levels up the ureter. The distance between stimulation points was 5 cm., since it was felt that too frequent stimulation led to indefinite and inaccurate interpretation. After the conclusion of the experiment pyeloureterograms were taken to exclude pathology in the urinary tract.

The results obtained in 8 patients so studied may be briefly summarized as follows:

In the lower one to 2 cm. of the ureter, the pain was referred suprapubically, being almost in the midline and extending upward about 4 cm. Pain into the perineum occurred in some cases but was not constant. Five centimeters from the ureteral orifice the pain was higher and somewhat lateral to the midline. The pain was always below the iliac crest and somewhat medial to McBurney's point. In many cases the patient complained of pain in the inside or outside of the thigh or inside of the leg at this level. In others, pain in the leg was only noticed at somewhat higher levels. From 10 to 20 cm. the pain was referred in practically the same abdominal areas as the lower levels but pain on the inside of the leg often extending to the toes was the rule. At the 25 cm. level the patient complained of pain over the anterior portion of the iliac crest and anterior iliac spines which was also present at the 26 and 27 cm. level. When the interior of the kidney was stimulated the pain was always referred to the back. In one case with a left chronic hydronephrosis and hydroureter no pain response could be elicited, which is in accord with clinical experience in these cases.

9106 P

Excitant Action of Morphine on the Long-surviving Decorticated Cat.*

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Morphine is known to be excitatory to several species of animals. The cat especially gives a violent maniacal response. As the first step in an analysis of this excitant action, the effect of morphine has

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been studied on the long-surviving cat after bilateral cerebral decortication. Up to the present time 4 such animals have been prepared, and the response of each to morphine has been observed on from one to 3 separate occasions.

Operation was done aseptically in 2 stages at least 2 weeks apart under sodium amytal anesthesia (50 mg. per kg., intraperitoneally), using a fronto-parietal approach. The cortex of each cerebral hemisphere was peeled off with blunt spatula, sparing the olfactory cortex as much as possible.

Anatomical Study. Gross examination of the formalin-hardened brains disclosed absence or probable degeneration of the entire cortex except for parts of the olfactory system, and considerable destruction of the striate nuclei. The thalami were largely intact. Histological study of the brains is now in progress. These cats were, therefore, essentially *Thalamic Preparations.*

Physiological Activity. The behavior of the animals will be discussed in detail in a later publication. The activity varied considerably in the different animals. Cats No. 2 and 3 showed very little spontaneous walking, but stood in one position most of the time, whereas the other 2 cats walked nearly continuously. All of them were attracted by the smell of food, but were unable to eat sufficient to maintain body weight, except cat No. 4, which drank milk spontaneously and required no supplementary feeding. The other cats were fed milk daily by stomach tube (which was done merely as a time-saving measure since they were all able to swallow milk when it was put in the mouth). The animals which walked had a high-stepping, spastic gait. The placing and hopping reactions and the ability to correct imposed abnormal postures were tested‡ in the last 3 cats and were all absent.

Results. All 4 cats, 2 to 11 weeks after total decortication, responded to morphine by a kind of excitement which was somewhat modified from, yet fairly characteristic of the effect produced in intact cats. The difference could largely be attributed to the absence of the postural and related reflexes. Thus the intact morphinized cat (10 to 20 mg. per kg., subcutaneously) typically shows bursts of violent maniacal charges from one side of the cage to the other. These alternate with slightly longer periods of relative inactivity during which the cat sits up with alert and roving head and eyes. The morphinized decorticated cat also shows alertness of head

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and eyes and periodic bursts of activity. But while resting it lies with stiffly extended legs, and the periods of activity are characterized by generalized muscle spasms which sometimes propel the animal across the floor. If set on its feet, the cat tends to take several quick, spastic, trot-like steps before it falls. This is the phase of the activity which most closely resembles the morphine mania seen in intact cats. It differs mainly (1) by the inability to assume or maintain an upright position, (2) by pronounced extensor spasm of the legs and (3) by quicker onset of fatigue.

Both intact and decorticated cats a few hours after morphine administration show a heightened "startle" reflex to noise (clapping of hands) and to tapping the animal. This effect is exaggerated in the decorticated cats and closely resembles the tetanus of early strychnine poisoning. Two of the decorticated animals in this condition were given a half-anesthetic dose of sodium amytal (25 mg. per kg., intraperitoneal) which uncovered vigorous running movements not seen in intact cats similarly treated.

Summary. The long-surviving cat after bilateral cerebral decortication with degenerative changes in the striate nuclei responds to morphine with an excitement which is quite similar to the effect on intact cats, but with certain modifications described in the text. The excitant action of morphine must, therefore, be mediated by subcortical centers.

9107

A Method for Determining Blood Volume in Rats.

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Methods for determining the blood volume of small animals are available, but all have one of two objections: (1) they require so much blood as to affect the subsequent blood volume of the animal, or may even cause its death; (2) they require the laborious preparation of standards consisting of dye-containing serum in uniform capillary tubes. Such standards are then presumed to be permanent.

Our method requires but 50 cmm. of blood, and the standard can

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