

that an unrecognized nutrient is implicated.

Hydrocephalus has been reported in various animal species though it is too rare to be of any practical significance in livestock production. It occurs in human infants, and though uncommon it is of some consequence. No satisfactory explanation of these cases has been advanced but it seems plausible now that many at least are the result of a nutritional deficiency. This possibility raises a question that deserves serious consideration; is there any wide variation in the severity of the symptoms. Up to the present hydrocephalus seems to be an all or none phenomenon but an attempt will be made to determine whether mild cases occur that escape detection by the method used in the

past. The possibility of tissue or functional damage, with no gross symptoms of injury, deserves serious study.

Summary. Female rats were supplied with an experimental diet that contained soybean oil meal as a source of protein, and a vitamin mixture that included all recognized vitamins except ascorbic acid, niacin, folic acid and B₁₂. The incidence of hydrocephalus in the young was less than 1%. When folic acid antagonist was added to this diet the incidence of hydrocephalus rose to 20%. The type of diet consumed during the pre-experimental period determined the amount of time that elapsed, during the experimental period, before hydrocephalus appeared in the young.

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The Cockroach as an Experimental Vector of the Virus of Spontaneous Mouse Encephalomyelitis (Theiler).^{*} (17882)

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The natural modes of transmission for the polio-encephalomyelitis group of viruses are not understood(1,2). A commonly accepted epidemiological hypothesis encompasses a fecal-oral spread and the alimentary tract as the portal of entry. In support of this hypothesis is the finding of virus in the intestinal tract, stools, sewage, and flies. The demonstration(3) that virus persists in non-biting flies for days, and possibly multiplies, suggests that members of the polio-encephalomyelitic group of viruses escape the intestinal-oral carrier chain in their natural mammalian hosts to utilize arthropods for the maintenance and passage of virus to new hosts. Attempts to incriminate mosquitoes(4-6) have

been unsuccessful. Lice(7) and fleas(8,9) were found incapable of transmitting the virus of human poliomyelitis. Since the capacity of cockroaches[†] for the maintenance and transmission of viruses has been little

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TABLE I.
Recovery of Encephalomyelitis Virus, GD VII Strain from Cockroach Feces.

		Results of the injection of a fecal suspension derived from									Normal roaches
		Roaches fed virus									
Days after single meal		0	1	2	3	4	5	6	7	8	1
Mouse	1	0/2*	2/2	2/2	2/2	2/2	2/2	2/2	0/2	0/2	0/2
Passage	2†	0/2	2/2	2/2	2/2	2/2	2/2	2/2	0/2	0/2	0/2

* Denominator signifies number of mice injected intracerebrally, 0.03 ml. Numerator signifies number that died of encephalomyelitis.

† Brain tissue from the mice of passage 1 was employed as the inoculum for passage 2.

explored, an experimental study was designed to learn whether a representative of the family *Blattidae* could acquire, maintain, and excrete a member of the polio-encephalomyelitic group of viruses. Cockroaches were selected as arthropods especially worthy of study because in many parts of the world the intimacy and constancy of the association of cockroaches with the food and excreta of man and animals rivals closely that of flies. Moreover, the nocturnal habits, gregariousness, and longevity of the cockroach operate to provide opportunities not readily available to flies for the acquisition of virus from excreta and for its transfer to food.

It is the purpose of this preliminary report to record the findings which were obtained when the American cockroach, *Periplaneta americana*, was investigated for its capacity to act as the intermediary for the maintenance and excretion some days later of the virus of mouse encephalomyelitis, GD VII strain (Theiler) (10).

Experimental. Adult cockroaches (*Periplaneta americana*) were strapped to corks with adhesive tape. Each cockroach was given by means of a tuberculin syringe with a blunt needle a single feeding of 0.2 ml of

† Five species of cockroach of cosmopolitan distribution are commonly associated with man: *Blattella germanica*, the small German roach or "croton bug"; *Blatta orientalis*, the larger oriental roach; *Periplaneta australiasiae*, the Australian roach; *Supella supellectilium*, the tropical roach; and *Periplaneta americana*, the large-winged American cockroach.

