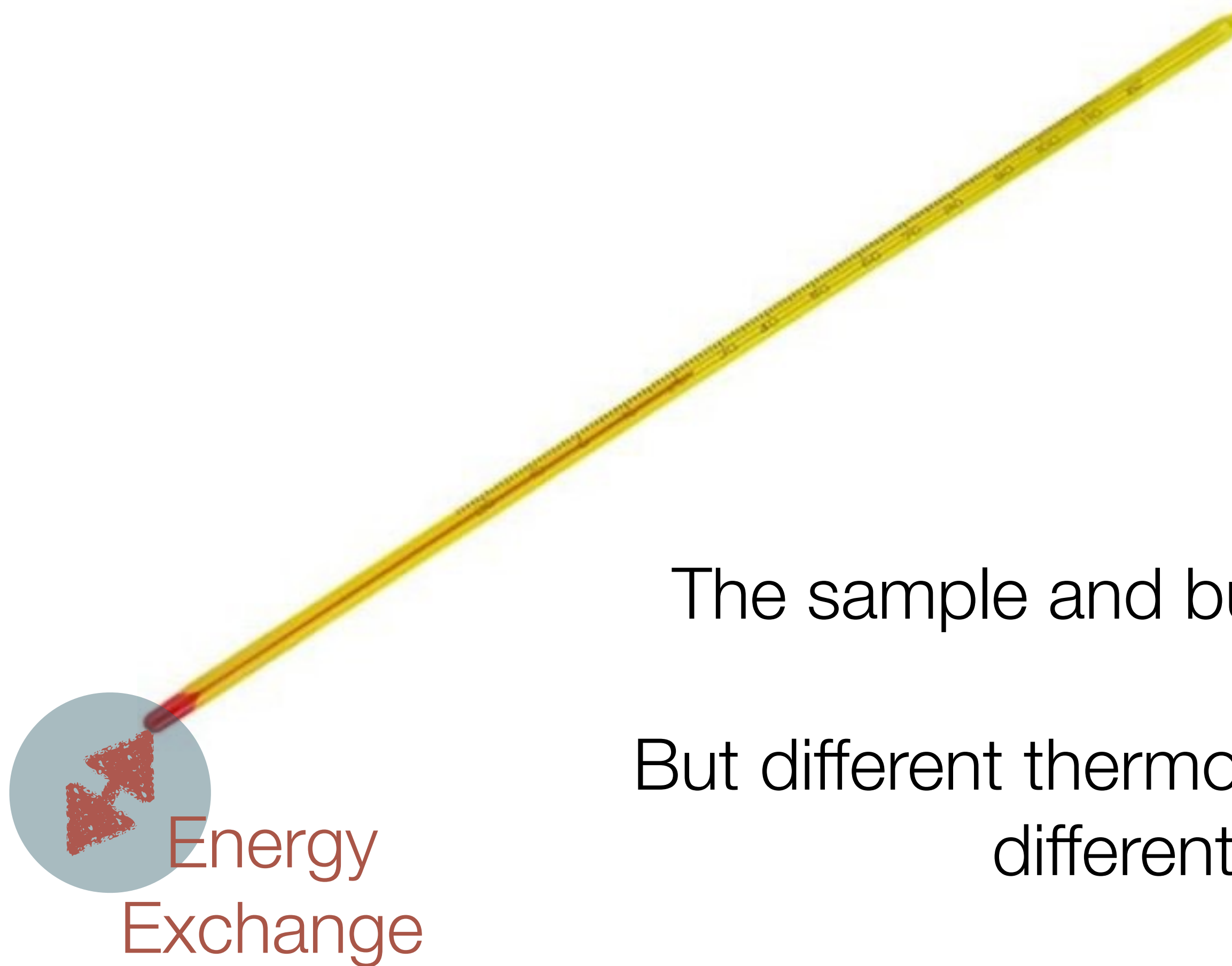


Temperature scale defined by the volume expansion of mercury

$$T_{\text{Celsius}} = C_1 \Delta V/V + C_2$$

The constants are chosen so that freezing is 0 and boiling is 100.



The sample and bulb exchange energy until they equilibrate.

