the effects of peripheral coördination based on joint and muscle mechanics has been ascertained. These statements are the result of two years of careful study of the effect of mechanical conditions on the action of the separate muscles of the hind leg of the frog, when these muscles have been electrically excited to action, in different positions of the bones.

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The senses and intelligence of the Chinese dancing mouse.

By **ROBERT M. YERKES.**

[*From the Psychological Laboratory of Harvard University.*]

For a few days during the first month of post-natal life the dancing mice which I have studied respond definitely to sounds, but neither direct nor indirect methods of testing auditory sensitiveness furnish any evidence of it in the adult.

Brightness vision is fairly acute; color vision is poorly developed. I have some evidence of the discrimination of red and blue, and of red and green, but no evidence that blue and green can be distinguished. In visual discrimination the mice apparently depend upon brightness differences.

The behavior of the dancing mouse is readily modifiable. Choice, by exclusion, of one of two objects which differ in brightness, with electrical stimulation in the case of a wrong choice, indicates that from 40 to 100 repetitions of an experience is necessary for the formation of a perfect habit. Such a modification of behavior lasts for from two to five weeks.

Modifications of behavior occur more rapidly in the male than in the female. Individual differences in plasticity and in the permanency of modification are marked.

There is little evidence of any form of imitative tendency in behavior.

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On the motor activities of the alimentary canal after splanchnic and vagus section.

By **W. B. CANNON.**

[*From the Laboratory of Physiology in the Harvard Medical School.*]

In this investigation one series of animals was studied with only

splanchnic nerves cut, and another series with only vagus nerves cut, and a third series with an entire severance of vagi and splanchnics. The animals used were cats.

After the observations the movements of the various parts of the alimentary canal were studied by means of the shadows cast on a fluoroscope when food mixed with bismuth subnitrate had been fed and the animals exposed to the X-rays.

Movements of the esophagus. — Splanchnic section resulted in no deviation from the normal. Bilateral vagus section resulted in the well-known paralysis of the thoracic esophagus. Swallowed food accumulated in the esophagus, and, during the first few days after operation, food was frequently regurgitated. The regurgitation, however, did not persist; there was still a hindrance to an easy passage through the esophagus, but swallowed food reached the stomach. In one case, nineteen days after the second vagus nerve had been cut, a bolus of semi-fluid material was seen moving slowly and steadily along the lower esophagus into the stomach. Peristalsis alone could have done this. A distinction must be drawn between the immediate paralyzing effect on the esophagus of cutting the vagi, and the later partial or almost complete recovery of efficiency by a local mechanism in the lower esophageal wall.

Movements of the stomach. — Splanchnic section caused no alteration from the normal movements. The immediate effect of vagus section was tardiness in the starting of gastric peristalsis after food was introduced into the stomach. There was sometimes a delay of three or four hours, and the waves, when started, were extraordinarily shallow. As time elapsed these abnormalities largely disappeared; more and more the waves started early and showed their normal vigor. Again a distinction must be drawn between the first and the later effects of vagus section.

When all the extrinsic nerves were cut the gastric waves passed at the usual rhythm, but were unlike those seen when the vagi alone were cut in being, from the first, deep and powerful contractions. After death in these cases the stomach was usually found strongly contracted.

Passage of carbohydrate and protein food from the stomach.— After total suppression of impulses through the splanchnics both carbohydrate and protein foods are discharged through the pylorus

at practically the normal rate. In the absence of impulses through the vagi and in the presence of impulses through the splanchnics the discharge of both carbohydrate and protein is notably retarded. But this retardation, especially when protein is fed, is much more marked soon after the operation than it is later. Again a distinction must be drawn between the immediate depressing effect of vagus section and the later considerable recovery of normal functioning. Although the passage of both carbohydrate and protein from the stomach remains slower after vagus section, the characteristic treatment of the two food-stuffs persists — the carbohydrate passes out much more rapidly than the protein food.

When all extrinsic nerves have been cut there is, as in the cases of vagus section alone, a difference between the immediate defect and the later partial recovery of normal function. After recovery, the carbohydrate passes the pylorus at about the same rate as when vagi alone are cut, but the protein discharge is more nearly normal when all nerves are cut than when vagi alone are severed. After all splanchnic and vagus impulses are removed a characteristic difference between the outgo of carbohydrate and the outgo of protein food from the stomach is still maintained.

Passage of food through the small intestine.—After splanchnic section the rate of transit from pylorus to ileocolic sphincter, when protein was fed, was much accelerated, and after vagus section it was much slower than normal. The rate was slower also when all nerves were cut. The variation from the normal was in all cases less with carbohydrate food than with protein.

Rhythmic segmentation of the food in the small intestine was observed in every condition of nerve section.

The persistence of characteristically different rates of discharge of protein and of carbohydrate food through the pylorus, after splanchnic section, after vagus section, and after severing both sets of nerves in the same animal, definitely proves that the control of this differential discharge is local and not mediated through the central nervous system.