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REPRINTED FROM

ANNALS OF SURGERY

227 South Sixth Street, Philadelphia, Penna.

FEBRUARY, 1915.

A PRELIMINARY REPORT ON A STUDY OF THE PROTECTIVE FERMENTS OF THE BLOOD BY THE ABDERHALDEN METHOD, AFTER THE TRANSPLANTATION OF ORGANS*

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OF NEW YORK

AT the recent meeting of the International Congress of Surgeons, Carrel reiterated his former statements to the effect that he had met with considerable success in autotransplantation but that homotransplantation of an organ, such as the kidney, was only temporarily successful, it invariably showing degenerative changes within a few days. Lexer, on the other hand, showed that he had succeeded in overcoming some of the biochemical reactions between his animals by a prolonged preliminary treatment of the host with tissues and blood serum taken from the donor.

Blood-vessels transplanted with proper precautions retain their vitality, become an integral part of the system and are believed to remain without extensive tissue metamorphosis.

But when parenchymatous organs with a more complicated physiological function, such as the kidney, the spleen and the thyroid, are transplanted the results as stated are different. They soon undergo autolytic changes and eventually become absorbed. This is known to be caused by biochemical reactions but may be due in part to injury incident to deficient venous drainage, and the technic about to be described is thought to minimize such injuries.

For an interval after an organ is transplanted, it remains in a state of vasomotor paralysis, and is apt to become overdistended with blood on account of insufficient venous drainage. Before appreciating the value of and employing end-to-end anastomosis I had found it necessary to split the kidney capsule in order to prevent parenchymatous destruction by hypertension.

In transplanting the kidney of one dog to the neck of another, one may unite the renal artery end to side to the carotid, but the stoma of the renal vein (Figs. 1, 2 and 3) should be placed end-to-end with that of the external jugular. This I consider very important, because it creates immediate venous drainage for the transplant on account of the

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negative pressure in the jugular. Such positive drainage does not occur if the anastomosis is lateral.

The Abderhalden method was used to seek the protective ferments in the blood which are brought into activity by the presence of a foreign transplant and which may induce its final autolysis.

The thyroid, on account of its accessibility and of the ease with which slight degenerative changes may be recognized, was chosen as the organ to transplant in this study. Furthermore, its venous drainage may be made adequate to prevent hypertension, thus minimizing parenchymatous changes due to physical injury (Fig. 4).

Thyroid transplantation had been undertaken by Borst and Enderlein, Stich and others. Stich in his series of experiments had two successful autotransplants. Of my autotransplants, in two consecutive instances, the thyroid having been removed from the body and reimplanted in the same animal, the results were satisfactory, the thyroid tissue retaining its normal appearance and, apparently, its activity (Figs. 5, 6 and 7).

In a series of homotransplants, although several of the animals lived for some time, the transplant invariably underwent degenerative changes with absorption (Figs. 8 and 9). From a series of fourteen specimens so far obtained at the Laboratory of Experimental Surgery at the New York University, work conducted through the courtesy of Dr. George D. Stewart, it has been possible in eight instances to demonstrate the presence in the blood of a protective ferment capable of digesting suprarenal tissue. The significance of the demonstration is problematical but it may be an index of the susceptibility of the suprarenal body to insults occurring anywhere in the hæmopoietic system. However this may be, the Abderhalden reaction was positive in eight specimens from dogs operated upon as above described.

Tests with different substrata are being made to determine whether organs other than the suprarenal are sensitive to a thyroid transplant.

It is hoped that a way may be found, perhaps with the aid of the X-ray in controlling lymphatic absorption, to modify the biochemical differences which at present cause autolysis and prevent the use of transplants in applied surgery.

