thrombi.

Nonviable Homografts—Freeze-drying, or potent sterilizing solutions, improve availability and storage of homograft valves, although they do destroy viable cells. Initial results were encouraging despite murmurs of aortic incompetence in nearly 45 per cent at the end of the first year postoperatively, but late results show a high failure rate.

Heterografts (porcine)—Preservation is aimed at eliminating antigenic components of the valves which, therefore, become nonviable, with function dependent on their inherent elasticity and flexibility. The preservation methods appears critical to the long-term performance of these valves. Several recent reports indicate favorable results when glutaraldehyde-preserved porcine valves (Hancock type) have been employed, with generally excellent function, low rate of thromboembolus formation, and good durability (thus far up to 5-6 years). They are particularly suitable in patients for whom anticoagulant therapy is contraindicated or highly problematical. Since heterograft inner-to-outer-diameter ratio is less favorable than for prosthetic valves in the smaller aortic valve diameters, enlargement of the aortic root is advised for small aortic valve annuli, or use of a central flow prosthetic valve should be considered.

Tissue Valves—Autologous, homologous, and heterologous grafts of fascia lata, pericardium, rectus sheath, and dura mater have been used. As with a natural valve, preservation and storage must be appropriately employed, except for autologous grafts. In the aortic position these various types have functioned satisfactorily for 4-5 years.

Synthetic Central Flow Substitute Valves—Synthetic substitutes for duplicating the central flow orifice valve have been unsuccessful; relentless growth of fibroblasts soon produces a stiff, nonpliable valve with subsequent valve dysfunction.

Lateral Flow Valves

Ball Valve (simple)—Of all valves based on a lateral flow design, the ball valve has had the greatest clinical success. Originally constructed of a heavy acrylic cage with a metal poppet, this type was later refined to a lightweight metal cage with a Silastic poppet and with many subsequent significant modifications. The Starr-Edwards type, having gained greatest acceptance by surgeons, became a standard for comparison with other models. It, too, had undergone many modifications, including a change in the method of cure of the Silastic poppet which also affected all ball valves using such a poppet. Earlier Silastic produced swelling of the ball with consequent valve dysfunction or poppet fragmentation. Although ball variance has not been completely eliminated, its incidence is now nearly negligible in follow-ups of up to 7 years.

The major problem with this type of prosthesis has been systemic thromboembolism (even with chronic anticoagulant therapy). This is a drawback with all prosthetic valves. Fortunately, the multiple modifications in fabrication of this valve have had a salutary effect on thromboembolism incidence. The current model (1260 aortic valve) appears to be associated with only a 5 per cent, 3-year incidence, compared with a 20 per cent, 3-year incidence a decade ago.

Cloth-Covered Prostheses—Since its introduction in 1967, the Starr-Edwards cloth-covered type of prosthesis has appeared to decrease thromboembolic episodes. But problems with cloth wear along the struts and at the seating ring necessitated many changes, and there is a paucity of follow-up data on the current types. (A Braunwald-Cutter model, introduced in 1970, has recently been withdrawn from the market because of hemolysis and accelerated poppet wear associated with poppet embolism.)

Track Valves—A modified Starr-Edwards fabric-covered model designed to prevent cloth wear is now being assessed clinically. The new design protects the cloth at the critical areas in contact with the ball.

Disc Valves—Integral to the design of a ball valve is a cage of sufficient length to permit adequate excursion of the ball from the inlet orifice. Although easily accommodated in the aortic position, it has been considered unsatisfactory for some atrioventricular valve replacements. To obviate its drawbacks, a low-profile disc valve with a flat lens suspended in an abbreviated cage was devised, but initial enthusiasm waned as the disc design failed to demonstrate any superiority in the atrioventricular position.

Semicentral Flow-Tilting Disc Valve—This type retains the low-profile contour but approaches the central flow concept, and consists of a free-floating lens in a partial Satellite cage. In the open position, it tilts 50° to 60° in the direction of blood flow. With an ultralight disc, this valve has an extremely favorable orifice-to-mounting ring ratio and thus appears to be well suited for pediatric patients or those with a diminutive aortic valve annulus.

The semicentral flow-tilting valve (Bjork-Shiley type) is also popular for use in adults and, to date, general problems have been few so far (except for thrombosis of the aortic valve prosthesis, which has occurred nearly exclusively in those with no or inadequate anticoagulant prophylaxis). Good control of long-term anticoagulation is clearly essential in patients with this type of valve implant, and although the wear characteristics thus far seem good, it remains to be seen if its performance will equal that of the ball-and-cage type. □