tional proof of the viability of the growing epidermis (Fig. 3). If the skin is inoculated with vaccinia virus, characteristic cytoplasmic basophilic inclusion bodies are formed in the epithelial cells (Fig. 4).

In addition, we were able to grow the virus of herpes zoster on one occasion (Fig. 5). This was done by inoculating skin which had been growing on the chorioallantois for 24 hours. The inoculum was untreated vesicle fluid taken from a patient with herpes zoster ophthalmicus of 48 hours' duration. The skin was removed after 6 days' additional incubation. The microscopic appearance of the infected area, including the presence of a large number of characteristic intranuclear inclusion bodies, confirms Goodpasture's observation in his single successful cultivation of the zoster virus.[3]

Summary and Conclusions. (1) Human skin may readily be grafted onto the chorioallantoic membrane of embryonated eggs. (2) The prepuce removed by usual surgical circumcision is a satisfactory source of adequate amounts of skin. (3) Penicillin and streptomycin obviate most bacterial contamination. (4) Grafted human skin may be passed serially from egg to egg at weekly intervals and remain viable. (5) Herpes simplex and vaccinia grow readily on grafted human skin, with the formation of characteristic inclusion bodies. (6) A successful inoculation with herpes zoster confirms the previous single successful cultivation of this virus outside of the human body.

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Atrio-Ventricular Anastomosis: An Additional Valve.

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In vascular surgery during the last few years communications have been established experimentally and therapeutically between blood vessels. Little has been done in surgery of the heart involving the formation of anastomosis between the cavities of this organ. Schepelmann[1] and Dimitrieff[2] were the first to create artificial communications between the atria or the ventricles. Neither of these workers tried to produce a new opening that would join an atrium to a ventricle.

If such an anastomosis could be created with valvular properties it would be of value in pathological changes of the valves. In stenosis of the mitral valve, for example, the blood which has been dammed back in the atrium could stream through the new pathway into the left ventricle. In insufficiency, on the other hand, the anastomosis could serve as a safety valve guarding against the rising pressure in the atrium. These points, however, remain to be settled experimentally.

Dimitrieff[2], Cutler[3] and Souttar[4] have shown that various operations on the auricular appendage are well tolerated. The appendage also represents the shortest anatomical pathway for producing a connection between atrium and ventricle. Furthermore, by using it for the atrio-ventricular anastomosis, valvular requirements can be fulfilled. Because of its funnel shaped structure, it is most suitable for transformation into a valve and for implantation into the ventricle. In an anastomosis using the appendage, the blood will flow from a broad base to a narrow apex, whereas back flow through this structure would be difficult. The experiments to be described

1 Schepelmann, E., *Deutsche Z. f. Chir.*, 1912, **120**, 562.

2 Dimitrieff, I. P., *Zentralbl. f. Chir.*, 1926, **53**, 715.

3 Cutler, E. C., and Beck, C. S., *Arch. Surg.*, 1929, **18**, 403.

4 Souttar, H. W., *Brit. Med. J.*, 1925, **2**, 603.

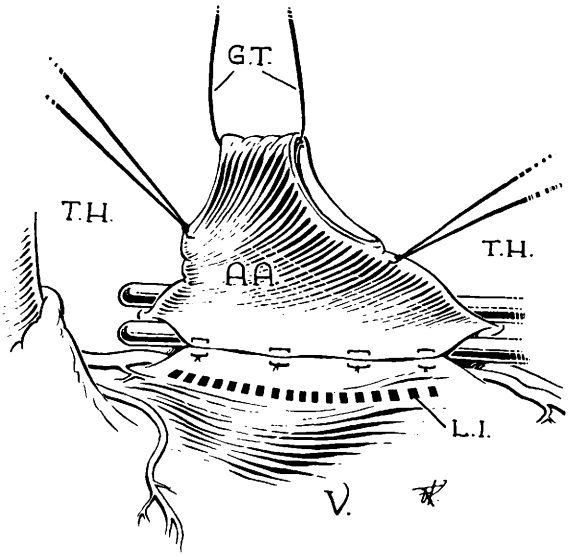

FIG. 1. Preparation of Auricular Appendage Showing Posterior Row of Sutures.
A.A. = Auricular appendage, posterior surface.
G.T. = "Guide thread."
L.I. = Line of ventricular incision.
T.H. = "Temporary hemostatic sutures."
V. = Ventricle.

were planned and initiated by the senior author (A.R.).

