amount of serum (0.25 cc. per kilo of body weight) was kept constant. The titrations were continued until the lowest dilution of the filtrate was found which was still consistently neutralized (*i. e.*, in all rabbits tested) by this amount of serum. The number of reacting units present in this lowest dilution of the filtrate was taken to indicate the same number of neutralizing units in 0.25 cc. of the serum.

The volume, nitrogen content, number of neutralizing units, agglutinins and precipitins of 2 batches of antityphoid horse sera and of 5 representative concentrated preparations are compared. The total yield in neutralizing antibodies was from 40 to 50% of that in the original serum. The concentration as indicated by the quotient Neutralizing Units/mgm. N varied from 28 to 80 times. Thus a great part of the neutralizing antibodies was recovered in a very small globulin fraction. The range of magnitude of this concentration exceeds by far any concentration attained by previous authors by chemical separation of antibodies of various antibody and antitoxin solutions. There is apparently no relation between the concentration of the agglutinins and the neutralizing antibodies. Further observations will decide whether a parallelism exists between neutralizing antibodies and precipitins.

Further work on antityphoid as well as on antimeningococcus and anticoli horse sera is under progress.

Preliminary chemical analysis of this highly specific serum fraction seems to indicate the preponderance of proteins in its constitution. Dr. Harry Sobotka and one of the authors will report this phase of the work in another communication.

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## Chorio-allantoic Grafting Followed by Direct Transplantation in the Chick.*

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The present note calls attention to the possibilities of a new procedure in tissue grafting which promises to prove useful in investigation of problems in development and which should be made avail-

* From the Department of Anatomy, Harvard Medical School; to which the author is indebted for the material and facilities.

able to other workers in this field. The technique combines the method of grafting into the chorio-allantoic membrane as done by Willier[1] and others with that of skin transplantation as described by Danforth and Foster.[2]

The writer is indebted to Professor P. D. F. Murray of Sidney for the information[3] that in his numerous experiments in chorio-allantoic grafting he has at times included pieces of skin which occasionally produced down differing in color from that of the host. As suggested by Professor Murray such experiments are of much value in the study of potentialities in down production during the period of incubation. But they are limited by the fact that each automatically terminates with the hatching of the host and loss of its allantois.

With the hope of finding a way to overcome this handicap the following experiment was undertaken. Twenty-four White Leghorn eggs were put in the incubator at 12 M. on May 7. On May 9, at 3 P. M., 12 Barred Plymouth Rock eggs were put in the same incubator. On May 16, between 3 and 6 P. M., all of the Plymouth Rock eggs were opened but found to contain only 2 living embryos, one of which showed ectopic viscera and undoubtedly would have died in a day or two. These embryos were taken out in warm salt solution and grafts prepared from each. The transplants were made in the usual manner into the membranes of 10 Leghorn embryos. One control and 2 operated eggs hatched on May 27. In one of the latter the graft to the allantois had apparently failed, but attached to the shell of the other, at some distance from the site of operation, was a small mass which on dissection proved to consist of bone, connective tissue, muscle(?) and a considerable amount of skin, on which there were about 40 dark-colored down feathers. This skin was carefully dissected free in 2 small pieces, one of which was transplanted to the back of the original host, the other to the leg (tibio-fibular region), since this was the part from which the original transplant had come. (It represented about half of one leg of the defective embryo.)

The grafted chick made a good start toward normal development but was accidentally killed on the sixth day following the second operation. The skin was immediately removed and examined under low power magnification, when it was found that the graft to the back had failed and the one on the leg had pulled in two, the prox-

[1] Willier, B. H., PROC. SOC. EXP. BIOL. AND MED., 1925, xxxiii, 26.

[2] Danforth, C. H., and Foster, Frances, PROC. SOC. EXP. BIOL. AND MED., 1927, xxv, 27.

[3] In a personal communication.

imal part of this also having failed. But the distal part, which bore several typical Plymouth Rock down feathers, was thoroughly healed in and apparently entirely normal. In the light of previous results from skin grafting there seems no reason to suppose that this part of the graft would not have persisted as long as the host might live.

This lone experiment is of interest (a) in showing incidentally that tissues of a defective embryo may, under favorable conditions, far outlive the life expectancy of the embryo itself; (b) in confirming the observation that at the time the first down follicles are forming, or even before (at the age of 7 days, 3 hours in this case), the skin appears to have already acquired some of its definitive potentialities; and, especially, (c) in indicating the possibility of bridging the gap between the periods before and after hatching in such a way as to make it seem feasible to study the behavior of feather follicles in foreign environments from the time they are first formed in embryonic skin through to adult life.

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## A Method for the Exclusion of Liver Function.

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When the patency of the common bile duct is destroyed, as by a stricture, or by the pressure of an inoperable tumor of the head of the pancreas, the surgeon is confronted with an operation of necessity; an exit must be provided for the bile. Various procedures have been suggested, and are applicable according to the actual conditions found in the given case. The most usual procedure is the operation of cholecystenterostomy—a direct anastomosis between the gall bladder and some portion of the digestive tube.

This is a life saving procedure, easily carried out, with quite satisfactory results. Perhaps the only objection is that the pressure within the digestive tube is greater than the pressure in the gall bladder, with the consequence that the intestinal content is forced into the biliary system, with sometimes a final result of dilatation and general cholangitis.

This untoward final result of the accepted operative procedure led to the following: The intestine is sectioned at some suitable