
New metal fillings for carbon tubules

Like hollow pastry shells begging for a creamy filling, carbon nanotubes cry out to be filled.

The exquisitely small carbon straws, first reported in 1991, show all the promise of a tantalizing new material — if only scientists could figure out how to stuff them with something useful.

Researchers have tried various methods to fill the tubules with metal. But most such efforts turn out only sparse amounts of stuffed nanotubes, making studies of bulk quantities difficult.

Two recent reports offer some new clues for filling the tiny tubes. In the Dec. 22/29 *NATURE*, H. Pascard, a materials scientist at the École Polytechnique in Palaiseau, France, and his colleagues describe some general principles for inserting metals into carbon nanotubes.

Using an arc-discharge technique, which involves very high temperatures and electrical voltages, the group filled carbon straws with 15 different metals. They found, among other things, that the elements chromium and gadolinium formed nanowires most readily within the slender carbon casings.

Studying data from nanotube fillings, the scientists concluded that “the propensity for forming continuous ‘nanowires’ throughout the length of the tubes seems to be strongly correlated with the existence of an incomplete electronic shell” in the metal’s charged state. In other words, metals most likely to accept electrons in vacant “holes” are the ones most likely to succeed as carbon nanotube fillings, they say.

In a related report in the Nov. 10 *NATURE*, chemists Malcolm L.H. Green and S.C. Tsang of the University of Oxford in England and their colleagues describe a “wet-chemical” technique that enables them to open and fill nanotubes with many metal oxides.

They boiled tubules in a bath of nitric acid and nickel nitrate, baked them in an oven, and then cooked them some more in superheated helium. Bypassing high temperatures and voltages, they managed to fill up to 70 percent of the carbon tubes with nickel, a formidable yield. Other experiments turned out tubules full of cobalt, iron, and uranium.

Speculating on possible uses for nanotubes filled in solution, Rodney S. Ruoff, a chemist at SRI International in Menlo Park, Calif., suggests thinking of the tiny cylinders as test tubes for studying chemical reactions.

The British team says that such metal-filled tubes “might find applications in catalysis, separation and storage technology, and in the development of materials with new magnetic and electrical properties.” — *R. Lipkin*

Psychotherapy’s road to cocaine control

Short-term psychotherapy that offers cocaine abusers practical strategies for maintaining abstinence sparks a marked drop in their overall cocaine use that emerges 6 months after the sessions end and lasts for at least the next 6 months, a new study finds.

In contrast, brief treatment with desipramine — a drug thought by some researchers to reduce cocaine cravings — generates much weaker drops in cocaine use over the following year, report psychologist Kathleen M. Carroll of Yale University School of Medicine and her coworkers.

“Our data underscore the importance of providing a potent psychosocial treatment to cocaine users,” the scientists conclude in the December *ARCHIVES OF GENERAL PSYCHIATRY*. “The effects of desipramine are modest and most apparent in the initial phases of treatment.”

Their investigation is the first long-term look at a specific psychotherapy and drug therapy for cocaine abuse that includes two key comparison treatments: inactive placebo pills and supportive counseling that offers no strategies for refraining from drug use.

A total of 121 cocaine abusers, either seeking help at a clinic or responding to announcements seeking volunteers, participated in the study. They randomly received one of four 12-week treatments: cognitive-behavioral psychotherapy plus desipramine, clinical management plus desipramine, cognitive-behavioral therapy plus a placebo pill, or clinical management plus a placebo.

Cognitive-behavioral treatment focused on delineating the harsh personal consequences of continued cocaine use and identifying ways to avoid or quell cocaine cravings in the future. Much research has found cognitive-behavioral approaches useful in treating depression and panic attacks.

Clinical management included general support, encouragement, and monitoring of medication effects.

Follow-up interviews and urinalysis screening occurred 1, 3, 6, and 12 months after treatment ended; 97 volunteers had at least one follow-up interview, and a majority of that number completed the final two interviews.

Overall, cocaine use and associated problems decreased or remained stable in all four treatment groups. At the 6-month interviews, recipients of cognitive-behavioral therapy first exhibited much steeper declines in cocaine use than those who received clinical management, regardless of desipramine or placebo treatment. This gap widened slightly at the 1-year follow-up.

A minority of participants in each group sought some form of treatment for cocaine abuse during the follow-up, but this did not affect the results, the researchers assert.

Support and encouragement from therapists and research staff may have provided immediate help to cocaine abusers, they note, while specific abstinence strategies forged in cognitive-behavioral therapy were implemented several months later. — *B. Bower*

This fat may aid spread of breast cancer

Last year, researchers noted that diets high in linoleic acid — a nutrient the body needs but must obtain from foods — appear to lower the risk that nascent prostate cancer will spread (*SN*: 10/9/93, p.229).

If that observation prompted you to load up your diet with linoleic-rich fare such as nuts, corn oil, and most margarines, here’s a sobering follow-up.

New animal data indicate that diets high in this same polyunsaturated fat *increase* the risk that a breast cancer will spawn potentially deadly satellite tumors.

David P. Rose and his coworkers at the American Health Foundation in Valhalla, N.Y., injected mice with cells cultured from either of two types of human breast cancer lines. They then compared how different proportions of linoleic acid — accounting for approximately 8 percent or 50 percent of dietary fat — influenced tumor development. (Each mouse derived roughly 40 percent of its calories from fat, a proportion similar to that of

the typical U.S. diet.)

Primary tumors — those that start in mammary tissue — grew faster in animals eating the diet containing more linoleic acid, the scientists report in the Dec. 15 *CANCER RESEARCH*. How much faster the tumors grow depended on the cell line.

But more important, notes coauthor Jeanne M. Connolly, were data on the ability of developing tumors to spread. When cancer victims die, it’s usually from metastases — secondary tumors that form when renegade cells begin colonizing other parts of the body.

“Linoleic acid enhances metastasis in both of the cell lines,” Connolly notes — a finding she says suggests this invasiveness is not a fluke.

The data also point to a mechanism underlying this effect: Linoleic acid can boost the cancer cells’ production of an enzyme that allows them to snip through barrier membranes and invade neighboring tissues or the bloodstream.

— *J. Raloff*