Technic. Dogs were anesthetized with intravenous nembutal and artificial respiration administered by positive pressure through an endotracheal tube. The animal was placed on the right side, a small pad under the right thorax providing the best exposure. The incision was usually made in the fourth intercostal space for the left auricle, the third intercostal space for the right. When the pleural cavity is opened a tampon soaked in 5% cocaine solution is used to paint the pericardium in order to block reflexes that might arise and disturb cardiac activity. Exposure is maintained by self-retaining rib spreaders and towels packing off the lungs. A longitudinal incision is made in the pericardium between two holding sutures which stretch and maintain the opening. The incision is carried up to the superior reflection of the pericardium. Cocaine solution (4%) is also introduced into the pericardial cavity and is spread over the epicardium by the heart contractions. The auricular appendage is gently grasped at its apex with tongue forceps, and a narrow slightly curved clamp is fixed as close as possible to its base. A row of interrupted mattress sutures, placed as close as possible to the clamp, joins the posterior wall of the appendage to the myocardium of the adjacent ventricle, just below the circumflex coronary vessels. Occasionally it is necessary to tie small branches of the coronary artery crossing this row of sutures. This does not cause any apparent damage as there is abundant coronary anastomosis in the dog heart (Moore[5]).

Preparation of the Auricular Appendage. The appendage can be opened on the anterior or posterior surfaces, by resection of the tip, or by bisecting it and everting the two resulting flaps. In this series longitudinal openings were cut along the borders of the appendage (Fig. 1). This creates two flaps which are joined at their tips, and therefore a valvular action can be expected. The adjacent walls are separated with fine curved forceps which are used to draw a paraffin-soaked thread through the two lateral incisions. This will

[5] Moore, R. A., *Am. Heart J.*, 1930, **5**, 743.

be the "guide thread" (Fig. 1). The ends of this thread are held in a clamp.

A suture is placed at the proximal limit of the opening on each side, tied into place (Fig. 1) and both free ends are threaded through a No. 6 curved round needle. They will be "temporary hemostatic sutures." The needles are clamped in needle holders and stuck in the drape sheets, ready for use.

Opening the Ventricle. A transverse incision is made in the anterior ventricular wall 5 mm below the posterior row of sutures already placed (Fig. 1). A broad scalpel or a punch which will produce a hole 15 mm long and 5 mm wide is used. After this has been pushed through the ventricular muscle a fine, curved Reverdin needle is introduced into the heart cavity about 3 cm below the ventricle opening. When it contacts the scalpel or punch the latter is pulled out, the Reverdin needle follows in its wake and the tip appears in the incision. The blood then spurts. The "guide thread" is threaded in the Reverdin needle and the latter is pulled out, quickly drawing the appendage into the incision and ventricular cavity. Hemorrhage is thereby diminished. While an assistant arrests further hemorrhage with direct digital pressure the "temporary hemostatic sutures", held in readiness, are guided into the ventricular cavity at the right and left corners of the incision. These are directed from within the cavity through the entire thickness of the ventricular wall (Fig. 2). Hemorrhage is completely arrested when these are drawn together and held by a single knot fixed in a hemostat.

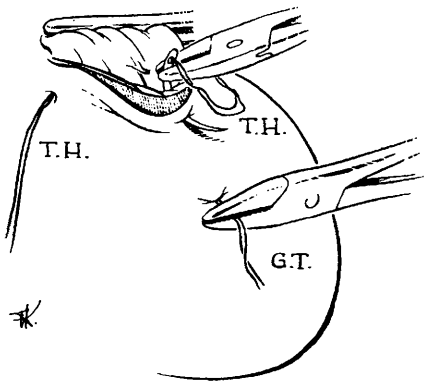

FIG. 2. Implantation of Auricular Appendage. Placing the "temporary hemostatic sutures." The auricular appendage is being held in position by a forceps on the "guide thread."

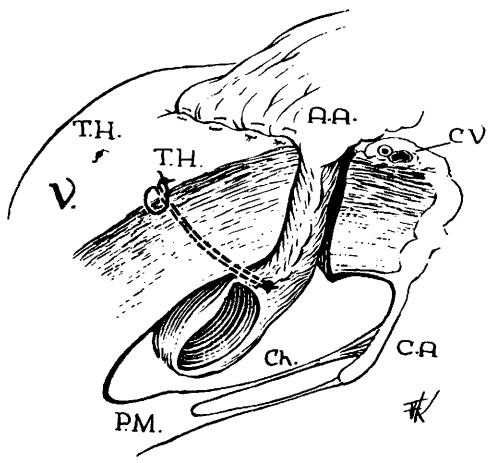

FIG. 3. Longitudinal Section of Anterior Ventricular Wall. Embedded Appendage "in situ."
C.A. = Anterior cusp.
Ch. = Chordae tendineae.
P.M. = Papillary muscle.
C.V. = Coronary vessels.
T.H. = "Temporary hemostatic sutures"—anchored.

