In one embodiment, there is provided an apparatus for thawing frozen biological material, the apparatus comprising:

a vessel having an interior space for receiving the biological material, the vessel having an upper portion extending around an upper portion of the interior space, a middle portion extending around a middle portion of the interior space, and a lower portion extending around a lower portion of the interior space; a plurality of thermal transfer devices operatively associated with the vessel for transferring heat between the vessel and the thermal transfer device, comprising at least:

a first thermal transfer device operatively associated with the upper portion of the vessel for transferring heat between the upper portion of the vessel and the first thermal transfer device;
a second thermal transfer device operatively associated with the upper middle portion of the vessel for transferring heat between the upper middle portion of the vessel and the second thermal transfer device;
a third thermal transfer device operatively associated with the lower middle portion of the vessel for transferring heat between the lower middle portion of the vessel and the third thermal transfer device; and
a fourth thermal transfer device operatively associated with the lower portion of the vessel for transferring heat between the lower portion of the vessel and the fourth thermal transfer device; and

at least one controller operatively associated with the first, second, third, and fourth thermal transfer devices for controlling the first, second, third, and fourth thermal transfer devices independently from one another, comprising the least one controller being adapted for controlling the first thermal transfer device to control thermal transfer between the first thermal transfer device and the upper portion of the vessel;

controlling the second thermal transfer device to control thermal transfer between the second thermal transfer device and the upper middle portion of the vessel;
controlling the third thermal transfer device to control thermal transfer between the third thermal transfer device and the lower middle portion of the vessel; and
controlling the fourth thermal transfer device to control thermal transfer between the fourth thermal transfer device and the lower portion of the vessel.

In one embodiment, there is provided a method for thawing frozen biological material, comprising:

introducing the frozen biological material into a vessel;
causing thermal transfer between an upper portion of the vessel and medium exterior to the upper portion of the vessel, comprising heating the upper portion of the vessel;
causing thermal transfer between an upper middle portion of the vessel and medium exterior to the upper middle portion of the vessel;
causing thermal transfer between a lower middle portion of the vessel and medium exterior to the lower middle portion of the vessel;
causing thermal transfer between a lower portion of the vessel and medium exterior to the lower portion of the vessel;
monitoring temperature of the biological material at different levels in the vessel;
adjusting the thermal transfer between the upper portion of the vessel and the medium exterior to the upper portion of the vessel at least partially in response to the monitoring of the temperature of the biological material;
the adjusting of the thermal transfer between the upper portion of the vessel and the medium exterior to the upper portion of the vessel being performed independently of the adjusting of the thermal transfer between the upper middle portion of the vessel and the medium exterior to the upper middle portion of the vessel;
the adjusting of the thermal transfer between the upper portion of the vessel and the medium exterior to the upper portion of the vessel being performed independently of the adjusting of the thermal transfer between the lower middle portion of the vessel and the medium exterior to the lower middle portion of the vessel; and

the adjusting of the thermal transfer between the upper portion of the vessel and the medium exterior to the upper portion of the vessel being performed independently of the adjusting of the thermal transfer between the lower portion of the vessel and the medium exterior to the lower portion of the vessel; and

adjusting the thermal transfer between the upper middle portion of the vessel and the medium exterior to the upper middle portion of the vessel at least partially in response to the monitoring of the temperature of the biological material;

the adjusting of the thermal transfer between the upper middle portion of the vessel and the medium exterior to the upper middle portion of the vessel being performed independently of the adjusting of the thermal transfer between the upper portion of the vessel and the medium exterior to the upper portion of the vessel;

the adjusting of the thermal transfer between the upper middle portion of the vessel and the medium exterior to the upper middle portion of the vessel being performed independently of the adjusting of the thermal transfer between the lower middle portion of the vessel and the medium exterior to the lower middle portion of the vessel; and

the adjusting of the thermal transfer between the upper middle portion of the vessel and the medium exterior to the upper middle portion of the vessel being performed independently of the adjusting of the thermal transfer between the lower portion of the vessel and the medium exterior to the lower portion of the vessel; and

adjusting the thermal transfer between the lower middle portion of the vessel and the medium exterior to the lower middle portion of the vessel at least partially in response to the monitoring of the temperature of the biological material;

the adjusting of the thermal transfer between the lower middle portion of the vessel and the medium exterior to the lower middle portion of the vessel being performed independently of the adjusting of the thermal transfer between the upper portion of the vessel and the medium exterior to the upper portion of the vessel;

the adjusting of the thermal transfer between the lower middle portion of the vessel and the medium exterior to the lower middle portion of the vessel being performed independently of the adjusting of the thermal transfer between the upper middle portion of the vessel and the medium exterior to the upper middle portion of the vessel; and

the adjusting of the thermal transfer between the lower middle portion of the vessel and the medium exterior to the lower middle portion of the vessel being performed independently of the adjusting of the thermal transfer between the lower portion of the vessel and the medium exterior to the lower portion of the vessel; and

adjusting the thermal transfer between the lower portion of the vessel and the medium exterior to the lower portion of the vessel at least partially in response to the monitoring of the temperature of the biological material;

the adjusting of the thermal transfer between the lower portion of the vessel and the medium exterior to the lower portion of the vessel being performed independently of the adjusting of the thermal transfer between the upper portion of the vessel and the medium exterior to the upper portion of the vessel;

the adjusting of the thermal transfer between the lower portion of the vessel and the medium exterior to the lower portion of the vessel being performed independently of the adjusting of the thermal transfer between the upper middle portion of the vessel and the medium exterior to the upper middle portion of the vessel; and

the adjusting of the thermal transfer between the lower portion of the vessel and the medium exterior to the lower portion of the vessel being performed independently of

the adjusting of the thermal transfer between the lower middle portion of the vessel and the medium exterior to the lower middle portion of the vessel.

In one embodiment, there is provided an apparatus for thawing frozen biological products comprising:

at least one vessel;
one or more stirring means;
a plurality of thermal transfer means surrounding the vessel; and
at least one means for temperature control.

In one embodiment, there is provided a process for thawing a frozen biological product comprising:

(a) introducing the frozen biological products into a vessel comprising one or more stirring means, a plurality of thermal transfer means; a plurality of thermocouples; and a means for temperature control;
(b) continuously measuring the temperature at a plurality of levels within the vessel using the plurality of thermocouples;
(c) heating the thermal transfer means adjacent to the frozen biological products at the same time mixing the contents of the vessel;
(d) cooling the thermal transfer means adjacent to the thawed biological products at the same time mixing the contents of the vessel;
(e) heating and/or cooling the thermal transfer means to compensate for the addition of additional frozen biological product and the thawing of the biological product.