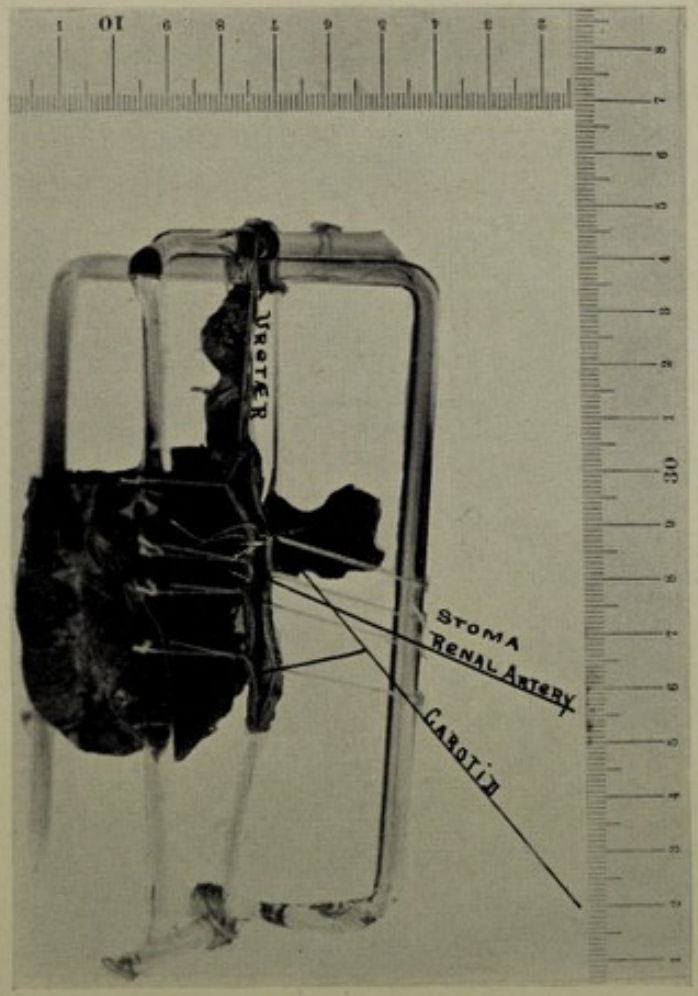

FIG. 1.—1*c*. Homotransplant of kidney.

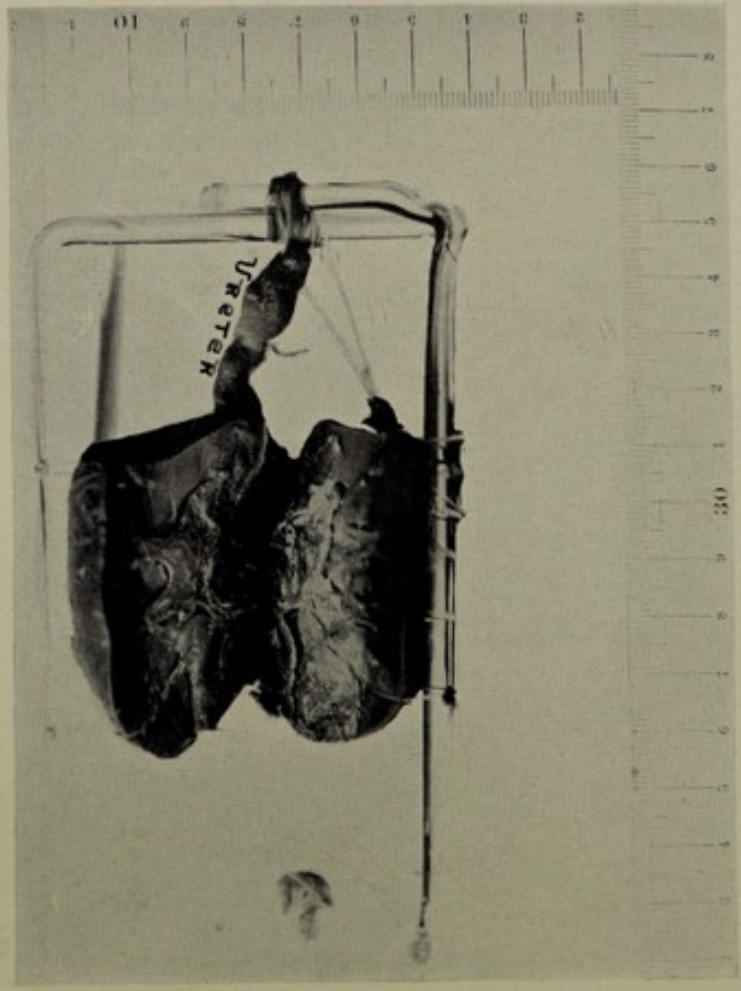

FIG. 2.—1*b*. Homotransplant of kidney.

