evidence of a decrease in narcotic concentration in the brain has not as yet been obtained. It also remains to be determined if active immunity can modify analgesia, as measured by other procedures. Moreover, there is a possibility that the morphine-hapten-antibody complex may not only act as a source of inactivation of the drug but, in contrast, as a depot for morphine. This situation could arise if there is a significant amount of dissociation of morphine from the antibody-hapten complex.

These studies do not establish an immune component for any aspect of narcotic addiction in man. The major contribution of this report is to show that the mouse can be made to develop antibodies that recognize a narcotic both in vitro and in vivo, and thus the mice may be a useful model for the study of immune theories of narcotic tolerance. However, in light of these findings, we must consider somewhat more actively that morphine, or its congener heroin, can bind to human proteins and potentially act as an immunogen-like material in man. Proteins with a strong affinity for narcotics have already been found in the serum of some heroin addicts (*7*). It also has been shown (*8*) that after the administration of a single dose of morphine to normal subjects, low concentrations of the alkaloid were present in plasma for as long as 48 hours. Our data provides the first evidence that antibodies to narcotic analgesics can potentially modify the pharmacologic effects or biologic disposition of these drugs. Further studies with antibodies against specific drugs to modify pharmacologic or physiologic responses seem indicated. There is a possibility that narcotic tolerance and dependence may be influenced by active or passive immunity.

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A New Approach in Integrated Control: Insect Juvenile Hormone plus a Hymenopteran Parasite against the Stable Fly

Abstract. *Two insect juvenile hormone analogs, 4[(6,7-epoxy-3-ethyl-7-methyl-2-nonenyl)oxy] benzene and 6,7-epoxy-1-(p-ethylphenoxy)-3,7-dimethyl-2-octene, when applied topically to pupae of the stable fly,* Stomoxys calcitrans *(L.), were morphogenetically effective against the metamorphosing pupae but did not affect oviposition and development of the hymenopteran parasite,* Muscidifurax raptor *Girault and Sanders, in the treated pupae. Also, reproductivity of the parent generation of parasites was not affected.*

The realization of the part played by beneficial insects (*1*) in controlling pest insects has resulted in a variety of efforts to increase the impact of these parasites and predators (*2*). At the same time, insect juvenile hormone (JH) analogs (*3*) are being considered as replacements for broad-spectrum toxicants because they are more specific for the target insect (*4*). For example, pupae of the stable fly, *Stomoxys calcitrans* (L.), an economically important, blood-sucking pest of both man and his domestic livestock, are sensitive to nanogram quantities of selected JH analogs (*5*). This hormonal activity is expressed by cellular differentiation of the head and thorax of the developing adult but not the abdomen. The result is a pupal-adultoid intermediate that dies within the puparium.

We report herein than topical treatment of stable fly pupae with the JH analogs 4[(6,7-epoxy-3-ethyl-7-methyl-2-nonenyl)oxy] benzene (JHA1) (*6*) and 6,7-epoxy-1-(*p*-ethylphenoxy)-3,7-dimethyl-2-octene (JHA2) (*7*) did not interfere with the development of the parasitic insect *Muscidifurax raptor* Girault and Sanders (Hymenoptera: Pteromalidae) in the pupae. Also, we observed no alterations in the reproductivity of these *M. raptor* parasites. Thus, this report introduces a new approach to integrated control, that is, the use of a JH analog in conjunction with an effective insect parasite for control of a pest insect.

In 1971, we applied two JH analogs to the surface of the breeding medium of stable flies in Nebraska and Florida (*8*) since nanogram levels had earlier produced morphogenetic effects in pupae of the stable fly which prevented the emergence of adults (*5*). Both analogs proved to be potential third-generation pesticides against stable flies (*8*). Moreover, when samples of these stable fly pupae were taken into the laboratory, two species of parasites, *M. raptor* and *Spalangia endius* Walker (*9*), emerged from puparia containing pupal-adultoid intermediates. The biology and worldwide distribution of these species are well documented, and they are known to parasitize both stable fly

Table 1. Development of *M. raptor* in stable fly pupae treated with two juvenile hormone analogs (six tests with 25 stable fly pupae per test) as expressed by eclosion of adult *M. raptor*. Values are numbers of adult *M. raptor* eclosing from stable fly pupae. (No stable flies eclosed when exposed to *M. raptor* or to either of the analogs.)

Treated with JH analog 1*	Treated with JH analog 2*	Untreated
15	20	23
22	21	22
19	15	24
21	12	14
16	13	25
15	18	24

* See Fig. 1 for the structures.

