Clinical use of platelet transfusion is limited by inability to preserve platelets for more than a few hours. Preparation of fresh platelet concentrates is burdensome, particularly at night and on weekends. Preservation of platelets in the frozen state would have obvious usefulness.

Cellular damage during freezing increases with the growth of ice crystals. Minimum sized ice crystals can be expected when samples are frozen at maximum freezing rates. Some authors report freezing rates of $-4^\circ$ C. to $-30^\circ$ C. per minute to be optimal [1,2,3,4,6,7]. Other authors obtained similar results at cooling rates of $5^\circ$ C. per second [5,8].

In our study the \textit{in vivo} survival of $^{51}$Cr labeled rabbit platelets was investigated after freezing at different cooling and thawing rates, with and without protective additives.

Different rapid cooling rates were obtained by dropping concentrated platelets directly into liquid nitrogen or liquid helium. Small droplets were produced with an average diameter of 2.6 mm. The average cooling rate was greater than $-10^\circ$ C. per second when liquid nitrogen was used and more than $-100^\circ$ C. per second in helium. In all experiments the frozen platelets were stored in liquid nitrogen for 4 days. For thawing the frozen droplets were transferred directly into 10 ml. or 70 ml. of homologous plasma or 70 ml. of saline. The thawing media had a temperature of $40^\circ$ C.

Different groups of platelets were labeled with $\text{Na}_2^{51}\text{CrO}_4$ and frozen without any protective agent; with 10 per cent glycerol; or with a mixture of dimethylacetamide (DMAC) and 5 per cent dextrose. After thawing the platelets were transfused homologously. Survival of the thawed platelets was compared with $^{51}$Cr labeled fresh unfrozen controls.

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Effect of Cooling Rate

Platelets frozen in liquid helium without protective agents could not be detected in the peripheral blood 30 minutes after reinfusion. However, when platelets without additives were frozen in liquid nitrogen, platelet radioactivity was 28 per cent 30 minutes after reinjection and decreased to 5.7 per cent at the 3rd day. Recovery of platelets up to the 3rd day, although demonstrated consistently, was significantly lower than the unfrozen control group (Fig. 1).

Effect of Cryophylactic Agents

The effect of glycerol or DMAC combined with dextrose was evaluated on platelets frozen in liquid nitrogen. These results were compared both with the survival of platelets frozen in liquid nitrogen without additive, and fresh platelets. Results with 10 per cent glycerol as the protective agent were significantly worse than those when no additive was used. When 5 per cent DMAC combined with 5 per cent dextrose was used, however, recovery of platelet activity 24 hours after transfusion was significantly higher than recovery when platelets were frozen without protective agents (Fig. 2).