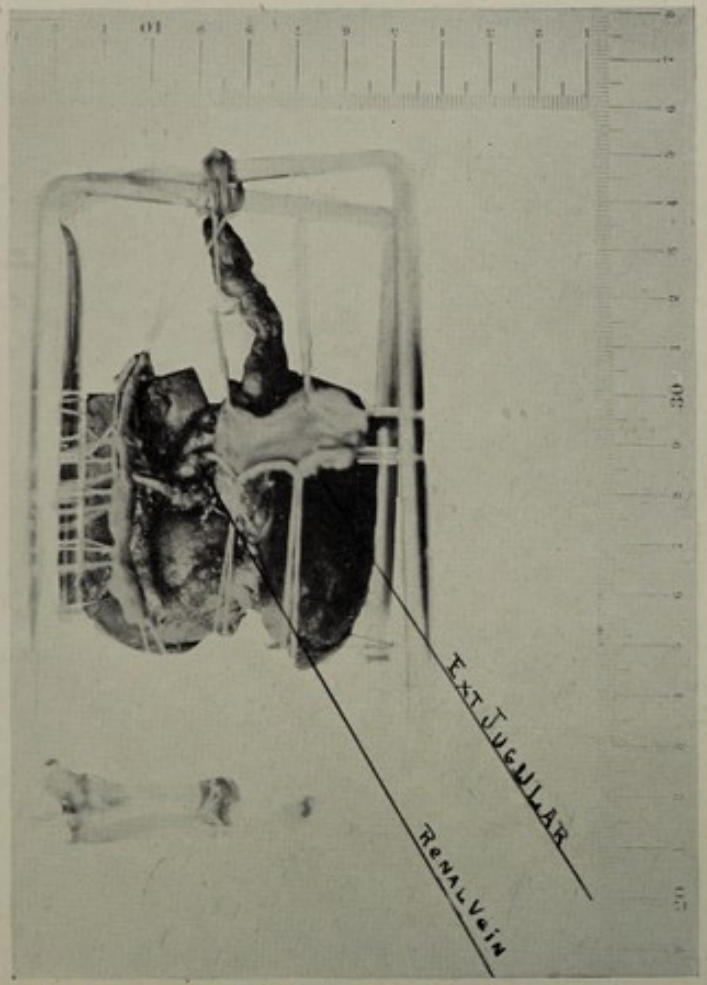

FIG. 3.—*1a*. Dog 765, host. Dog 685, donor. Homotransplantation of kidney to neck. Terminolateral anastomosis, left renal to right carotid; end to end renal vein to external jugular. Removed 8 days post-operative. Note difference in calibre of vessels.

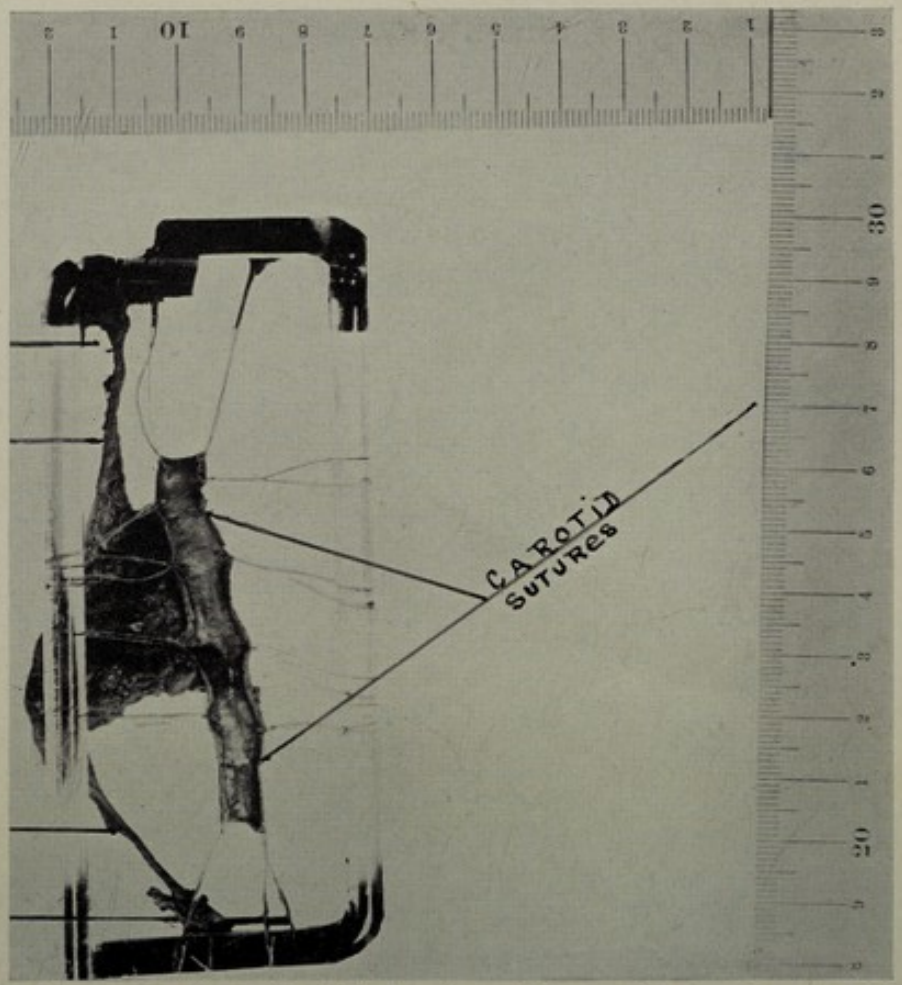

FIG. 4.—Dog 185, moribund black medium sized mongrel, donor. Dog 208, Irish terrier, brown mongrel, host. Homotransplant of thyroid, April 9, 1914. Segment of left carotid of dog 185 interposed between severed ends of right carotid of dog 208. Inferior thyroid vein end to end with left external jugular; superior thyroid vein end to end with right internal jugular. Dog died fifth day, hemorrhage.

