

## Butterfly colors: Alluring or alarming?

Like two men shaking their fists and shouting, male butterflies may flash their brightly colored wings at each other as a sign of aggression. And, as in the case of their human counterparts, one of the two insects may be so intimidated by his opponent's display that he'll give up the fight before it even starts. Robert Silberglied of the Smithsonian Tropical Research Institute in Panama suggested this after presenting data contradicting the popular idea that male butterfly color attracts females.

This traditional explanation for color, with roots in the writings of Charles Darwin, says that male wing color and pattern (including ultraviolet pattern not visible to the human eye) provides the female visual criteria to distinguish her species from others and to recognize the most genetically fit of her own kind. This belief is still popular among lepidopterists.

But Silberglied, who spoke at the AAAS meeting, has data indicating this is not true. He and Orley R. Taylor, at the University of Kansas, manipulated wing color and pattern on hundreds of male butterflies, mostly of the species *Colias philodice* and *Colias eurytheme*. Research focused on *Colias* both because they are abundant and easy to collect and because their ranges overlap in parts of the United States. An overlapping range in similar species means that females must be well-equipped to distinguish their own species in order to prevent mistakes. Silberglied and Taylor changed the wings by painting them red, green, blue, or black (*C. philodice* is normally yellow and *C. eurytheme* orange) and by transplanting them from one species to the other.

They found that females did not discriminate against males showing either incorrect colors or patterns. Females are selective when choosing a mate, says Silberglied, but probably reject unsuitable suitors only on the basis of pheromones. While he warns that it's "dangerous to generalize from [a few] species to 15,000," Silberglied told SCIENCE NEWS he believes this will turn out to be true with most butterflies.

To explain the bright colors common to males of so many species, Silberglied suggests that color is used as a threat signal between males in conflict over a female. Such ritualization of combat, which reduces the possibility that either opponent will get hurt, is common in the animal world but has not been demonstrated in butterflies before. It makes sense, says Silberglied, not only because male butterflies are aggressive toward other males, but also because they are very fragile. Avoiding physical combat would have an obvious advantage.

Although Silberglied's proposal runs counter to conventional belief, it has re-

ceived an at least guardedly favorable response. "I've never thought about this specifically before, but it's possible," says Paul Opler, a lepidopterist with the U.S. Fish and Wildlife Service Office of Endangered Species. "It's true that territorial birds are the ones showing the brightest colors." "I think it's plausible," says John M. Burns, an associate curator of Lepidoptera at the Smithsonian Institution. But because his findings contradict what most butterfly experts have always believed, Silberglied plans more research. He will observe conflict between males of several species and then, with similar techniques used to investigate the effect of male color on female attraction, will test the impact of color changes on the outcome of male conflicts. —L. Tangley

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## Aquaculture: Tips from deep-sea vents

Lewis Carroll's walrus, preparing to dine elegantly on shellfish (oysters), needed little more, chiefly, than a loaf of bread to complete his repast. Given new information gleaned from the submarine hydrothermal vent systems at spreading centers along the East Pacific Rise, a modern walrus instead might augment his bread with mussels nourished by bacteria grown in an artificial vent system.

At the AAAS meeting, Holger Jannasch of Woods Hole Oceanographic Institution described land-based experiments suggested by findings that clams and mussels growing in coastal waters off Massachusetts use bacteria in ways similar to those employed by giant clams and mussels discovered near some deep-sea hydrothermal vents. Both clams and mussels on the lightless seafloor derive their energy from bacteria that oxidize the hydrogen sulfide abundant at the vents (SN: 1/12/80, p.28). The bacteria use the energy produced in the course of the chemical reaction converting the  $H_2S$  to sulfate. They actually live in the clams in a little-understood symbiotic relationship, while mussels filter the bacteria and digest them immediately. Richard Lutz of Rutgers University in New Brunswick, N.J., attributes the high growth rates of shellfish at the vents more to the rich food source provided by the bacteria than to the low temperature or high pressure.

Scientists at Woods Hole are trying to duplicate this productive arrangement in an artificial vent system in which bacteria found in coastal waters are nurtured in water rich in hydrogen sulfide. As the bacteria in a controlled generator multiply and accumulate, they are removed and fed to common blue mussels that have been seeded in aquaculture tanks.

It is too soon to know whether the cultured mussels will display the same spectacular growth rates as those in the deep sea, but the project has the potential to please just about everyone. People who culture shellfish in enclosed systems may find a way to grow their wares faster and to larger size per individual animal. The aquaculture process provides a positive application for what now is a nagging pollutant—hydrogen sulfide is a troublesome byproduct of processing and use of coal, oil and gas, and is most familiar to residents of Canada and the northeast and central states for its role in producing acid rain. And scientists welcome the opportunity not only to study chemosynthesis and the workings of a vent-like community, but to demonstrate a commercial application for their basic research at the hydrothermal vents.

Jannasch is confident that the cultured shellfish will taste good, unlike their deep-sea counterparts, which sometimes smell and taste of rotten eggs—a sign of their  $H_2S$ -rich environment. "Shellfish at the vents are surrounded by hydrogen sulfide, but they don't require it," Jannasch told SCIENCE NEWS. The shellfish grown in feeding experiments needn't come into contact with  $H_2S$  at all. By the time the bacteria are fed to the mussels, the  $H_2S$  is oxidized completely. —C. Simon

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## Embryo issued biochemical disguise

The embryo is a foreigner in its mother's body. As early as its two-cell stage it displays on its surface molecules characteristic of its paternal, as well as of its maternal, heritage (SN: 12/19 & 26/81, p. 392). Yet the maternal immune system does not attack the developing fetus, as it would attack a graft from so dissimilar an individual. Anil B. Mukherjee of the National Institute of Health, speaking at the meeting in Washington of the AAAS, proposes a new explanation of the embryo's protected status. He suggests that the uterus biochemically masks the surface molecules of the embryo.

Two proteins play a specific role in disguising the foreignness of developing rabbit embryos during implantation, Mukherjee finds. In the earliest stages of rabbit pregnancy the uterus produces increased amounts of the active form of an enzyme called transglutaminase and of another protein called uteroglobin. Mukherjee's experiments indicate that transglutaminase catalyzes the linkage of uteroglobin to the surface of the embryo. Immune system cells from the female rabbit do not recognize young embryos as foreign if the embryos have been treated with either fluid from a pregnant rabbit's uterus or a mixture of uteroglobin and transglutaminase.

The same mechanism may protect