Reye's syndrome, is postulated to have toxic qualities (*23*). This may or may not be related to its neuramidinase-like activity. If other viruses—for example, EMC—have this property, it is possible to postulate an interaction between a viral toxin and a chemical toxin. If other viruses, particularly those reputed to be associated with Reye's syndrome, also have such toxic properties this theory could have validity.

2) Simple virus infection allowing release of a stored chemical toxin. Virus infection could act as a releasing factor for stored chemical toxins. A similar phenomena is seen in children exposed to lead for a long period who develop acute encephalopathy after infectious contact (*17*).

3) Chemical enhancement of viral lethality by increasing replication and spread. Cell necrosis, however, has not been observed in the animal model and thus this hypothesis would have foundation only if the virus caused profound alterations in cell function without cell necrosis.

From 10 to 20 million gallons of petroleum oil by-products are used as pesticide dispersal agents and emulsifiers (*24*) each year in the United States alone. With this widespread use it is increasingly important to know the toxic nature of these chemicals, which are mainly ignored because they are considered safe on substantially insufficient grounds. The safety of these products is, of course, of increased importance in that such compounds are so widespread in our environment, being present in manufactured products other than insecticides. The effects in exposed humans may be cumulative, and the potential toxicity of these compounds could assume considerable significance both for inherent toxicity and enhancement of other agents of viral or toxic nature.

JOHN F. S. CROCKER, RUDY L. OZERE
Departments of Pediatrics and *Microbiology, Dalhousie University,* and *Izaak Walton Killam Hospital for Children, Halifax, Nova Scotia*

STEPHEN H. SAFE
Department of Chemistry, University of Guelph, Guelph, Ontario

SHARON C. DIGOUT
KENNETH R. ROZEE
Department of Pediatrics and *Microbiology, Dalhousie University,* and *Izaak Walton Killam Hospital for Children*

OTTO HUTZINGER
Department of Chemistry, Laboratory of Environmental Chemistry, University of Amsterdam, Amsterdam, The Netherlands

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Courtship Differences in Male Ring Doves: Avoidance of Cuckoldry?

Abstract. *Male ring doves exhibit less courtship and more aggressive behavior toward females that have recently associated with other males than to females that have been isolated. The difference in response may be related to the differing probability of cuckoldry.*

In many vertebrate species the female is most attractive to males at, or shortly before, ovulation. Moreover, at this time she is most likely to be receptive to their sexual advances. We have found, however, that male ring doves (*Streptopelia risoria*) court sexually unstimulated females more vigorously than they court females that are close to ovulation as a result of prior exposure to other males.

Trivers (*1*) suggests that, in those species in which the male contributes extensively to parental care, it is vital to the male that the eggs are fertilized by his own sperm. Otherwise, his large parental investment is wasted. If the male is attracted to and copulates with the female only at the time of ovulation, there is the possibility that she has been inseminated prior to his copulation. In polygynous and promiscuous species cuckoldry is of minor consequence since the male typically does not contribute to the reproductive effort beyond insemination, the cost of which, in energy and lost opportunities to mate with other females, is relatively small. However, when the male parental investment is large, mechanisms that ensure the genetic paternity of the investor increase in importance. Accord-

Table 1. Median performance levels and quartile deviations (Q) of males (N = 35) given 15 minutes with females that had been either exposed to other males (preexposed) or isolated for several weeks (unexposed).

Male behavior	Stimulus condition			
	Preexposed		Unexposed	
	Median	Q	Median	Q
Nest soliciting (duration in seconds)	90.0	112.8	185.0	182.6
Bowing and cooing (number of displays)	20.0	20.8	20.0	29.0
Chases (number of incidents)	18.0	25.5	10.0	7.7
Pecking (number of incidents)	12.0	13.3	3.0	3.4

ing to Trivers, an effective strategy for a male in such circumstances is to sequester a female for a period long enough to determine whether egg laying is imminent. Early egg laying or other evidence that the female has been recently exposed to another male should reduce her attractiveness and be reflected in the male's behavior toward her.