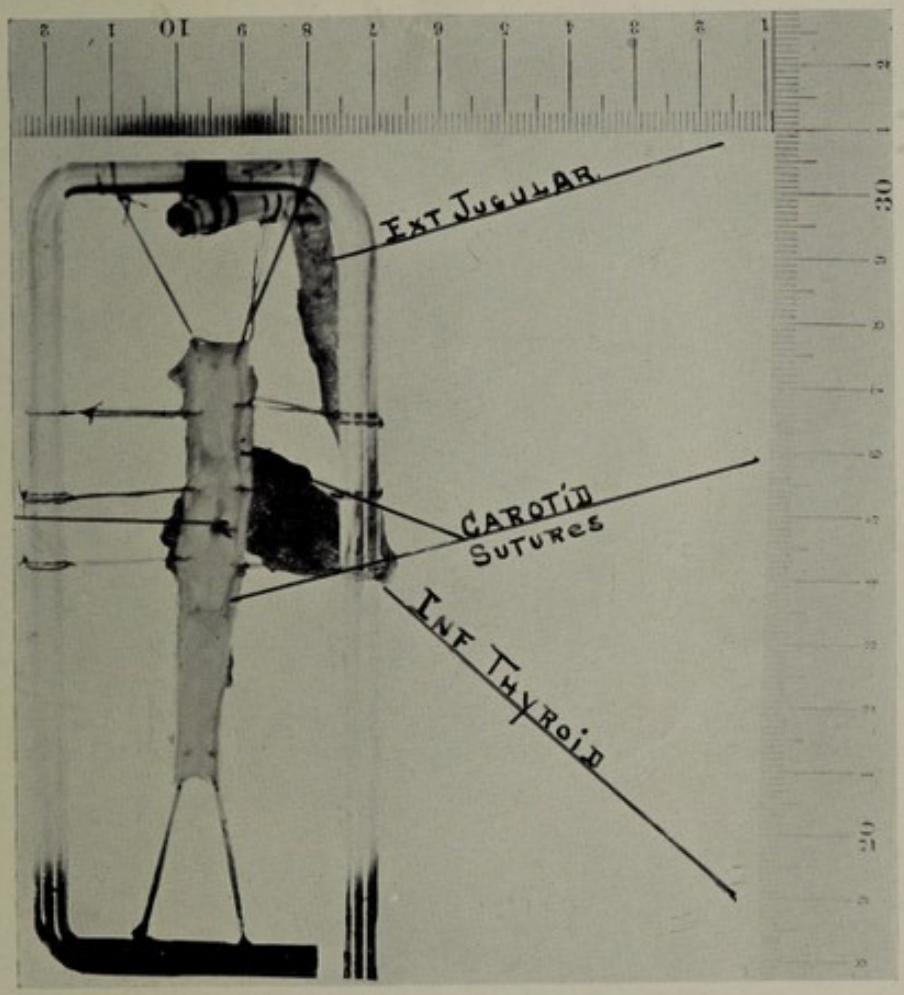

FIG. 5.—Dog 132. Autotransplantation of thyroid, February 26, 1914. Right thyroid with segment of carotid transplanted to left side. Inferior thyroid vein end to end with right external jugular. Removed twenty-three days after operation. Pathological report, normal gland.

