tencies comparable to those of the control groups. In addition, except in the diethyldithiocarbamate experiment, the PBZ-treated animals had latencies significantly longer than those of the corresponding saline-treated groups that received an amnestic treatment.

These results are consistent with our previous findings that epinephrine-produced amnesia is blocked by prior treatment with PBZ. In addition, the results indicate that PBZ attenuation of amnesia has considerable generality; it seems clear that PBZ can block the amnesia produced by most classes of amnestic agents. The treatments chosen differ substantially in the mechanisms generally presumed to mediate the effects on memory. However, because a single drug can block the amnestic effectiveness of these various treatments, the results suggest that many, if not all, amnestic treatments may act through a common neurobiological mechanism. We therefore caution against interpreting the effect of a particular treatment on memory in terms of one biological effect of that treatment.

The mechanism by which PBZ blocks the development of amnesia is not yet clear. Because PBZ readily penetrates the blood-brain barrier and is distributed throughout the central nervous system (*13*), our findings do not address the question of whether or not the adrenergic antagonist acts centrally or peripherally to block amnesia. This question has some relevance here because our previous examinations of PBZ attenuation of epinephrine-produced amnesia indicate that a rapid but transient decrease in brain norepinephrine and adrenal epinephrine after training may be related to amnesia. When we examined the effects on biogenic amines of PBZ injected before training and epinephrine injection, we found that the absence of amnesia was correlated with an attenuated decrease in both brain norepinephrine and adrenal epinephrine concentrations (*8*). Therefore, the release of one or both of these amines may be responsible for the development of amnesia. Our present findings indicate that it may be useful to examine posttraining changes in amine concentrations (as well as other physiological responses to stress) after a variety of amnestic treatments to determine the generality of the relationship between changes in these systems and impaired memory formation. Whatever the specific mechanism underlying PBZ attenuation of amnesia, it may be possible to view many amnestic treatments in terms of a common nervous system action. Findings such as these may significantly reduce the number of neurobiological systems that must be considered in order to understand the mechanisms responsible for retrograde amnesia.

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11. The dose of PBZ was chosen on the basis of preliminary findings that this dose has no effect itself on retention performance in animals trained with either low or high footshock (*8*). At higher doses (for example, 8 mg/kg), the drug impairs later retention performance. Of particular relevance to the findings reported here, we have not observed enhancing effects on retention of PBZ-treated animals under low footshock training conditions. This finding is important because it indicates that the drug's attenuation of amnesia is not simply the result of better acquisition during the training trial, an effect that would not be observed in the present study because the control groups' retention latencies are at or near the maximum allowed.
12. The electrode leads were isolated during the footshock. Electrographic recordings were made after brain stimulation. No differences in brain seizure patterns in the groups receiving stimulation of the frontal cortex were observed in PBZ-treated animals compared with saline-injected rats. Stimulating the amygdala did not produce seizures or other electrographic abnormalities in animals that received either saline or PBZ.
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The Compleat Angler: Aggressive Mimicry in an Antennariid Anglerfish

Abstract. *A case of aggressive mimicry is described in which an anglerfish of the genus* Antennarius *(order Lophiiformes) utilizes a lure that mimics a small fish. The lure provides not only a highly attractive visual cue but presumably also a low-frequency pressure stimulus for potential prey with a minimum of energy expenditure.*

I have an artificial minnow, . . .' [the body made of] cloth, . . . the belly, shadowed as perfectly as you can imagine, . . . the tail and fins . . . of a quill . . ., the eyes of two little black beads, and the head so shadowed, and all of it so curiously wrought, and so exactly dissembled that it would beguile any sharp-sighted trout in a swift stream.—The Compleat Angler, IZAAK WALTON, 1654

Luring as a mode of energy capture appears to be widespread in both the plant and animal kingdoms. From spiders to whales (*1–3*), numerous organisms conserve energy by using a feeding strategy of remaining motionless and offering enticement to would-be predators. Some animals lure with specialized structures of attraction that mimic food items or provide false sexual cues, while others attract prey in more passive ways by offering what is mistaken by smaller organisms as suitable shelter or feeding substrate (*4*). Fishes of the teleost order Lophiiformes are the best known anglers, and have evolved one of the most complex and efficient luring mechanisms (*5, 6*). Nearly all of the more than 200 species of the order (*7*) are equipped with a modified first-dorsal fin spine placed on the tip of the snout, consisting of a sup-

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porting pterygiophore and a flexible spine. The spine (illicium) is baited terminally with a fleshy appendage, a tuft of filaments, or, as in the case of deep-sea forms, a bacterial, light-emitting organ (*8–11*).

Shallow-water anglerfishes of the family Antennariidae are for the most part benthic forms with a wide geographic distribution in tropical and temperate waters; they are particularly abundant and diverse in coral-reef habitats of the Indo–West Pacific Ocean (*9*). They are structurally and chromatically cryptic forms whose piscivorous feeding strategy consists of maintaining the immobile, inert appearance of a sponge- or coralline algae–encrusted rock while wriggling a highly conspicuous lure (*1, 5, 12*). Various bait types are found among these anglers, but they are principally characterized as representing invertebrates such as worms or crustacea (*1, 8, 12, 13*). As far as we know, no anglerfish yet described has a bait that resembles a fish (*12*). We now report a case of aggressive mimicry (*1*) in which a member of the antennariid genus *Antennarius* is equipped with a bait that simulates a small fish.