In the ring dove, the amount of parental investment provided by the male is substantial; both sexes construct the nest, incubate the eggs, and feed and care for the young. Ovarian activity, which culminates in ovulation and egg laying, is stimulated by male courtship (*2*); the prominent "nest-soliciting" display of the male appears to be particularly effective in the induction of ovarian activity in the female (*3*). Although the female herself normally exhibits little courtship behavior when first paired with the male, the secretion of ovarian steroid hormones induced by the male stimulates her to engage in the nest-soliciting display with increasing frequency (*4*). This display by the female, coupled with her attachment to the nest site, seems to signal her readiness to construct a nest, an endeavor that the male and female pursue cooperatively (*5*). Thus the female's nest soliciting is important to the social synchrony of nest construction but also indicates that she is rapidly approaching ovulation as a result of recent exposure to a male. According to Trivers' hypothesis, male ring doves should be wary of females that show nest-soliciting behavior too soon after their initial encounter, since such early nest soliciting reflects the fact that the females have been courted and, possibly, inseminated by other males. In our study we compared the courtship and aggressive responses of male ring doves when they were introduced to females that had been either isolated for several weeks or stimulated by other males to the point of active nest soliciting.

All males were hatched in the laboratory and, at the time of the study, were sexually mature. Immediately prior to testing they spent a minimum of 2 weeks in visual (but not auditory) isolation from other animals. Seventeen males were observed, first with a "preexposed" female, then, 4 days later, with an "unexposed" female; 18 males were tested in the reverse order. These tests were conducted between 0900 and 1300 hours in an 89-cm cubical cage supplied with food, water, nesting material, and a glass nest bowl. One group of stimulus females was prepared for testing by giving them six 15-minute exposures to an active male (not a subject male) at 1- or 2-day intervals. These females readily engaged in nest-soliciting displays when introduced to the test males. A second group of stimulus females was given a parallel series of exposures to the empty test cage. None of these showed nest-soliciting behavior when introduced to the test males.

Table 1 shows the differences in male performance on exposure to each kind of stimulus female (*6*). Unexposed females elicited much more nest-soliciting activity from the males than did preexposed females ($t = 97$, $P < .0094$). Conversely, preexposed females provoked more frequent chasing and aggressive pecking ($t = 27.5$, $P < .00006$; and $t = 84$, $P < .0004$, respectively). Typically, the nest-soliciting displays of the male when in the presence of a preexposed female occurred prior to any nest-soliciting performance by the female. In most instances the male terminated his nest soliciting and attacked the female when she began her own nest-soliciting display.

We found no clear relation between the condition of the female and the frequency of male bowing and cooing, a second behavioral display ($t = 251.5$, $P > .94$). However, this behavior is performed most frequently during the first few moments after meeting a female or another male, and its principal function may be to identify the species and sex of the performer (*7*).

The female dove that has been hormonally primed by a male is placed in a difficult position if she loses her mate prior to nest construction and egg laying. Three to 4 days of male courtship are sufficient to induce ovulation and egg laying in a majority of females (*8*). Thus, if the female ring dove loses her mate after such stimulation, she must recruit another before her eggs are laid. If she manages to do so, she still must enlist his aid in nest construction or must attempt to build the nest herself. In either case, the premature emergence of female nest-soliciting displays or nest-building activity after pairing could indicate to a male the likelihood that the female has been recently exposed to another male and, therefore, is to be driven off or avoided. The differences in courtship, chasing, and attack portrayed in our study suggest that, given the opportunity for a direct choice, males prefer those females whose ovaries have not been primed through exposure to other males.

CARL J. ERICKSON
PATRICIA G. ZENONE
Psychology Department,
Duke University,
Durham, North Carolina 27706

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Stimulant-Related State-Dependent Learning in Hyperactive Children

Abstract. *Hyperactive and nonhyperactive children performed a learning task in two states, while being treated with stimulant medication (methylphenidate) and while taking a placebo, and were tested for retention of each class of learned material in both states. Symmetrical state-dependent learning was demonstrated in the hyperactive group but not in the nonhyperactive group. The state-dependent effect was contingent on the presence of drug-induced facilitation during initial learning. This is apparently the first report on record of state-dependent learning with a drug agent that facilitates rather than impairs performance of human subjects.*

The phenomenon of state-dependent learning has attracted interest with regard to both its underlying mechanism (*1, 2*) and its implication for clinical practice (*3, 4*). In both animals (*1, 5*) and humans (*2, 3, 6*), when a drug affects performance during acquisition of new material, performance at a later time may depend on reinstatement of the drug treatment.

When drugs are used therapeutically (*3, 4*), an important clinical question arises as to whether information acquired by a patient under the influence of