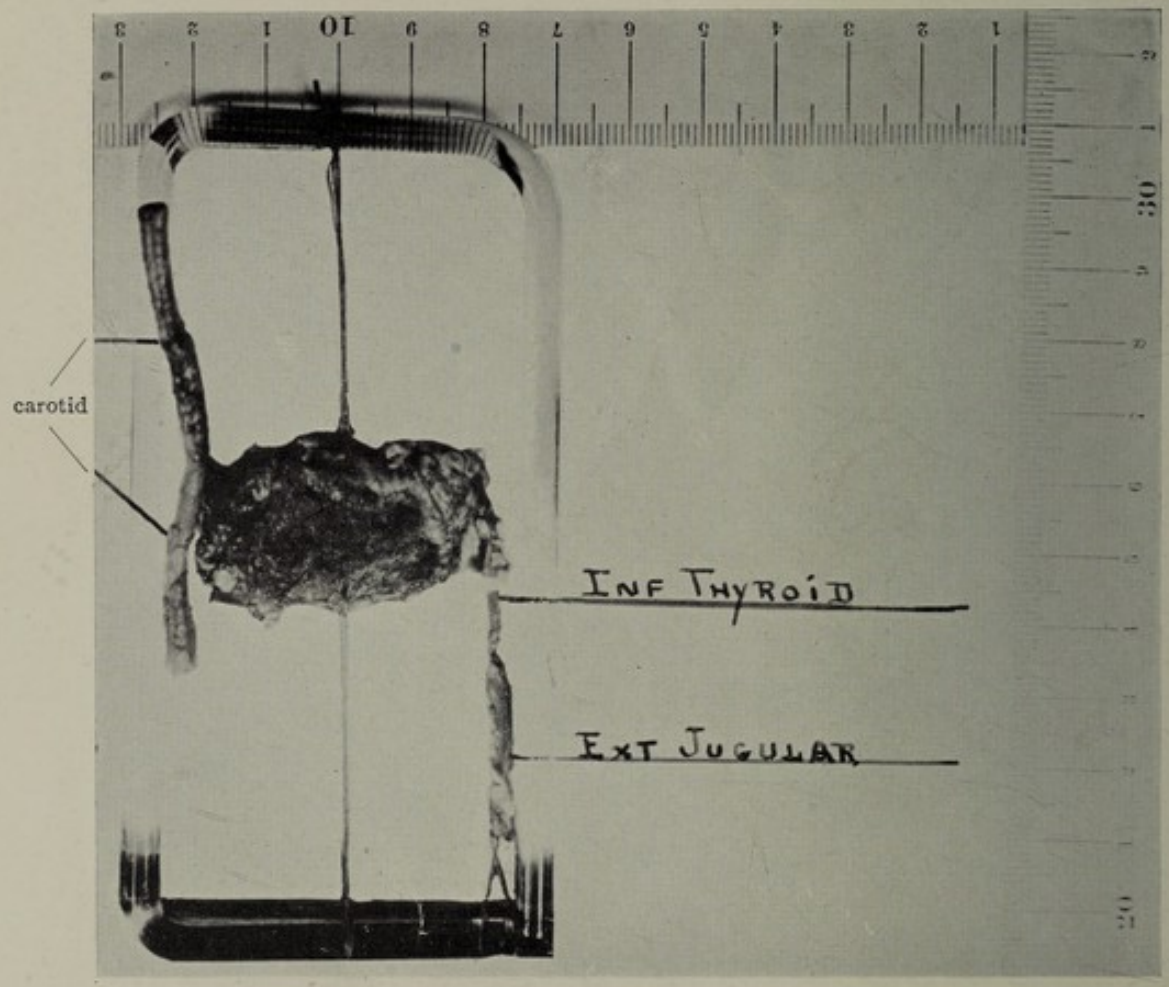

FIG. 6—Dog 138. Autotransplant thyroid, March 2, 1914. Thyroid with segment of right carotid interposed between ends of severed left carotid; right inferior thyroid vein end to end with external jugular. Death due to pericardial hemorrhage, following aspiration of the left ventricle.

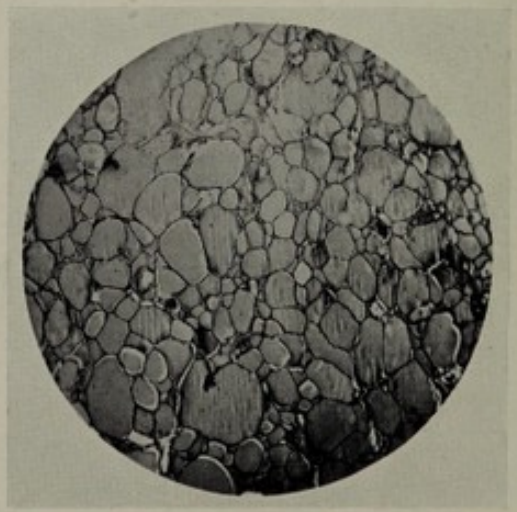

FIG. 7—Dog 132. Autotransplantation of thyroid; specimen removed twenty-three days after operation.

