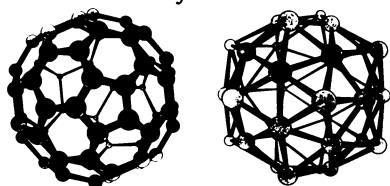


Boron molecules that look like fullerenes

It didn't take Harvard chemist William N. Lipscomb long to pick up on the link between boron molecules and the hollow, 60-carbon molecule called the buckyball. In 1976, he had predicted that a molecule with 32 boron atoms and 32 hydrogen atoms would exhibit an icosahedral structure not unlike the buckyball's soccerball shape, though that molecule had yet to be detected. Lipscomb also knew of smaller boron compounds that resembled other carbon molecules: For example, the eight-carbon cubane matches with a six-boron hydride ion.

Massa and Lipscomb



C_{60} and its corresponding $B_{32}H_{32}$ (right).

Now Lipscomb and Lou Massa, a materials scientist at Hunter College in New York City, have taken a systematic look at the possible correspondence between boron molecules and fullerenes, the new class of all-carbon molecules that includes the buckyball. In the June 10 *INORGANIC CHEMISTRY*, they describe how a one-to-one match between the faces of one type and the vertices of the other leads to similar shapes and symmetries in these molecules. They use a classical law in geometry to predict matches.

In the boron hydrides, the boron atoms bond to each other to form a particular shape and are the atoms considered in the researchers' comparisons with carbon molecules. The hydrogen atoms radiate from these boron cages.

Superimposing the two molecules, the buckyball's 60 atoms would match up with the boron compound's 60 faces, while each of the 32 boron atoms would fall smack in the middle of the faces formed by the buckyball's carbon atoms, says Lipscomb.

The Descartes-Euler formula describes the fit between the two types of molecules. It sums the number of faces and the number of atoms — which represent the vertices — and subtracts two to get the number of contacts. In closed geometrical structures, contacts represent the connecting lines between vertices; in molecules, they represent the shortest distances between neighboring atoms.

Like fullerenes, hollow boron molecules should have useful new properties, Lipscomb and Massa say. They recommend that chemists try to make closed boron hydrides using lasers to vaporize a calcium boron compound in the presence of hydrogen.

— E. Pennisi

Sidestepping Galileo's jammed antenna

After several failed attempts to free Galileo's stuck main antenna, scientists last week revealed their plan for continuing the spacecraft's mission to Jupiter without it.

The main antenna, which resembles a large umbrella, failed to open in April 1991 after two of its ribs jammed. Since then, scientists have used Galileo's two smaller, low-gain antennas to transmit data to Earth. While these antennas have performed well so far, scientists worried that when Galileo begins orbiting Jupiter in 1995, the craft's experiments would flood the antennas with more data than they could handle.

Now NASA officials say that a few high-tech tricks could soup up Galileo's communication system to handle much of the data. "The good news we have today is that we have found a way to accomplish the majority of the orbiter's objectives," Galileo project manager William J. O'Neil of NASA said at a press conference last week. In fact, Galileo could still complete up to 70 percent of its experiments without the main antenna, mission scientists say.

Researchers plan to boost the performance of the smaller antennas in two ways. First, Galileo's on-board computer would be reprogrammed to

squeeze data into fewer computer bits, enabling scientists to send back more images and sensor information. Second, researchers plan to make the network of ground antennas that receive Galileo's signals more sensitive. Galileo's low-gain antennas could then step up data transmission from 10 bits per second to 100 bits per second. Together, these modifications should improve Galileo's present capabilities a hundredfold.

Loss of the main antenna would still hurt some experiments, especially those that rely on numerous high-resolution pictures, says Galileo project scientist Torrence V. Johnson. Galileo could complete about 80 percent of its atmospheric research, 60 percent of its magnetosphere experiments and 70 percent of its studies of Jupiter's moons, he adds.

Scientists haven't abandoned the idea of unfurling the main antenna. They will make another attempt in December, when the spacecraft whips around Earth for its final gravitational assist on the way to Jupiter.

But even if future efforts to free the antenna fail, scientists remain confident of Galileo's success. "We can still do a very good job," O'Neil says. — M. Stroh

Anxiety before surgery may prove healthful

A new study suggests that physicians and nurses should offer this seemingly paradoxical advice to patients awaiting surgery: Don't relax, be worried.

Relaxation training helps people feel less tense before and after surgery for non-life-threatening conditions, but it also seems to spark a potentially harmful surge of two key "stress hormones" during and after surgery, concludes a study reported in the May/June *PSYCHOSOMATIC MEDICINE*. In contrast, surgical patients who receive no relaxation training experience considerable anxiety, but their stress-hormone levels remain stable or decline slightly after surgery.

