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Lesions in the Pyramidal Tracts in Cats.*

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The present experiments attempt to produce lesions confined to the cortico-spinal (pyramidal) tract in cats. Theoretically, this might be done in the pyramids of the medulla, and both pyramids should be cut to remove all cortico-spinal innervation from even one side of the body. This operation, with survival long enough for Marchi studies, has been described only by Starlinger[1] (dogs) and by Schäfer[2] (monkeys). Lesions of one pyramid only, or of the pyramidal decussation have been reported by a few others.

In the present series, 12 bilateral and 4 unilateral lesions were made in the pyramids in cats. Survival was permitted for varying periods to 24 days. Nembutal and sodium amytal were used as anesthetics. The pyramids were cut through an incision in the ventral aspect of the neck. The findings reported begin with the second day and unless otherwise specified refer to the animals with bilateral lesions.

Posture. The assumption of temporary grossly abnormal postures was observed initially in 5 of the 12 bilaterally operated animals and disappeared in these after a few days. Milder manifestations of defective postural control, such as slipping of the feet on a smooth floor, undue twisting of the pivoting leg on a turn, or an over extension of the toes with a backward position of a limb, were present in practically all animals initially. They almost or entirely disappeared.

Of the more constant early postural abnormalities the most common was a tendency to stand with the hind legs abducted and sometimes also inwardly rotated. Less frequently the forefeet appeared unduly flattened on the floor. Many of the animals assumed at times a peculiar half sitting position, resting the whole of the hind feet from toes to ankle on the floor with the rump some distance above it. They often settled into this position with a peculiar slowness and moved slowly from it into other postures. These phe-

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[1] Starlinger, J., *Neurol. Centralbl.*, 1895, **14**, 390; *Jahrb. f. Psychiat. u. Neurol.*, 1897, **15**, 1.

[2] Schäfer, E. A., *Quart. J. Exp. Physiol.*, 1910, **3**, 355.

nomena usually disappeared with time. The animals rarely spontaneously put their weight on the dorsum of a foot, but if a foot was placed in the turned over position by the examiner, the normal correction movements were absent for from 4 to 21 days.

Motion. Gross difficulty in walking, marked staggering, or swaying appeared in only 4 of the series and in these it lasted no more than a day. A rather constant abnormality of gait was an apparent stiffness in the hind limbs, which were brought forward with less than the normal play in the distal joints. The forelegs usually showed no defects in walking, but in a few cases a certain heaviness or plodding was noticed. A striking feature was the frequent occurrence of a marked reduction in general activity. This was manifested in the early days by little spontaneous walking and later by a slow or unhurried motion. Running, galloping, or general friskiness were rarely observed in the bilateral animals even at the end of 3 weeks, although by this time little or no disturbance in the gait itself was usually apparent. Walking along the rungs of a horizontal ladder, or along a narrow track often brought out defects when walking on the floor appeared to be normal. Jumping down from a height or walking on the hind legs only, showed certain other deficiencies. But even these functions were capable of marked improvement.

Placing and Hopping Reactions. The flexion movements obtained by stroking the hairs of the feet (Munk's Berührungs reflex) or by bringing the dorsum of the feet lightly against a table edge (Stehbereitschaft of Rademaker) were absent initially but eventually returned. The visual stehbereitschaft was temporarily impaired. The hopping reactions showed an initial delay, *i. e.,* the leg had to be bent far from the vertical before the hop would begin, and the resulting movement was in many cases excessively forceful and heavy. Marked or total recovery eventually took place.

Tone. The resistance of the limb to passive flexion (extensor tonus) was almost always increased initially, particularly with certain postures of the animal. This could usually be readily demonstrated by suspending the animal ventrally in a sling where the increased resistance was observable in all limbs, or by holding it with one hand under the belly where it could be seen in the hind legs. When lying on its back in a trough this resistance was usually less marked than in the other positions described. In general, ventral stimuli appeared to increase, dorsal stimuli to inhibit it. Along with the increased resistance to flexion went a diminution of the flexor activity normally incited by passive manipulation of the

limbs, a function most readily measured by resistance to passive extension. Both these phenomena gradually passed away, with a certain tendency for the diminished flexor activity to persist for a time after the resistance to passive flexion had disappeared.

General. After unilateral operation, the contralateral limbs were chiefly but not exclusively involved. The homolateral hind limb was damaged to a lesser extent and the homolateral forelimb hardly at all. In general, also, the contralateral limbs were somewhat less disordered after unilateral, as compared with the bilateral operations. Marchi degeneration studies are in progress.

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Relative Utilization of Calcium from Calcium Carbonate and Calcium Gluconate by Chickens.

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Numerous investigations have indicated that the chicken may use a number of forms of calcium for its metabolic needs. Workers at the Kentucky Experiment Station[1] studied calcium carbonate, calcium lactate, calcium sulphate, tri-calcium phosphate and calcium chloride as sources of calcium for chickens and found that calcium carbonate was the most effective judged by the degree to which it was utilized in the production of eggs, its influence on the weight of egg contents and shells, and quantity of the salt consumed. Calcium sulphate was not so effective as the carbonate as shown by a smaller egg production and lower weight of shells and egg contents. Calcium lactate was readily utilized but the quantity consumed was variable and small as compared to the carbonate and sulphate. Only small quantities of calcium chloride were consumed and the precipitated tri-calcium phosphate was not a satisfactory source of calcium for egg production as compared to calcium carbonate. The above mentioned salts were fed as supplements to a wheat, yellow corn and skim milk ration.

Bethke[2] and his associates state that no difference was found in the availability of calcium in the carbonate, sulfate, lactate and

[1] Buckner, G. D., Martin, J. H., and Peter, A. M., *J. Agr. Res.*, 1928, **36**, 263.

[2] Bethke, R. M., Kennard, D. C., and Kick, C. H., *Poultry Science*, 1929, **9**, 45.