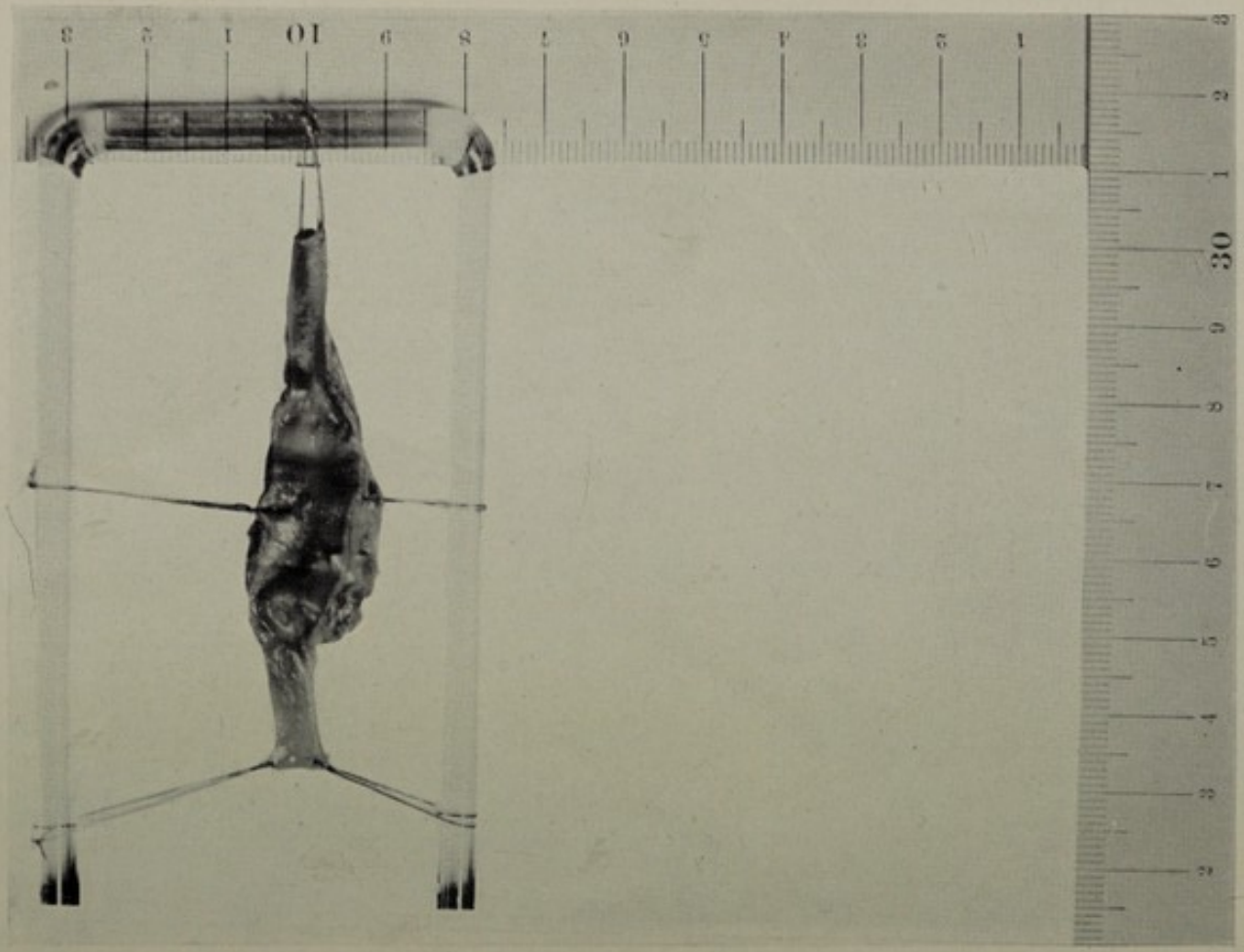

FIG. 8.—Dog 163, donor. Dog 164, black and white coach, mongrel, host. Homotransplant, March 19, 1914. Specimen removed April 23. Gland shows partial absorption. Carotid has smooth intima. No thrombosis.

