fer generations of lines which have become highly malignant as a result of numerous transfers. A variety of lines should be tested with agents offering encouraging results on particular lines.

Summary. Survival time was lengthened significantly in 3 transfer lines of mouse myeloid leukemia by treatment with either potassium arsenite, urethane, x-rays, or benzol in decreasing order of effectiveness. Two transfer lines of lymphoid leukemia grown in genetically identical hosts did not respond favorably to the same treatment with the chemical agents. Potassium arsenite was more effective than urethane on a weight basis, and in the effective dose range was tolerated better than urethane.

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Further Experiments on Bridging of Long Nerve Gaps in Monkeys.*

EBEN ALEXANDER, JR., ROBERT P. WOODS, PAUL WEISS.

From the Children's Hospital, Department of Surgery, Harvard Medical School, and the Department of Zoology, University of Chicago.

The method of bridging gaps in peripheral nerves by a fiber cable embedded in a tubulated blood bridge, as described by Weiss and Taylor[1] for lower mammals has been successfully extended to monkeys by Matson, Alexander and Weiss.[2] The nerve gaps in these experiments measured up to 14 mm in length. The present experiments were undertaken to determine the feasibility of bridging longer gaps (from 22 to 32 mm), by the same technic.

Experiments. Five adult *Macaca rhesus* monkeys were used. The technic was essentially the same as in the earlier experiments. A section of the tibial nerve was cut out and the stumps allowed to retract; a segment of internal jugular vein was threaded over the proximal stump; the desired length of the gap was fixed by a tantalum sling stitch without tension; the nerve stumps were connected axially by a cable of finest nylon fibers (.006 inch); a trough made from polyethylene tubing of nerve caliber was placed under the cable-spanned gap and filled with blood from the jugular vein; after firm clotting had occurred, the trough was removed; finally, the sleeve of the vein was pulled over the bridged gap and secured to each nerve stump by a silk stitch. After wound closure with silk, no further provisions were made for the protection of the site of operation. The animals were set free in large cages. All remained in good health.

No detailed records were kept of the course of nerve recovery, and all tests were left to the terminal exploration, which was made under intravenous nembutal anesthesia, 289 to 333 days after the operation. After measuring both calves and exposing the nerve, the responses of leg and foot muscles to faradic stimulation of the nerve were determined. Segments of the regenerated nerve and of the control nerve from the opposite side were removed for histological study. In 4 of the 5 cases, the weights of the gastrocnemius muscles of both sides were also recorded.

Results. There were no technical failures in this series. Wounds healed without infection. In no case had the activities of the animals during the early postoperative period disrupted the nerve bridge. On re-exploration, the nerve bridge, after being freed from moderate adhesions, presented itself as an elon-

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1 Weiss, Paul, and Taylor, A. C., *J. Neurosurg.*, 1946, **3**, 375.

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TABLE I.
Recovery of Muscles After Nerve Regeneration Over Long Nerve Gaps with Bridges.

No. of monkey	Length of gap, mm	Days post-op.	Atrophy* of calf, %	Response to faradic stimulation of nerve				% of wt. recovery in Gastrocnemius
				Gastrocnemius	Posterior tibial	Long flexors	Intrinsic foot muscles	
66	32	333		+	+	+	0	(Control muscle unavailable)
72	23	321	6	++	++	++	0	82
73	25	302	13	++	++	++	++	86
74	26	289	5	++	++	++	++	77
75	22	307	5	++	++	++	++	95

* Percentage difference of circumference between calves on reinnervated and opposite control sides.

gated swelling of the nerve 1½ to 2 times the diameter of the normal nerve.

The degrees of recovery in the various cases are summarized in Table I. To gross observation, the functional use of the limbs appeared recuperated, but no detailed study of coordination has been attempted. The electrical stimulation of the exposed tibial nerve above, as well as below, the anastomotic site, yielded good contractions in the gastrocnemius muscles, the posterior tibial muscles and the long flexor muscles of the toes in all animals. The intrinsic muscles of the foot, studied after severance of the Achilles tendon, showed no perceptible response in two cases, fibrillary twitching in two others, and a marked response, with clear-cut opposing motion of the great toe, in the fifth.

Weight recovery in the reinnervated muscles was likewise very satisfactory. While denervated muscles are reduced to 30% of control weight (88 days after transection of the tibial),[2] the calf muscles innervated by the bridged nerves have recovered 77-95% of their controls, with an average of 85% (Table I). The degree of recovery expressed in these figures is actually higher than that observed in the previous series with shorter gaps (50-93%, with an average of 63%), but this difference may be attributable to the longer recovery period in the present series (289-333 days, as compared to 222-288 days). It is evident that the increase in the length of the gap has not reduced the effectiveness of the bridge in facilitating nerve regeneration in this series of experiments.

Histological observations. Sections through corresponding levels in midcalf of the regenerated and control tibial nerves, treated with osmic acid, fully confirm the results of the earlier series with shorter gaps. The regenerated distal nerve stumps contain approximately their normal quota of fibers. An actual count (monkey 74) showed 10,460 fibers in the regenerated nerve, and 11,565 fibers in the opposite control nerve. Numerically speaking, the volume of innervation has thus been practically fully restored. This point deserves emphasis since one encounters reports of successful nerve regeneration containing histolog-

ical pictures of regenerated fibers in the distal stump, but without substantiation of their number.

As in the former series, the diameters of the regenerated branches were subnormal, with only a few reaching the 8-9 micra class. This caliber deficit indicates that the fibers have been encroached upon at some proximal level by endoneural fibrosis, possibly at the points where the nylon cable was sewn through the stumps. It has been shown that the narrowing of the lumen of a fiber at any one level limits the caliber growth of the distal portion of the fiber.[3,4] While one must suspect that permanently subnormal calibers entail some deficiencies in function,[5] these have not been severe enough to become grossly discernible.[2]

Conclusions. Comparing these results with those of the earlier series involving gaps of about half the length, no evidence of a decline of the power of regeneration with the increase in the length of the gap can be detected. It may be reasonable to assume that the gap could be lengthened even more without becoming unbridgeable.

Summary. Gaps of from 22-32 mm in length in tibial nerves of monkeys were closed by nylon cables embedded in tubulated blood bridges.[1,2] The reinnervated muscles regained an average of 85% of their normal weight. The distal regenerated nerve fibers were approximately normal in number, though subnormal in size. There has been no reduction of regenerative power with increased length of the gap in this series as compared to a previous series with shorter gaps.

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Erythrophagocytosis in Bone Marrow Culture with Relation to Antagonism of Pteroylglutamic Acid.*

HERBERT SALIS.† (Introduced by Arnold D. Welch.)

From the Department of Pharmacology, School of Medicine, Western Reserve University, Cleveland, Ohio.

A small series of cultures of bone marrow has been studied, as part of a larger investigation of the function of pteroylglutamic acid (PGA).[1] Through the addition of PGA-antagonists [(crude antagonist N67-A,[2-4] 'Methopterin' (a methyl pteroylglutamic acid of unidentified structure,[5]) and 'Aminopterin' (N-[-{[(2,4-diamino-6-pteridyl) methyl]-amino}-benzoyl]-glutamic acid][6]‡ it had been hoped to achieve *in vitro* a maturation arrest

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† Resident, Department of Medicine, Crile Veterans Administration Hospital, Cleveland, Ohio. The author is indebted to Dr. Robert W. Heinle and Dr. Arnold D. Welch for their valuable aid and advice.

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