A single specimen of an undescribed species of *Antennarius* (approximately 95 mm in total length), collected from the Philippine Islands (*14*), was obtained from a local aquarium retailer (Fig. 1A). The globose body of this form is highly irregular, covered with bulbous protuberances and mottled with a light-cream, dark chocolate-brown, red, and black coloration. The illicium, approximately 27 mm long, has a permanent, slightly sigmoid curve. The bait, approximately 14 mm long and 6 mm deep, is strongly compressed laterally (Fig. 1B). At its base is a pair of black, eyelike pigment spots. Ventrally, there are compressed filaments that resemble pectoral and pelvic fins. Posteriorly, there are compressed extensions that simulate dorsal and anal fins, and even a slightly expanded, distally truncate caudal fin. The entire bait is mottled with white and a rich chocolate-brown coloration. There are four or five strongly pigmented vertical bands proximally just behind the "eye-spots" (an area corresponding to the shoulder and pectoral region of a fish), and two lighter bands distally (corresponding to the caudal fin). In summary, the bait is nearly an exact replica of a small fish that could easily belong to any of a number of percoid families common to the Philippine region.

The movements of the illicium and bait heighten the mimicry to a remarkable extent. The pattern of movement of the ilicial apparatus appears to be species-specific among antennariids (*15*), ranging from simple strokes in the vertical plane to a complex triangular pattern, alternating with rapid sinusoidal thrusts. In the *Antennarius* sp. reported here, the illicium in a nonluring situation is laid back over the head; the bait is irregularly folded into a tight ball (*16*) and held back next to the base of the third dorsal-fin spine. During a single luring sequence the illicium is initially brought straight forward in front of the mouth of the angler, and the bait is rapidly vibrated for 1 or 2 seconds. The bait is then held nearly motionless as the illicium is slowly laid back again onto the head and returned to its nonluring position. When the animal is sufficiently aroused, however, the bait makes a large and rapid sweeping motion that describes a nearly perfect circle (Fig. 1C). The thin, membranous quality of the bait allows it to ripple while being pulled through the water, simulating the lateral undulations of a swimming fish. The lure thus provides not only a highly attractive visual cue but presumably also a low-frequency pressure stimulus for potential prey.

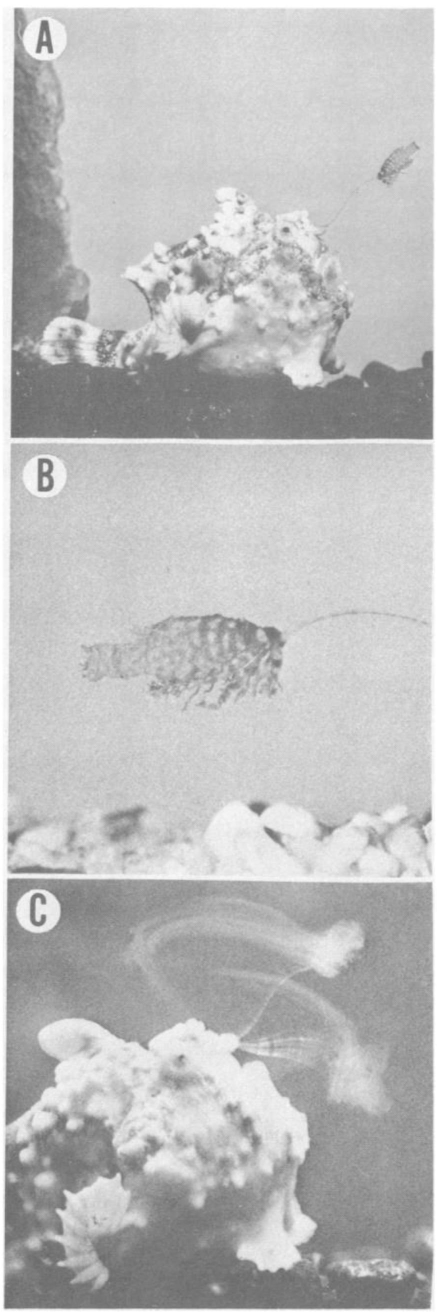

Fig. 1. Photographs taken in experimental aquariums. (A) *Antennarius* sp. (approximately 95 mm in total length) in luring posture. (B) Close-up of the bait. Note the "eye-spot," dark banding, and mottled pigment pattern giving a scalelike appearance. (C) Two-second time exposure showing pattern of movement of the luring apparatus.

Anglerfishes use great energy-saving tactics in their quest for food. The combined structural and behavioral adaptations involved in their total strategy of energy capture are key innovations that have played an important role in the evolutionary success of the Antennariidae. The species of *Antennarius* described here appears to represent the ultimate product of that success.

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16. The contraction of the bait of antennariids is accomplished by a system of smooth muscle fibers, which we observed histologically in a number of antennariid species. This system was recently described and figured in the bait of a deep-sea anglerfish [K. Hansen and P. J. Herring, *J. Zool. (London)* **182**, 120 (1977)].
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