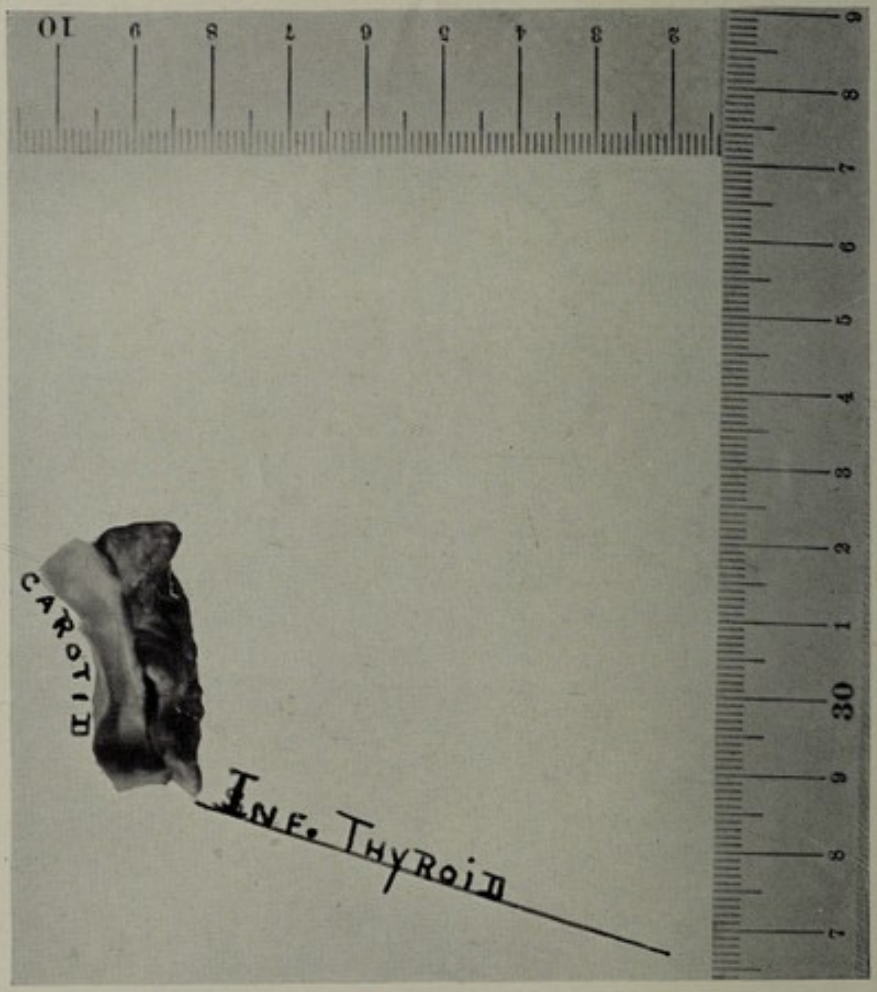

FIG. 9.—Dog 156, black and white bull, donor. Dog 157, mongrel host. Homotransplant of thyroid, March 16, 1914. Microscopic report—partial necrosis; no thrombosis.

ILLUSTRATIONS DEMONSTRATING THE VARIOUS STEPS IN THE TECHNIC EMPLOYED IN THE TRANSPLANTATION OF THE THYROID IN A DOG.

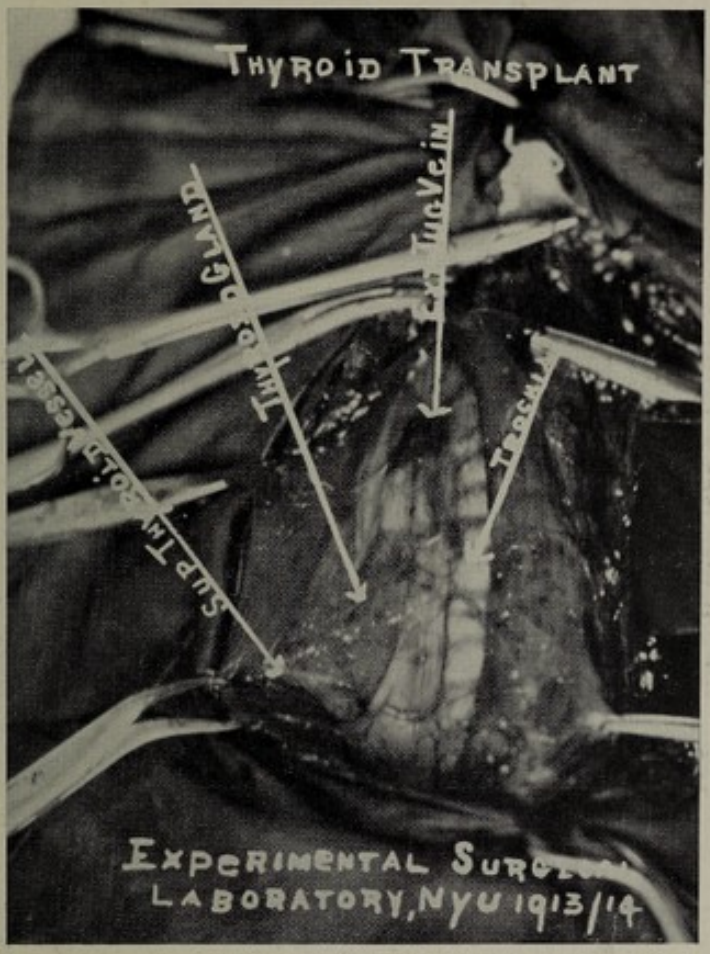

FIG. 10.—Exposure of thyroid body.

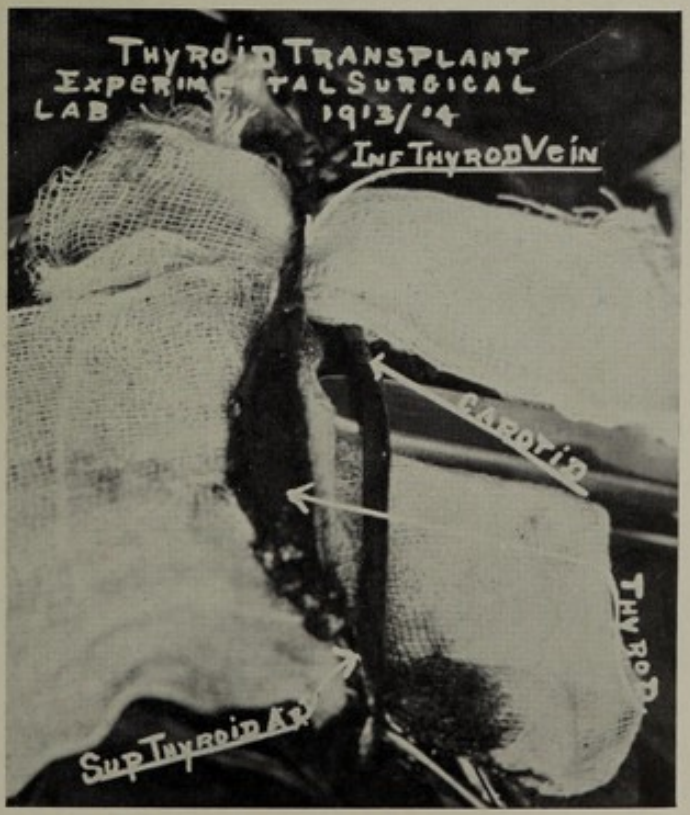

FIG. 11.—Thyroid isolated with vessels ready for removal.

