IN VIVO ASSESSMENT OF THROMBORESISTANT MATERIALS BY DETERMINATION OF PLATELET SURVIVAL. N. Coe, R. Collins, A. Jagoda, D. Brier, J. Lindon, E. Merrill, R. Cohen and E. Salzman. Beth Israel Hosp., Harvard Med. School and M.I.T., Boston, MA., U.S.A.

The reactivity of potentially thromboresistant polymers was determined in sheep by measurement of the lifespan of Cr^{51}-labelled platelets. Materials were tested as tubing (90-125 cm x 2.5-3 mm I.D.) interposed in a 7 cm silicone rubber carotid A.-ext. jugular V. shunt.

Platelet lifespan decreased as the length of the basic silicone rubber shunt increased from 7 cm ("shunt control", $T_{\frac{1}{2}}$ 78.3 ± 11.6 S.D. hrs.; n=18) to 50 cm ($T_{\frac{1}{2}}$ 62.0 ± 7.5 hrs.; n=7; $p < 0.001$ vs. shunt control) but was longer than in sheep without a shunt ($T_{\frac{1}{2}}$ 63.1 ± 11.2 hrs.; n=21; $p < 0.001$ vs. shunt control), probably because of artifactual activation of platelets in blood sampling by needle puncture in the absence of a shunt. Of sixteen polymers studied in 42 sheep (n=117), all significantly shortened platelet lifespan except polyurethane ($T_{\frac{1}{2}}$ 72.8 ± 12.1 hrs.; n=12) and non-cross-linked silica-free polydimethyl siloxane ($T_{\frac{1}{2}}$ 69.8 ± 13.9 hrs.; n=9). Polymethyl acrylate (PMA) ($T_{\frac{1}{2}}$ 71.2 ± 5.4 hrs.; n=11; $p < 0.04$ vs. shunt control) was passivated by exposure to platelet free plasma before whole blood ($T_{\frac{1}{2}}$ 90.3 ± 3.6 hrs.; n=5; $p < 0.05$ vs. untreated PMA). Thus, the adsorbed film of plasma constituents has a lasting and decisive effect on thromboresistance of the surface. The long term behavior of an artificial surface may be dictated by the events of the first few seconds of blood-surface contact.

EARLY PLATELET ACTIVATION DURING PERFUSION OF A HOLLOW FIBER ARTIFICIAL KIDNEY. B. K. Kim and M.G. Baldini. Memorial Hospital, Pawtucket and Brown University, Providence, Rhode Island, USA.

Studies of early platelet changes caused by contact with artificial surfaces in a flow-system were done by the use of a bench-model of a hollow fiber (silicone rubber) mini-kidney. The artificial device contained 64 fibers in a polyurethane casing and was inserted in a silicone rubber circuit provided with a roller pump. Human platelet-rich plasma was used for perfusion. Perfusion for 60 m' at a rate of 6 ml/m' caused no decrease in platelet count and no visible thrombus formation in the fibers. However, after perfusion for 5 m' there was a significant increase in ADP induced platelet aggregation with values of 75 ± 10% (control 56 ± 5.8%). The values rose to 80 ± 8.5% after 30 m' of perfusion. Collagen induced platelet aggregation also increased with values of 81 ± 9.3% (control 67 ± 5.3%) after 5 m' and 82 ± 6.3% after 30 m'. Platelet F3 availability measured by the Kaolin clotting time was 108 ± 5.5 sec before perfusion and became progressively enhanced during perfusion. The Kaolin clotting time became 93 ± 2.9 sec after 5 m', 84 ± 1.7 sec after 15 m', 76 ± 3.3 sec after 30 m' and 71 ± 3.7 sec after 60 m'. Platelet release of ^{14}C-serotonin was only 2% to 3% after 60 m' perfusion. The content of purine nucleoside phosphorylase (a cytoplasmic enzyme) and of β-glucuronidase (a lysosomal enzyme) detected in the plasma medium after 60m' perfusion were only 1% to 2% of the respective platelet enzyme activity. It was concluded that contact with silicone rubber surfaces during short-time perfusion of hollow fibers caused significant platelet activation with enhancement of platelet aggregability and platelet F3 availability in the absence of significant degrees of release reaction.

ULTRASTRUCTURAL STUDY ON IN VIVO BLOOD COMPATIBILITY OF BIOLIZED MATERIALS. H. Harasaki, G. Picha, M. Helmus, A. Fields, R. Kiraly, Y. Nosé. Cleveland Clinic.

The long-term implantation of cardiac prostheses has been hampered by the lack of thromboresistant blood interfacing materials. Glutaraldehyde treated pericardium and glutaraldehyde treated, gelatin-coated rubber have been utilized for the blood contacting materials of our devices. These "biolized" cardiac prostheses were implanted in calves: 8 total artificial hearts for up to 5 months, 7 left ventricular assist devices for up to 7 months, and a passive pump implanted in the aorta for 5 1/2 years. The blood-solid interaction and endothelialization of these materials were chronologically followed at an ultrastructural level using scanning and transmission electron microscopy.

The devices implanted up to 40 days were covered by a thin layer of fibrinous material. The adhesion of blood corpuscles were minimal except for the region of diaphragm-housing junction. The majority of the adhered platelets were "contact" and "spread" platelets. Once this fibrin-rich layer was formed, no significant thrombus formation was observed. The endothelialization was observed in the portion of the pericardium surface adjacent to the inflow valve in the heart implanted for 145 days. The coverage of the endothelial cells was more complete in the passive pump. Although Weibel-Palade bodies were observed in the cytoplasm of these cells, they were characterized by the sparse microvillous projections, small number of pinocytotic vesicles, and widely opened intercellular junctions. In the subendothelial layer, no basement membrane was observed.

The study showed the aldehyde treated collagen and gelatin are suitable materials as blood contact surfaces of the cardiovascular devices.