

months" so that it can be ready by next August. This may not be soon enough for the shuttle's first orbital flight, however, which NASA says "is anticipated between the end of March and July 1980." The agency believes that inspection and repair of tiles will not be necessary on the first flight, which has been "designed to cause lower than normal stress." Also, tests of the tiles will soon be conducted on F-15 and F-104 jet aircraft in maneuvers intended to expose the tiles to dynamic pressures up to 1.4 times as great as those expected for shuttle operations.

Another in-orbit tile-inspection method under study is the deployment of small "satellite" TV cameras from the shuttle, after which the craft would fly around them to expose different parts of its surface to view. □

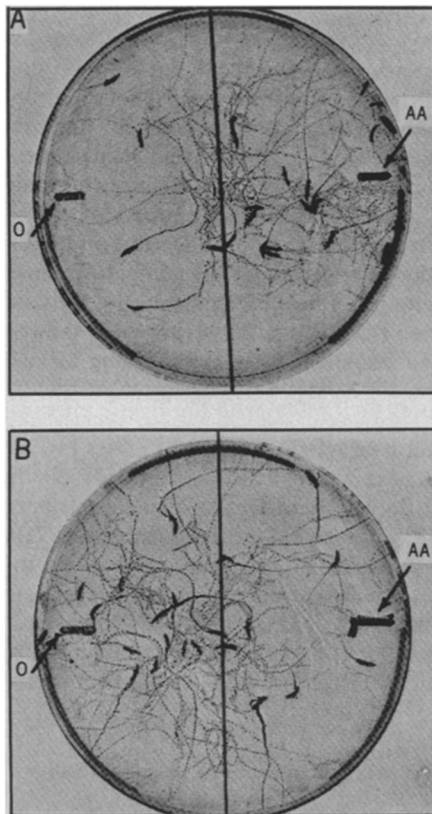
## Flies are never too young to learn

The simple brain of an immature fruit fly can grasp the association of an odor and an electric shock — unless, of course, the larva comes from the family lines named dunce, turnip or cabbage. Only a few years ago scientists devised a scheme to show that adult fruit flies (*Drosophila melanogaster*), the geneticists' favorite organism, are capable of learning and that scientists are capable of detecting and measuring the flies' abilities (SN: 6/15/74, p. 391). The testing scheme involves administering an electrical shock simultaneously with a whiff of an odorant. Given the choice of that scent or of one not associated with an electric shock, most fruit flies move toward the innocuous scent.

But adults have no monopoly on learning ability and may not be the most convenient stage of development to study, Efrain O. Aceves-Piña and William B. Quinn of Princeton University now report. The worm-like, immature form of the fly, which later undergoes extensive metamorphosis, can discriminate odors, respond to electric shock and learn to associate the shock with odors nearly as well as do its elders. Thus the structures involved in learning are already present in the simple larval brain.

Not satisfied to observe learning, the geneticists, in their customary style, sought flies with slight genetic variations that create non-learners. Among the adults, they found three such learning-deficient mutants, which they named dunce, turnip and cabbage; another mutant fly called smellblind simply does not respond to odors. Such learning-deficient flies give scientists the opportunity to pinpoint biochemical and anatomical sequences that are necessary for normal learning behavior.

The mutations that produce dunce, turnip and cabbage flies also function in



Larvae trained to avoid the odor of 3-octanol (O) trek to the right side of the plate, while those trained to avoid the amyl acetate (AA) odor move to the left. The dotted lines are larval tracks.

the larval stage, Aceves-Piña and Quinn find. The larvae with those mutations can sense odors and respond to electrical shock, yet fail to learn to avoid an odor that is associated with a shock. The scientists had expected larvae with the smellblind mutation to be able to sense odors because the olfactory end organs are sloughed off during metamorphosis and replaced in the adult fly with receptors of a different type. Instead, smellblind larvae are as insensitive as smellblind adults. The researchers suggest that either both receptor types require the normal gene product or that the mutation disrupts olfactory information processing not at the receptors but in the brain.

Although immature flies may be adequate learners, their memories are not as efficient as those of adults. The larvae forget the odor-shock association within 30 minutes, whereas adults remember their experiences for 1 to 6 hours. "We believe that the difference between larval and adult retention spans is probably intrinsic and that the lengthened adult span results from anatomical or metabolic changes in *Drosophila's* nervous system during metamorphosis," Aceves-Piña and Quinn say in the Oct. 5 SCIENCE. The biologists were unable to learn whether genetic traits for poor memory extend from the adult to the larval brain. Even normal larvae forget as

fast as do those adults considered to be amnesiacs.

Because larval brains are simpler, more compact and easier to isolate than are adult brains, researchers may now shift their search for the anatomical and biochemical elements of learning to the larvae and work on teaching very young *Drosophila* old tricks. □

## Estrogen therapy: Still deliberating

Several hundred physicians, scientists and concerned citizens gathered in mid-September at the National Institutes of Health for a Consensus Development Meeting on the subject of estrogen replacement therapy for post-menopausal women. The consensus, unfortunately, was that no one knew enough about estrogen's effects to issue any hard-and-fast recommendations. But the panel did summarize the known risks and benefits of estrogen therapy, and in the process provided some general guidelines for its use.

Overall, the panel advocated a policy of "lowest dose for the shortest time" for women whose menopausal symptoms are severe enough to warrant estrogen therapy. The note of caution was sounded not only because much remains to be learned about the hormone, but also because its users are subject to a two-to-twelve-fold increased risk of endometrial cancer. This danger, which increases with the length of treatment, is generally acknowledged to be the best-documented risk of estrogen therapy. Some researchers found an increased incidence of the disease among users after only six months of the hormone therapy; others extended the "safe" period to five years. The difference in time span as well as the wide variation in increased risk factors is attributed to different research methodologies. The panel judged the time span after which risk increases to be from two to four years.

The increased risk of cancer associated with estrogens, however, does not linger indefinitely. Barbara Hulka of the University of North Carolina at Chapel Hill reported that a two-year estrogen-free interval reduces the risks to normal, non-user levels. Hulka pointed out that this is a very short interval in which to eliminate the hazard of a presumed carcinogen; after five years of abstinence, cigarette smokers only lower their risk by one-half — still far higher than the risk for non-smokers.

The benefits of estrogen replacement therapy are as well-documented as the risks. Estrogens are effective in preventing vasomotor flushes (commonly known as hot flashes); they do overcome vaginal atrophy, which produces symptoms of dryness, itching and pain during intercourse; they do retard osteoporosis, the decrease in bone density that occurs frequently in aging women.