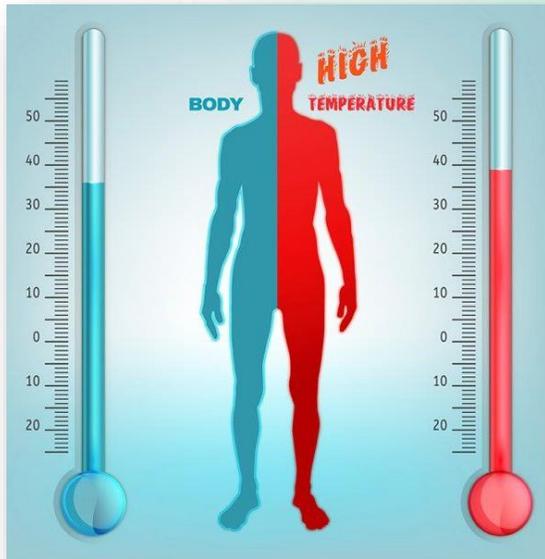


# Body Thermometer

We have been applying the concept of the degree to describe heat change. Little did we know that it took more than ten centuries for inventors to determine the scale of the thermometer.



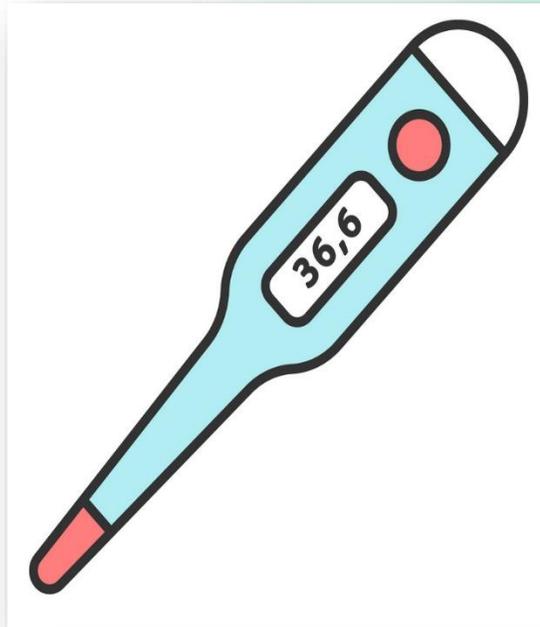
In 1592, the famous Italian physicist Galileo Galilei (1564 – 1642) successfully invented the first thermometer. It was a straight and slender glass tube with a scale. Its closed end was spherical while the unsealed end was immersed in water. When there were changes in the surrounding temperature, the height of the water column in the glass tube would differ, thus indicating the temperature level. Nevertheless, this method of measuring temperature change lacked accuracy since other than being affected by temperature change; the water level was also affected by atmospheric pressure since the water (in the unsealed end) was exposed to the atmosphere.

To solve this problem, Galilei's student replaced the water in the thermometer with alcohol in 1654. The thermometer which was not be affected by atmospheric pressure was first used by Italian medicine Professor Santorio Santorio (also called Sanctorio Sanctorio) to measure human body temperature. However, as the boiling point of alcohol was relatively low ( $78^{\circ}\text{C}$ ), the thermometer could not be used to measure objects with a high temperature.



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# Body Thermometer



In 1714, Daniel Gabriel Fahrenheit, a scientific instrument businessman who came from Amsterdam, Netherlands, replaced the alcohol in the thermometer with mercury. With a melting point of  $-39^{\circ}\text{C}$  and boiling point of  $350^{\circ}\text{C}$ , the wide temperature measurement range covered by the thermometer succeeded in overcoming the shortcomings of its predecessor.

There were, however, lots of confusion during that time as there was no standardization to the scales used in different thermometers. Thus, Fahrenheit proposed to fix the freezing point of water as 32 whereas the boiling point of water at 212, under atmospheric pressure. There would, therefore, be 180 grids in between, whereby each grid was fixed as 1 degree. This was the well-known Fahrenheit scale. Temperatures measured using a Fahrenheit thermometer was denoted using  $^{\circ}\text{F}$ .

As the use of the Fahrenheit thermometer was inconvenient to most people, Swedish astronomer Anders Celsius designed and developed a new kind of thermometer, in 1742. In his version of the thermometer, he fixed the freezing point of water as 0 whereas the boiling point of water as 100, with 100 grids in between the temperatures and each grid representing 1 degree. This would be the Celsius scale which we are most familiar with today. Thermometers using Celsius scale were denoted using  $^{\circ}\text{C}$ .

# Body Thermometer



Although mercury thermometers were widely used in clinical tests, people somehow found them inadequate in many aspects. In 1867, English physician Sir Thomas Allbutt invented the first medical thermometer based on human body's temperature characteristics and needs. The 15 cm long thermometer was used specifically to measure the temperature of a person or an animal. This was perhaps the official birth of the thermometer which is in use today.

With the advancement in technology, thermometers underwent several revolutions. In 1984, a Finnish medical instrument designer invented an even more convenient and accurate electronic body thermometer. Later, an American medical instrument company also created a type of pacifier-style thermometer which was specifically used for infants. With the rapid development of technology, other more advanced, more sophisticated and more accurate body thermometers are expected to be invented soon.

## Food for Thought:

- Innovation or invention must be based on the accumulation of previous experience by predecessors. With in-depth exploration and continuous research, greater success could be attained.
- The fact that inventors first used water, then alcohol, and then mercury to measure temperature showed that continuous improvement is needed to increase practicality and opportunities for promotion or commercialization of innovation or invention.

