stomping was often seen; it was greatest at the beginning of the session, and typically occurred between intermissions. These results show that there is a definite relation between the offset of rewarding brain stimulation and sexual behaviour, because foot-stomping appeared in both cases.

Third, what was the relation between foot-stomping and the gerbil's affective state? Although our initial impression from the self-stimulation data was that foot-stomping was related to a rewarding condition, our later observations of the gerbil suggested the opposite possibility; namely, that the offset of reward was aversive and that the foot-stomping was somehow a representation of this response to the aversive quality of the tone at the termination of the stimulation. That the termination of reward can produce aversive consequences is suggested by recent electro-physiological experiments of Grastyan, who showed that hippocampal theta was present during rewarding stimulation of posterior hypothalamus, but changed to desynchronization at the offset of stimulation. That hippocampal desynchronization represented an aversive state was shown by another experiment in which aversive stimulation produced hippocampal desynchronization, but at the cessation of stimulation, hippocampal theta was observed. To obtain some ideas of the relation between aversive stimulation and foot-stomping, each gerbil was administered foot shock through an electrified grid floor for 2-10 sec until it showed a response to electrical stimulation to the feet. In six of the seven gerbils foot shock produced foot-stomping (see Table 1). In a recently completed experiment, foot-stomping after electric shock has been obtained from nine of a group of ten unoperated gerbils. As in our brain stimulation experiments there was complete cessation of all other activity during foot-stomping. These results suggest, but certainly do not prove, that foot-stomping is associated with a high arousal, negative incentive condition.

Presumed loci of the electrode placements as seen in Nissl and myelin stained sections are presented in Table 1. We do not want to go into detail here of differences between the gerbil brain and that of the rat. While grossly similar, we have noted larger mammillary bodies relative to the rat. For the present, we wish to note that electrode placements yielding reward were rarely in what appears to be the medial forebrain bundle, although it is doubtful whether such an observation would have been made in the absence of previous data and theory on this point. It appears that (1) the two placements yielding high rates of self-stimulation were in the substantia nigra, (2) there was no point where self-stimulation (10 responses/ min) was not obtained, and (3) the only point producing any foot-stomping at all during stimulation was in the temporal cortex (this was the only probe that fell outside of the ventral mesencephalic region). Before any firm statements concerning anatomical location of the self-reward phenomenon can be made, it will be important to determine the extent to which individual differences of barressing behaviour may influence anatomical conclusions. This is particularly relevant in the case of the gerbil, for we have seen this animal perform at high rates (5-10 responses/sec) while responding for food on a fixed ratio schedule (FR 30). Finer analysis of barressing behaviour and other measures of motivation should assist in an accurate description of the gerbil reward system.

The preliminary observations of the present work give us reason to believe that brain and behaviour problems can be further elucidated. It will be of considerable interest to attempt to understand why this foot-stomping behaviour is shown after foot shock, during sexual behaviour and after rewarding brain stimulation. As a working hypothesis we have assumed that foot-stomping reflects an aversive state and that the cessation of rewarding brain stimulation, the interruption of intermissions, and the "slow pain" following the foot shock are sufficient to produce this behaviour. Whatever the correct view, future experiments should further our understanding of the relation between rewarding brain stimulation and both approach and withdrawal mechanisms.

I thank Dr. Preston L. Perlman for supplying progesterone, and Dr. Irving Zucker for his helpful suggestions.

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Parasitic and Free-living Cycles in Entomogenous Nematodes of the Genus Deladenus

This Australian Unit located in England is undertaking an investigation of siricid woodwasps and their natural enemies in coniferous forests in Europe; the ultimate objective is the biological control of Sirex noctilio F. in Australia.

Nematode parasites of siricids were discovered by Zondag 2 in 1962 in S. noctilio in New Zealand. They were found in 1964-65 by Wilson and Spradbrow (unpublished work) in S. juvenilis L., S. cyanus F., Urocrocoecia gigas L., Xeriscretum L. and the parasite Itala lewissipoides (Hooker) from various European countries, and in Australia by Hoek in 2 species of Rhysa (parasites of siricids) introduced into Tasmania from India and Europe. I have investigated nematodes from these and allied hosts, and various unusual features have been revealed in relation to the nematodes' life-history (Fig 1).

