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REUNION OF STUMPS OF SMALL NERVES BY TUBULATION INSTEAD OF SUTURE[1]

IN the course of extensive experiments with peripheral nerves of amphibians,[2] recently extended to rats,[3] a method of nerve union has been perfected which, owing to its adequacy and wide applicability, deserves to be placed on record. The problem is to appose closely the cut surface of a proximal nerve stump, as the source of regenerating fibers, to the cut surface of a distal stump, as the channel into which the fibers are to be routed. Apposition by ordinary suturing can never be precise enough to prevent masses of fibers from escaping into the surroundings and straying off to uncontrollable destinations. Moreover, when we are dealing with nerves of only a fraction of a millimeter in diameter, neat suturing becomes a mechanical impossibility. Both difficulties can be met by tubulating the nerve ends with a tightly fitting cuff of fresh artery.[4]

A fragment of artery slightly narrower than the width of the nerves to be united is chosen, squeezed free of blood and immersed in Ringer's solution. All further manipulations take place in this solution. For instruments we use two pairs of hard steel (watchmaker's) forceps ground down until the ends have become very slender and sharp-pointed. The steps of the operation are illustrated in the accompanying figures. (1) With forceps F pull artery A over closed forceps G; artery becomes greatly dilated.

[1] Research aided by the Dr. Wallace C. and Clara A. Abbott Memorial Fund of the University of Chicago.

[2] Paul Weiss, *Biol. Rev.*, 11: 494, 1936.

[3] R. W. Sperry, *Jour. Comp. Neurol.*, 73: 1940.

[4] Tubes filled with various media have been used by surgeons to bridge nerve defects. In the present note tubulation is introduced in a different capacity and on a different order of magnitude.

(2) Open forceps G slightly and grasp perineurium of nerve stump NP. (3) With forceps F strip artery from G and pull half-way over NP. (4) Withdraw G. (5) Insert F into empty end of artery and open prongs slightly; introduce nerve stump ND into the opening, until the two stumps meet (some additional

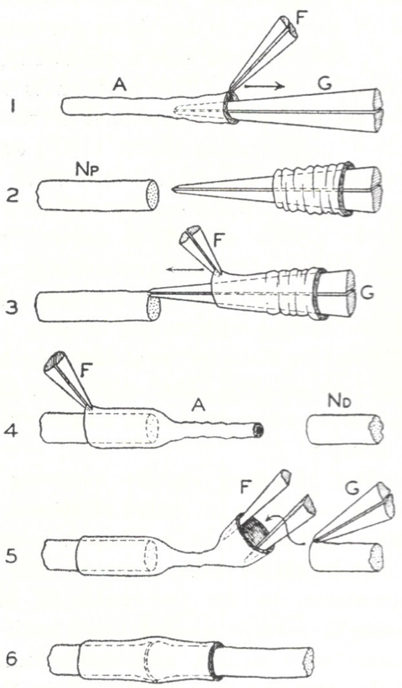

FIG. 1

pressure, flanging the ends, is advisable). (6) Stretch the arterial cuff until it fits snugly.

Enough slack should be allowed to the nerve stumps to insure apposition without stress. After sucking and blotting the excess Ringer's solution from the wound, clotting occurs rapidly. The arterial cuff, firstly, provides a firm link between the nerve ends

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and, secondly, prevents the formation of a neuroma and the uncontrollable escape of fibers. It is gradually transformed into perineural connective tissue and after several months can no longer be identified. Regenerating fibers traverse the wound in straight parallel courses instead of in the usual confusion following nerve suture.

It has recently been described[5] that good binding between severed nerve trunks can be obtained by applying clotting blood plasma to the apposed cut ends, and that regenerating fibers under these conditions take fairly straight courses in crossing the scar.[6] Whether this method provides the experimenter with as definite an insurance against undesirable stray fibers as tubulation does, remains to be seen.

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[5] J. Z. Young and P. B. Medawar, *Lancet*, 1940: 126.

[6] These experiments essentially reproduce conditions first established in tissue culture by the author (P. Weiss, *Jour. Exp. Zool.*, 68: 393, 1934) and confirm the guiding effect of an oriented fibrin matrix on nerve fiber growth.