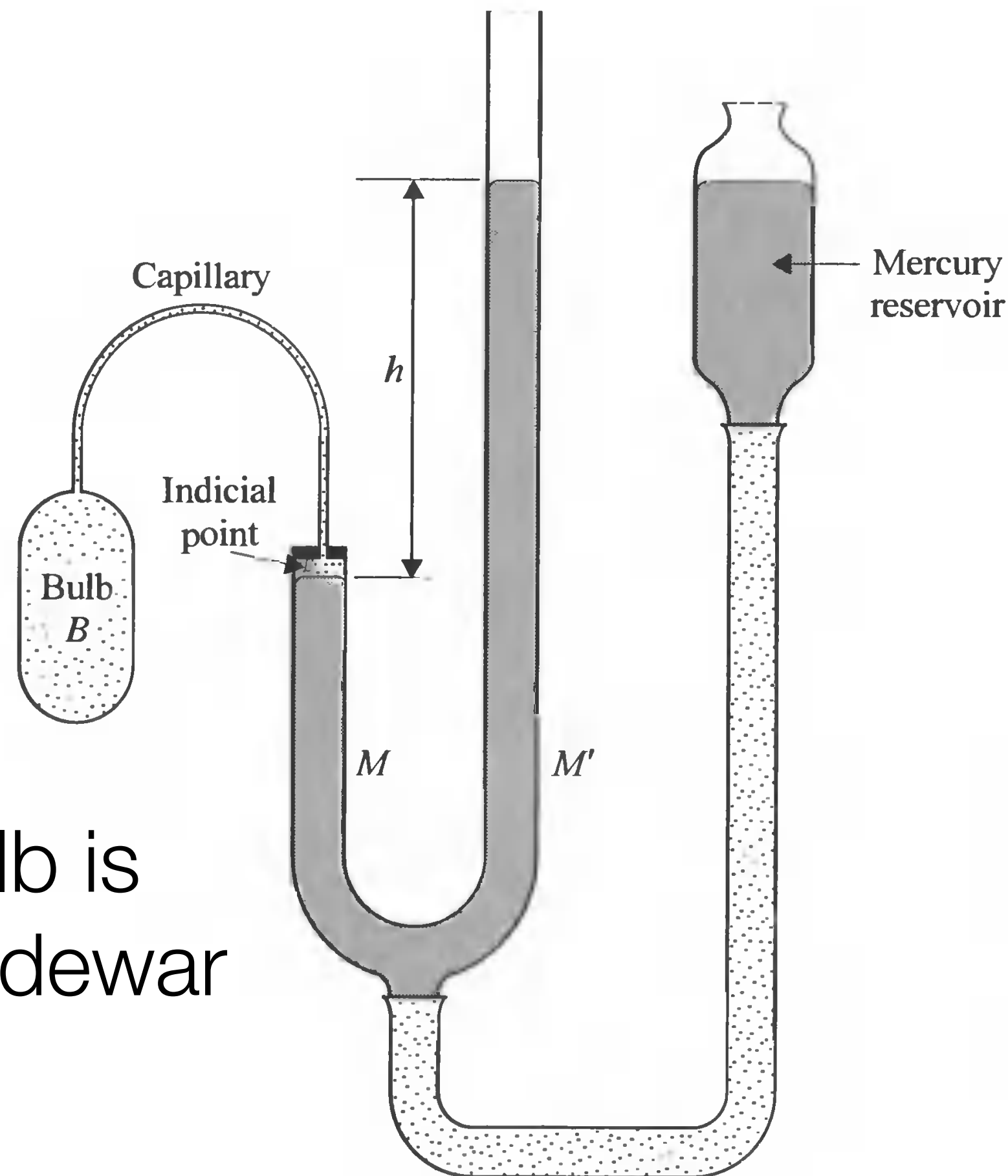
But different thermometers (based on alcohol or mercury) gave different readings away from 0 and 100

# The constant volume ideal gas thermometer

Changes in pressure in the bulb (at constant volume) defines a temperature scale:

$$T \equiv T_{\text{ref}} \frac{P}{P_{\text{ref}}}$$

$T_{\text{ref}}$  is a conventional constant



Gas bulb is placed in dewar

Place the bulb in the sample. If the sample is hot, then the gas will try to expand. But we can then increase the height of the mercury column  $h$ , increasing the pressure on the gas, to keep the volume of the gas fixed (at the indicial point). The pressure of the gas can be measured from the height of the mercury column.

The measured pressure  $P$  relative to a reference point  $P_{\text{ref}}$  defines a universal temperature scale, *which doesn't depend on the type of gas at low gas density.*