Parasitic cycle: it has been found that nematode larvae removed from the adults of these hosts can be cultured on species of the fungus Aspergillus (which is pathologically associated with the siricids), and that they develop in 3-8 days at 24°C into adult males and two types of female. The commoner form continues to feed on the fungus and, after copulation, lays 50-600 eggs, which develop rapidly into males and both types of female. This non-parasitic cycle can continue indefinitely. The less common form is the infective female.

<table>
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<th>Table 1. SUMMARY OF MAIN RESULTS</th>
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<td><strong>No. of self-stimulation responses/min</strong></td>
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Substantia nigra, pars compacta; cerebral peduncle; medial forebrain bundle; substantia nigra, pars reticulata; ovulomotor cortex; medial forebrain bundle (ventral); fornix.
The two forms are remarkably different in many morphological features. The stylet shows striking functional dimorphism, being small and finely tapered in the fungus-feeding form, and very much longer and stouter in the infective form. The fungus-feeding form (as well as the male) has the diagnostic characters of Deladenus Thorne (Neothylenchidae), whereas the infective form would be placed in the Allantonematidae. This situation bears critically on the status of these two families, and possibly has wider taxonomic implications.

The infective female does not feed on the fungus, but, without copulating, enters a host larva, and develops in the haemocoele. Males do not enter such hosts, and so reproduction is almost certainly parthenogenetic.

Males enter such hosts, and so reproduction is almost certainly parthenogenetic. The parasite parasitic female is viviparous, and releases 5000-10,000 larvae in the haemocoele soon after the host emerges as an adult from the pupa. If the host is a female siricid, the larvae migrate into its eggs, whereas if it is a male siricid they congregate in the teratoma, which becomes hypertrophied and devoid of spermatogenae. Thus both sexes of siricid hosts are rendered sterile.

The nematodes have different effects on the hymenopterous parasites. For example, in Rhysus persicae a parasite, does not affect the male reproductive system; however, it often totally suppresses egg production in the female. The nematode larvae then disperse through the trabeculae, and feed on the fungus, usually in the outer 5 cm of the wood. Parasitized R. persicae females, while drilling to locate siricids, probably also introduce nematodes into timber. Male siricids and male parasites which contain nematode larvae do not transmit them during copulation, and the larvae die within and soon after their hosts.

A considerable increase in nematode numbers can occur during the free-living cycle, and this would greatly facilitate the finding of hosts. The parasitic cycle is the mechanism by which the nematode is transferred to fresh timber infected with Amylostereum. No such nematode life-history, involving female dimorphism associated with free-living and parasitic cycles, has been recorded previously. This dimorphism suggests, however, the possibility that some fungus-feeding nematodes described as neothylenchid species may have parasitic form described separately as allantonematids.

The European nematodes investigated at this Unit can be separated into at least two new species of Deladenus, Mr. R. Zondag kindly supplied from New Zealand infected S. noctilio, from which a nematode culture was established, and comparison showed this nematode to be morphologically identical with one of the two species.

Host specificity tests, using Deladenus from five siricid species, two Rhysus species, and an associated beetle, Seropalpus barbatulus (Schall.), from various European countries, have shown that nematodes from each of these sources will infect and develop in both siricid and R. persicae larvae.

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Received December 23, 1966.

Identity of Feline Ataxia Virus with Feline Panleucopenia Virus

Kilham and Margolis investigated the cerebellar hypoplasia associated with feline ataxia virus (FAV), a spontaneously occurring disease of kittens previously believed to be of genetic origin. They demonstrated that the condition could be reproduced by passage of affected cerebrospinal fluids in neonatal kittens or ferrets, and that the transmissible factor was a filterable agent: resistant to treatment with heat and other disinfectants; and designated feline ataxia virus (FAV). The properties of FAV led them to compare the virus with the serologically distinct Kilham rat virus (RV) and hamster osteolytic virus (H-I), of which the former can induce similar cerebellar hypoplasia in cats, rats, and hamsters. From a detailed line of research, Johnson and co-workers concluded that the properties of feline panleucopenia (FP) virus were similar to those of RV and H-I. Subsequent correspondence between the two groups led to the present report.