The anastomosis is completed by interrupted mattress sutures uniting the anterior wall of the appendage to the edge of the ventricular incision. The single knot of the "temporary hemostatic suture" is opened and each double thread is permanently fixed where it emerges. These anchor the edges of the auricular appendage to the endocardial margin of the incision and hold it deeply implanted in the ventricular cavity (Fig. 3). The guide thread is pulled out after cutting one end short. The auricular appendage, now mobile, lies between the chordae tendineae of the anterior valve and the anterior ventricular wall (Fig. 3). If the appendage is too short to be implanted into the ventricle, it can be embedded in an incision made closer to its base, behind the coronary vessels. These are retracted after careful dissection. The ventricle is opened by an obliquely placed incision on the upper limit of the ventricular myocardium, just below the A-V ring. The appendage is then also lodged between the chordae tendineae and anterior wall of the ventricle.

The pericardium is left open, 100,000 units

of penicillin are put into the thoracic cavity and the chest closed in the usual manner. The post-operative course is uneventful.

Observation. No regurgitation through the anastomosis was ever observed. As long as the clamp at the base of the auricular appendage remains closed, no ventricular pulsations in the appendage and no hemorrhage are seen. After the clamp is opened, blood from the atrium streams through the anastomosis and pulsates in rhythm with the atrium. Bleeding may now occur around stitch openings accidentally torn in the thin appendage wall, but it can easily be controlled.

This operation has been performed on 13 dogs of various size. One death occurred during the operation. The reason for the relatively good survival incidence could be found in the fact that the heart during the whole period of surgical intervention remains fully active and its muscle supplied with fresh oxygenated blood. No attempt is made to operate in a bloodless field; rather the main consideration is given to reducing to a matter of seconds that phase of the operation when the ventricle is opened. This is achieved by means of the technic described above. The blood loss varies between 50 and 150 cc. After all, this technic deals with quickly taking care of a wound which has been produced in the heart before our very eyes, and that problem has long been solved in surgery.

The authors are indebted to Professor C. H. Best, who has shown continuous interest and provided facilities for these experiments. They are also grateful to Dr. J. Markowitz for his helpful advice and encouragement.

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Experimental Hatching of the Eggs of *Ascaris suum*.*

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Yoshida and Toyoda[1] reported the *in vitro* hatching of the eggs of *Ascaris suum* by direct incubation of the eggs for 5 days in a variety of media. Fenwick[2] did not secure hatching in several of the media reported by Yoshida and Toyoda,[1] but he consistently produced hatching in dilutions of Milton solution, a commercial sodium hypochlorite preparation. Fenwick[3] secured living larvae by treating infective eggs with a 1:15 dilution of Milton solution for 12 hours at 38°C, expressing the larvae between a slide and coverslip, and then washing the liberated larvae with an experimental saline. Pick[4] reported the hatching of the eggs of *A. megalocephala* in a Ringer-horse serum solution 34 days after the liquid had evaporated, but during which time the residue had been kept moist. Pick[4] further observed spontaneous hatching among eggs 21 days after transferring them from a Ringer-horse serum solution to a glucose agar medium.

As a preliminary step in the study of the culture requirements of the larvae of *A. suum*, it was necessary to develop a method of hatching *Ascaris* eggs that would provide large numbers of living larvae in a short time.

Materials and methods. Fertile eggs were secured from the mature female *Ascaris* worms from the small intestines of hogs. The eggs from individual worms were incubated at 23° to 25°C in 40 ml of 2% formalin in separate 250 ml cotton-stoppered Ehrlenmeyer flasks.

* The early phase of the work was accomplished through a research fellowship awarded by the Zoological Society of San Diego under a grant from the Ellen Browning Scripps Foundation.

1 Yoshida, S., and Toyoda, K., *Livro Jubilar do Professor Lauro Travassos*, 1938, 569.

2 Fenwick, D. W., *J. Helminth.*, 1939, **17**, 69.

3 Fenwick, D. W., *J. Helminth.*, 1939, **17**, 211.

4 Pick, F., *Bull. de la Societe de Pathologie exotique*, 1948, **41**, 208.