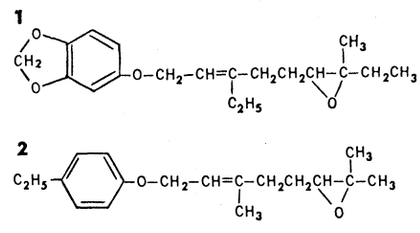

Fig. 1. Structures of JH analogs 1 and 2.

pupae and pupae of the house fly, *Musca domestica* L., which are found commonly in breeding sites with the stable fly (*10*).

Therefore, in 1972, we established a colony of *M. raptor* in the laboratory to determine whether the JH analogs would affect parasitic development and reproductivity.

The test procedure was as follows. New stable fly pupae, still opaque white, were treated topically with 10 μg of the JH analogs in 1 μl of acetone. Then 25 pupae were placed in holding cages, and six females and four males of *M. raptor* (3 to 4 days old) were immediately placed in the cage with the treated pupae. The holding temperature was 27° ± 1°C, and the relative humidity was 90 percent. The controls were treated and untreated pupae that were not exposed to the parasite and untreated pupae that were exposed. At 9 days posttreatment, the treated pupae that had not been exposed to the parasite were evaluated by determining the number of adults that eclosed and the number of pupal-adultoid intermediates within the puparia. At 20 days posttreatment, we recorded the number of parasites that emerged from the treated and untreated pupae exposed to the parasite. Also, we dissected these pupae to determine whether additional parasites were present as the result of the diapause that will occur in *M. raptor* (*11*). This experiment was replicated five times.

Finally, adult *M. raptor* that emerged from the treated and untreated pupae were placed separately with untreated pupae and allowed to feed and oviposit for 20 days. The numbers of parasites that emerged from these two groups were then compared to determine the effects on the reproductivity of parasites that had developed in stable fly pupae treated with the JH analog.

Table 1 shows that when the two JH analogs were applied to stable fly pupae, the development of *M. raptor* was not affected although the dose administered was 1000 times more than required to obtain a pupal-adultoid intermediate in the stable fly (*5*). No pupae eclosed that were exposed to *M. raptor*, the JH analogs, or both. Adult stable flies emerged from untreated pupae at 7 days; however, when the pupae treated with the analogs were dissected, pupal-adultoid intermediates were found within the puparia. Since the JH analogs do not immediately kill the stable fly pupae (the metamorphosing pupae live 6 to 7 days before death occurs), *M. raptor* has time to develop. Thus, at 7 days the parasite was in the pupal stage within the stable fly puparium and the adult parasites then emerged 7 to 15 days later.

Table 2. Development of progeny of adult *M. raptor* that developed in stable fly pupae treated with the two juvenile hormone analogs (25 pupae per test; progeny developed in untreated pupae). Values are numbers of *M. raptor* F_1 progeny eclosing when P_1 developed in stable fly pupae.

Treated with JH analog 1	Treated with JH analog 2	Untreated
19	18	16
11	15	13
13	11	13
16	18	15
17	17	16

Table 2 shows that the reproductive ability of *M. raptor* adults that developed within the stable fly pupae treated with the JH analogs was not affected. These adults oviposited viable eggs in untreated stable fly pupae, and the F_1 generation developed and eclosed.

The significance of the normal development of the parasite in the pupae treated with the JH analogs is that the chemicals were selective against the stable fly pupae and not *M. raptor*. Even the reproductivity of this beneficial parasite was not affected. Thus, a new approach for integrated control of insects has been demonstrated, namely, the use of a chemical JH analog in conjunction with a parasitic wasp, *M. raptor*, for control of the hematophagous stable fly.

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Translation of Bacteriophage Qβ Messenger RNA in a Murine Krebs 2 Ascites Tumor Cell-Free System

Abstract. *Qβ is a small bacterial virus whose three genes are encoded in a single-stranded molecule of RNA. This RNA serves directly as the Qβ message. Here we describe conditions under which RNA corresponding to the coat cistron of this bacterial virus is translated in a system derived from mammalian cells. Translation of the bacterial virus messenger RNA is less effective than that of mammalian globin messenger RNA, but is somewhat enhanced by mild alkali treatment of the messenger. The synthesized product when subjected to electrophoresis migrates with authentic Qβ coat protein and yields tryptic peptides that correspond to those derived from the Qβ coat protein.*

Universality is one of the striking features of the genetic code implying that there are strong selective pressures which maintain the code intact among species that diverged millions of years ago (*1*). Thus, the core word for phenylalanine is the same in both bacteria and mammals. Nevertheless, the early studies of Nirenberg and his co-workers (*2*) suggested that there were subtle differences among the code words used preferentially by different species. Other