DNA Fingerprinting to Track Caviar

Economic turmoil in the former Soviet Union and rising U.S. demand for caviar have conspired to create tough times for the sturgeon, the homely, ancient creature from which the tasty fish eggs are harvested. Overfishing in the Caspian Sea, where most of the world's caviar originates, has driven many of the sturgeon's 25 species close to extinction. Several nations, however, are working to devise quotas that will protect the fish.

In anticipation of new rules, scientists are turning to the fish equivalent of DNA fingerprinting to determine which species produced any given sample of caviar. Researchers from the American Museum of Natural History in New York describe the approach in the August CONSERVATION BIOLOGY.

"I think if Caspian sturgeon can be saved, it's through the establishment and adherence of species-level quotas," says Stephen R. Fain, genetics supervisor at the U.S. Fish and Wildlife Service's forensics laboratory in Ashland, Ore. Genetic tests will help investigators track harvested eggs from individual species and detect poaching, he says.

To trace caviar's origin, scientists cannot rely on sight alone. Traders market the salty delicacy in only three major categories—beluga, sevruga, and osetra (or Russian)—distinguished by egg size. Certain species tend to produce eggs of a given size and are traditionally included in a category. Taste is not a reliable indicator of species, says Vadim J. Birstein, a coauthor of the CONSERVATION BIOLOGY report.

Mote Marine Laboratory, Fla.

These Gulf sturgeon are relatives of the Caspian sturgeon that produce caviar.

Birstein told SCIENCE NEWS that he and his colleagues offered their test to the Fish and Wildlife Service, which will monitor U.S. imports for compliance with the new international rules. However, they asked the agency to pay royalties for the use of the technique's patented parts, which identify DNA sequences unique to certain sturgeon species.

The agency instead developed its own test, which is based on sequencing one section of DNA common to all sturgeon species, says Kenneth W. Goddard, director of the forensics lab. This approach, yet to be published, uses characteristic variations in the genetic code to identify individual species. The agency wanted a tool it could share with enforcement agencies in other nations without bothering with fees, Goddard says.

Birstein and his colleagues raise a bone of contention by arguing that high demand has prompted unscrupulous suppliers to mix eggs of inferior species with those of finer caviar. Overall, U.S. caviar imports have doubled since 1991.

The scientists say they sampled 95 lots, mostly purchased in New York City stores. They found that about 25 percent contained species of sturgeon different from those that buyers would expect. These included three lots of beluga, which can fetch prices of $90 an ounce. Unless they use genetic testing, importers can be tricked by their suppliers, Birstein says.

However, after examining 105 samples purchased on the East and West Coasts, Fain suggests that only about 3 percent of lots are mislabeled.

According to Fain and Frank Chapman, a sturgeon researcher at the University of Florida at Gainesville, categories of caviar can legitimately contain more than one species, so Birstein and his colleagues may have overstated the degree of mislabeling. Birstein retorts that each of the major categories should contain eggs of only one species. *—J. Brainard*

Nanotubes get another glowing review

Many scientists say that carbon nanotubes—tiny tubes of graphite that are cousins to the buckyball—have a promising future as a new generation of microscopic wires, probes, and sensors. Now, a new study shows that their future isn't the only thing that's bright.

Researchers at the Swiss Federal Institute of Technology (EPFL) in Lausanne, Switzerland, have found that sending a current through nanotubes not only causes them to give off electrons—a process called field emission—but also to luminesce.

"You can actually see the light with the naked eye when you darken the room," says EPFL's Jean-Marc Bonard. Even a single nanotube generates a faint but visible glow.

The nanotubes emit just one photon of light for every million electrons. "It's something that happens on the side, but it tells us a lot," says Bonard. The luminescence offers insight into the tubes' electronic properties, the group reports in the Aug. 17 PHYSICAL REVIEW LETTERS.

In 1995, Richard E. Smalley's group at Rice University in Houston reported seeing nanotubes give off light but attributed the glow to rapid unraveling of carbon chains from the surface (SN: 9/16/95, p. 183). The tubes were essentially burning up, the group said.

"That work stimulated the entire work that we did," says Walt A. de Heer, a coauthor of the current study who is now at the Georgia Institute of Technology in Atlanta. The Swiss team decided to take a careful look at the origins of light emission, working at voltages that wouldn't destroy the tubes.

The researchers balanced a single nanotube on the tip of a gold wire electrode and placed another electrode nearby to detect emitted electrons. When they sent a current through the tube, the tip glowed with light of wavelengths around 700 nanometers.

"Luminescence tells us something special is happening at the tip," says Bonard. "Our interpretation of these results is that we have emission from different electronic levels at the tip of the tube."

These different levels might result from the tube's structure, de Heer suspects. Electrons flow through the shaft of the nanotube much as they do in a metal wire, sharing one broad energy level. However, the dome-shaped tip, like a molecule, has discrete energy states. Occasionally, an electron moving between these energy levels triggers the release of a photon, de Heer suggests.

The team also looked at thin films containing many nanotubes, which also glowed in response to an electric current.

"It looks like an interesting observation," says R.P.H. Chang of Northwestern University in Evanston, Ill., whose group recently used nanotubes to generate electrons for a flat panel display. "By understanding the mechanism of field emission, one also will understand the electronic properties of nanotubes."

Studying luminescence will probably yield more basic knowledge than practical applications, says Bonard. "But who knows? Maybe someone will need a very tiny device that will at the same time emit light and electrons." *—C. Wu*