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a 10% suspension of brain tissue derived from a mouse moribund of spontaneous mouse encephalomyelitis, GD VII strain. The diet thereafter consisted of fox chow and water. Fecal specimens representative of a 24-hour period were collected daily and stored at -20°C until tests for the presence of virus were made. Each 24-hour fecal specimen in preparation for inoculation was made up separately by trituration in a mortar with normal physiological saline to yield a 1% suspension, treated in an amount per ml of suspension with penicillin, 500 units, and streptomycin, 100 µg per ml, mixed, allowed to stand at room temperature for 30 minutes, and centrifuged at 700 r.p.m. for 10 minutes. The supernatant fluid was employed as the inoculum for the injection intracerebrally, 0.03 ml, of normal 21-day-old Swiss albino mice. The control consisted of fecal material obtained from normal cockroaches and made ready in a similar manner for transfer to normal mice.

Results. The results of one set of experiments are shown in Table I. In these experiments the 24-hour fecal specimens for each of 6 consecutive days when tested as a 1% suspension was shown to contain sufficient virus to paralyze and kill mice in from 2 to 4 days after its intracerebral injection. The test mice for the seventh day remained normal. The brain tissue in 1% suspension from dead mice was lethal on passage to normal mice.

In contrast to these findings, the mice that were utilized to test similarly prepared fecal suspensions from normal cockroaches showed no evidence of infection during a 14-day period of observation. Bacteriological control studies of all mouse brains eliminated the

possibility of bacterial infection.

Three more sets of experiments were carried out by following the same procedure. These experiments confirmed fully the results described above and gave further information since in one instance virus was recovered from the 24-hour fecal specimen representative of the seventh day after a single feeding of virus.

Discussion. Under the experimental conditions described in the present paper, cockroaches fed a single meal known to contain the virus of spontaneous mouse encephalomyelitis, GD VII strain, excreted daily over a period of as long as 7 days sufficient virus to kill on intracerebral injection the test recipient normal mice. Thus, it is possible that this species of cockroach, and others, in the natural process of feeding on mammalian excreta may acquire virus from the host carrier for later transfer by contamination of food. From the available data it is impossible to say whether these findings have any practical implication in the epidemiology of mouse encephalomyelitis or of other members of the polio-encephalomyelitis group of virus diseases. It is surprising that natural or experimental evidence to suggest a role for cockroaches in the dissemination of virus diseases is limited to the experimental findings of Hurlbut(11) which appeared at the time

this manuscript was in preparation. He found that the injection of human poliomyelitis virus, Lansing strain, into the hemocoel of the cockroach, *Periplaneta americana*, made it possible 15 days later to demonstrate virus by the trituration of the whole cockroach and its passage to normal mice. Attempts to demonstrate virus in roach feces and in roach eggs were unsuccessful. However, the possibility that cockroaches can operate to transmit pathogenic microorganisms other than viruses has been established for bacteria under experimental and natural conditions (12-14).

Summary. In experiments in which cockroaches, *Periplaneta americana*, were fed a single meal containing the virus of mouse encephalomyelitis, GD VII strain, proof was obtained that the test cockroaches daily over a period of as many as 7 days excreted sufficient virus to kill test mice. Control experiments showed that the lethal effect was from infection by the virus of mouse encephalomyelitis, GD VII strain, and not from extraneous bacterial or viral infection.

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Influence of Diphenhydramine on Blood Pressure Response to Epinephrine in the Dog under Adrenergic Blockade. (17883)

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A variety of substances have been shown to potentiate the vasopressor effect of epinephrine: *vis.* diphenhydramine·HCl, cocaine, ergotamine, curare, dibutoline, tetraethylammonium chloride (T.E.A.) and a number of ethylene diamine derivatives(1,2,3,4,5,6,7, 8). Two theories have been suggested for

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