gross pathological manifestations were observed as a result of the inclusion of amounts of choline chloride up to 4% of the ration.

Four representative specimens from each lot were slaughtered, and showed appreciable differences in body fat deposits. Carcasses of chickens fed the diet with 4% added choline had considerably less subcutaneous, abdominal and mesenteric fat than those fed the 1% and 2% levels, which in turn had less fat deposits than chickens receiving 0.50% of choline in the diet.

Summary. Various levels of choline chloride were added to rations fed to growing chickens. The addition of 1%, 2% and 4% reduced the rate of gain by about 12%, 13.8% and 23.8% respectively. As much as 4% of choline chloride added to the diet produced no toxic manifestations other than retarded growth.

15411

Ulnar-Femoral Nerve Anastomosis in Paraplegic Rhesus Monkey.*

J. LAWRENCE POOL. (Introduced by Fred A. Mettler).

From the Department of Neurology, College of Physicians and Surgeons, Columbia University.

In seeking a method of bridging the gap in neural continuity caused by transection of the spinal cord, the following experiment was carried out.

The left ulnar nerve of a rhesus monkey was dissected from the axilla to the forearm and transposed subcutaneously to the left flank. The left femoral nerve was then exposed through a retro-peritoneal approach, and divided close to its origin where its proximal end was sutured to the distal end of the transposed ulnar nerve. For the sake of convenience, the left forelimb was then amputated at the shoulder.

Five and one-half months later the spinal cord was transected at D 4. Following transection it was evident that struggling movements resulted in active flexion of the left thigh despite the atrophy which had followed femoral nerve section.

Faradic stimulation of the anastomosed ulnar-femoral nerve through the intact skin, both above and below the point of nerve suture elicited contractions of the ipsilateral psoas and vastus muscles (innervated by the sutured femoral nerve).

Ten days after cord transection, the right motor cortex was exposed under ether anesthesia, and stimulated electrically. Stimulation of the exposed leg area, as expected, yielded no response. Stimulation of the forelimb area, however, with the same strength of current, elicited contractions of the contralateral (left) shoulder muscles and also simultaneous contractions of the left psoas and vastus muscles, innervated by the anastomosed femoral nerve. An ensuing generalized convulsive seizure involved not only the musculature above the level of the cord transection but also the above-mentioned muscles of the left thigh, which were the only muscles that participated in the convulsion below the level of cord transection. These movements were phasic and coordinated with the phasic movements of the upper extremities.

Electrical stimulation of the segments of the cervical cord giving rise to the transposed ulnar nerve yielded contractions of the ipsilateral thigh muscles while stimulation of the cervical cord elsewhere at the same current strength failed to do so.

On exposing the anastomosed ulnar-femoral nerve, it was found that direct electrical stimulation of the nerve both above and below the point of suture elicited flexion of the left thigh. There was no evidence that stimulation of the skin (or other structures) or of the anastomosed femoral nerve itself, distal to the suture line, caused a pain reaction. Microscopic studies of the anastomosed

* Aided by the William J. Matheson Commission.

nerves showed that regenerated nerve fibers had traversed the line of suture.

Conclusions. Clinical, electrical and microscopic studies demonstrated functional continuity after ulnar-femoral nerve anastomosis in a paraplegic rhesus monkey.

15412

Non-Utilization of Intravenously Administered Acetyl-*dl*-tryptophane.

JAMES MURRAY LUCK, PAUL DELOS BOYER,* AND VICTOR E. HALL.

From the Biochemical Laboratory, Department of Chemistry, and the Department of Physiology, Stanford University.

Albanese, Frankston, and Irby,[1] reporting on the fate of acetyl-*dl*-tryptophane given by mouth to human subjects, conclude "that, with the exception of a 5% urinary loss, all of the acetyl-*dl*-tryptophane may be available to man."

We have had occasion recently to investigate the fate of acetyl-*dl*-tryptophane administered intravenously to human subjects. Since the conclusions resulting from our investigation differ from those of Albanese *et al.*, publication of our findings is indicated: the difference in routes of administration must, of course, be emphasized.

Acetyl-*dl*-tryptophane (Merck) was used throughout. Two colorimetric methods for analysis of urine samples were employed. In the first of these the urine was diluted 100 fold. Portions of 1.0 cc were rendered strongly alkaline with 4.0 cc of 0.5 N NaOH and treated finally with 1.0 cc of the Folin-Ciocalteu phenol reagent.[2] The constituents were thoroughly and rapidly mixed and the resultant color read in a Klett-Summerson colorimeter after 2 minutes. The galvanometer deflections obtained were referred to a standard rectilinear reference plot of the corresponding readings obtained for varying quantities of 0.001 M acetyl-*dl*-tryptophane similarly treated with alkali and phenol reagent.

In the second method *p*-dimethylaminobenzaldehyde, as used by May and Rose[3] for tryptophane determination, was the reagent employed. Sodium nitrate, as proposed by Bates,[4] was used to accelerate the color development. Again the urine was diluted 100 fold. Portions of 0.25 or 0.50 cc, further diluted with water to 1.0 cc, were treated with 1.0 cc of sodium nitrate solution (1 mg per cc) and 5.0 cc of 0.05% *p*-dimethylaminobenzaldehyde in 12 N HCl. Readings were made on a Klett-Summerson colorimeter after 55 minutes and were corrected for the color given by normal urine. The reference curve, based on the use of 0.0 to 1.0 cc portions of 0.0005 M acetyltryptophane was rectilinear.

Recovery experiments on urine which was 0.0010 M to 0.0016 M with respect to added acetyltryptophane yielded a 96 to 101% recovery by either method. The correction for the color obtained with normal urine with the aldehyde reagent was, however, substantially lower than that obtained with the phenol reagent.

Three adult male subjects were used. In the first experiment each received intravenously 50 cc of 0.30 M acetyltryptophane adjusted to pH 7.2 with sodium hydroxide, passed through a sterilizing asbestos filter, and briefly heat-sterilized before use. The urine was collected in 3 post-injection periods of 6, 6 and 12 hours respectively, except in the third

* Present address: Division of Agricultural Biochemistry, University of Minnesota, St. Paul, Minn.

[1] Albanese, A. A., Frankston, J. E., and Irby, V., *J. Biol. Chem.*, 1945, **160**, 31.

[2] Folin, O., and Ciocalteu, V., *J. Biol. Chem.*, 1927, **73**, 627.

[3] May, E. E., and Rose, E. R., *J. Biol. Chem.*, 1922, **54**, 213.

[4] Bates, R. W., Proc. Am. Soc. Biol. Chem., *J. Biol. Chem.*, 1937, vii, 119.