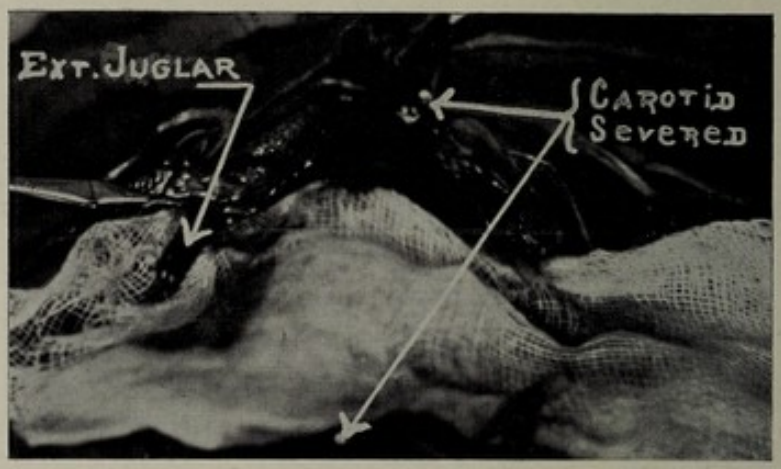

FIG. 12.—Carotid and external jugular of host prepared for reception of transplant.

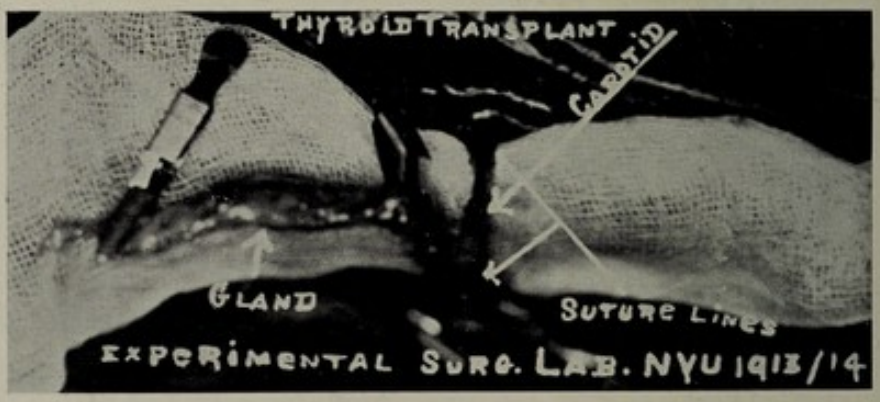

FIG. 13.—Carotid suture completed. Serrefines on thyroid vessels to prevent contamination of operative field.

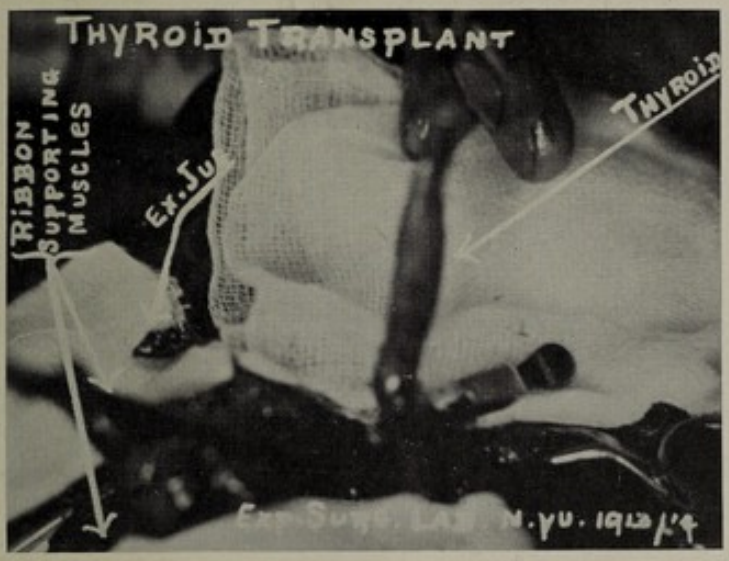

FIG. 14.—Muscles in front of trachea tunneled and raised to admit transplant.

FIG. 15.—Suture of thyroid end-to-end with external jugular of opposite side, completing transplantation.