and magnetic storm kicked up by the potent laser burst.

First, when the light hits the target, it kicks out electrons from the surface atoms. As the electrons fly away from the target's surface, they pull the now positively charged borons and nitrogens after them. At the same time, the energy burst at the surface creates a powerful magnetic field, projecting from the surface as a series of magnetic field lines. These lines tug on the ions as they travel, causing them to spiral around the field lines. Key to separating the isotopes, the less massive ions fly in a tighter spiral, while the more massive ones take a wider trajectory, which moves them farther out on the target.

The result was that the outer region of the disc had about twice the amount of the heavy boron isotope as the inner region—enrichment that Ditmire calls surprisingly good. What's more, the Michigan team had similar results with gallium and copper, two other elements that are widely used in electronic devices. They are already planning to use their technique to make isotopically pure thin films of semiconductors, which are known to have an improved ability to conduct heat, a key requirement for today's densely packed computer chips. And Pronko says the technique may also prove useful for separating medical isotopes, such as yttrium-90, which is used to treat non-Hodgkin's lymphoma.

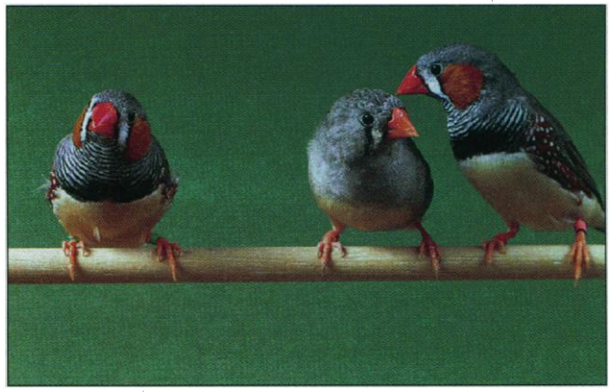
For now, he adds that his group has no plans to see whether the technique can be used to purify bomb-grade uranium—and that application may not be economically feasible in any event. Gérard Mourou, who directs Michigan's Center for Ultrafast Optical Science, says that—fortunately—many laser setups would be needed to collect the kilograms of enriched nuclear material needed to build a bomb. **–ROBERT F. SERVICE**

EVOLUTION

Handsome Finches Win a Boost for Their Offspring

Why one individual finds another attractive is, as the old song puts it, a "sweet mystery of life." For species that have evolved showy feathers or fins, the thinking has been that the ornaments might signal otherwise invisible "good genes" to a potential mate. Peacocks are a classic example: Those that thrive while sporting a magnificent—but unwieldy—tail, the theory goes, must be fit in other ways as well. New results now suggest that at least for birds, the mother's contribution to the fitness of offspring fathered by attractive mates may have been overlooked.

On page 126, evolutionary ecologists Diego Gil, currently at the Université de Paris X in Nanterre, France, Jeff Graves of the University of St. Andrews in Fife, Scotland, and their colleagues report that female zebra finches that have mated with such males deposit more of the sex hormone testosterone in their eggs than they do after a liaison with males they deem less attractive. Studies in canaries have suggested that developing chicks that receive more testosterone beg more vigorously for food and grow faster than other chicks. Therefore, Graves concludes, it is not clear whether the father's "good genes" or the mother's extra help should get the credit for any added success enjoyed by offspring of an especially attractive father.



A head start for hunks? A female zebra finch (center) includes more testosterone in eggs fertilized by males wearing attractive red leg bands (right) than in those fertilized by green-banded males (left).

CREDIT: JEFF GRAVES/UNIVERSITY OF ST. ANDREWS

Why the offspring of attractive males should be accorded such favored treatment remains a mystery. But the finding raises a caution about other experiments meant to show that attractive males really do pass good genes to their offspring, says evolutionary ecologist Doug Mock of the University of Oklahoma, Norman. "People want to believe [the good genes theory]. It is a very sexy idea, but people will have to be careful" in testing it, he says.

Graves and Gil, with St. Andrews University colleagues Neal Hazon and Alan Wells, took advantage of a peculiar taste of zebra finch females. The birds seem to find males wearing red leg bands particularly attractive, but they tend to ignore males wearing green leg bands. No one is sure exactly why red leg bands are the finch's equivalent of a sleek Rolex, while green labels a guy a geek. But because females also pursue males with especially red beaks, it's possible that the leg bands trigger the same reaction, says Nancy Burley of the University of California, Irvine, who was the first to document the attraction. Whatever the explanation, the female zebra finch's fetish allowed researchers to vary a male's attractiveness—and thus distinguish the effects of his sex appeal on the mother from those of his genes.

The team randomly gave males either a red or a green leg band, and then divided 12 females into two groups of six. The researchers allowed members of one group to mate first with a green-banded male, and then, after collecting the resulting eggs as soon as they were laid, mated each female with a red-banded male. Members of the other group mated with a red-banded male before receiving a green-banded suitor.

To see if the female's ardor had an effect on the egg content, the researchers analyzed the yolks for testosterone and its breakdown product 5α-dihydrotestosterone, which in other studies had seemed to influence a chick's eventual success. They found that the birds consistently included more of the hormone in eggs fathered by their red-banded mates than in eggs fathered by the green-banded ones. This suggests that the mothers have more influence on the fitness of the progeny of highly attractive males than scientists had thought.

The new result "certainly raises the bar for people who want to demonstrate good-gene effects from the father in birds," says evolutionary ecologist Carl Gerhardt of the University of Missouri, Columbia. It leaves several questions unanswered, however. Because the researchers had to destroy the relatively small finch eggs to determine their hormone levels, they cannot be sure that the differences they observed do in fact influence the success of zebra finch chicks. To answer that question, Gil is planning experiments in which he will inject finch eggs with an extra dose of testosterone.

Nor can the scientists explain how the females control testosterone levels in their eggs, although Gil suggests that it may be due to the attractive, red-banded males increasing the females' general arousal. Other work has shown, he notes, that a female canary's overall hormone levels affect those in her eggs, and another study suggested that testosterone levels in a bird's blood increase with high levels of social interaction. But he adds, "The problem is we don't know much about [these hormones] in females."

The team hopes their findings will prompt others to help answer such questions—and a broader question as well. "We do have females choosing particular males," says Graves. "The question remains, what do they get out of it? Good genes is a nice answer if it worked—and it may well work—but it's not as easy as it seemed" to solve the "sweet mystery."

–GRETCHEN VOGEL