Medical evidence now suggests that high levels of stress hormones on the days following surgery may contribute to weight loss, fatigue and impaired immune function, say British psychologist Anne Manyande of University College in London and her colleagues. However, researchers have yet to establish a clear link between stress-hormone levels and medical complications after surgery.

"Our data indicate that simple, innocuous forms of reassurance before surgery can have real biological effects and may need to be used as carefully as medication," contends psychologist Peter Salmon, also of University College, who

took part in the investigation. "Preoperative anxiety may protect against the stressfulness of surgery."

The findings support a theory — proposed in 1958 by psychologist Irving L. Janis — that worrying represents mental preparation for surgery and ultimately reduces its stressfulness.

Manyande's team studied adults undergoing minor operations, such as an ulcer repair or the removal of hemorrhoids. The day before surgery, 21 patients listened to a 15-minute tape recording that described mental strategies to reduce tension in different muscle groups. A control group of 19 patients listened to a 15-minute recording that gave background information about the hospital and its staff.

Before and after listening to the tapes, all patients filled out questionnaires assessing the extent to which they felt anxious in general and in response to the upcoming surgery. Patients listened to their assigned tapes at least twice more before surgery and as often after surgery as they wished. On the two days following surgery, each participant again completed questionnaires, as well as a survey of coping strategies regarding surgery, such as worry ("considered several ways of handling the situation"), action ("watched others going through the same

thing") or suppression ("tried to relax and not think about the situation").

The researchers obtained blood samples from each participant before and after the patient listened to tapes, just before surgery, in the recovery room and on the two days following surgery.

Levels of adrenaline and cortisol—two hormones associated with the body's reaction to stress and danger—increased significantly during and after surgery only among patients who listened to the relaxation tape. Yet compared with the control group, relaxation patients reported less anxiety and worry, displayed a lower average heart rate and blood pressure, and received fewer pain-killing drugs following surgery.

Relaxation training may serve to distract people from focusing constructively on the upcoming surgery, Salmon suggests. "Our hypothesis is that thinking about and preparing for a stressful event is a better tactic," he says.

Further support for this notion comes from an unpublished study directed by Salmon. Surgical patients shown a videotape that describes ways to prepare mentally for surgery displayed lower adrenaline and cortisol levels than did controls, he maintains. Another study, reported by Salmon in the June 2, 1990 LANCET, charted marked jumps in stress hormones following major abdominal surgery among the least anxious patients. —B. Bower

Rio summit launches two 'Earth' treaties

Negotiating teams representing 178 nations this week wrapped up 12 days of complex deliberations at the United Nations Conference on Environment and Development (UNCED). This Earth summit brought heads of state from 116 nations to Rio de Janeiro for discussion of—and hopefully commitment to—"integrated strategies to prevent further degradation of the global environment."

While UNCED's organizers had hoped the agreements forged through their diplomatic labors would contain more legal bite, most concede that the documents emerging from this meeting represent important achievements. Indeed, three may eventually result in treaties.

Chief among them was the Convention on Climate Change. Aimed at limiting the threat of global warming, it requires no binding limits on greenhouse gases—just a commitment to policies for controlling emissions and enhancing absorption of the pollutants (SN: 5/16/92, p.326).

At press time, at least 150 nations had signed this convention, signaling their leaders' support. To enter into force, such proposed treaties require subsequent legislative ratification—in this case, by 50 countries.

Tracking the cause of asthma's wheeze

Until recently, scientists believed that asthma resulted when muscles surrounding the lung's airways went into spasm, restricting the flow of air. But a computer study augments recent evidence that inflammation and thickening of the airway tubes is the chief cause of an asthmatic's wheezy breathing.

Mathematician Barry R. Wiggs and his colleagues at the University of British Columbia in Vancouver turned to a computer model of the human lung in their search for the underlying cause of asthma. First, the team obtained data on the thickness of airway walls by studying tissue removed at autopsy from the lungs of people with severe asthma. The researchers gathered further data on airway walls by looking at lung tissue removed during surgery from people without asthma. Compared to the controls, the asthmatics' airway tubes were severely thickened by the effects of chronic inflammation.

Next, the Canadians plugged the data into the computer model. When the team simulated the constriction of the smooth muscles surrounding the airway tubes, they found some airflow resistance. That's to be expected, says Wiggs, who notes that a person with healthy lungs experiences some resistance to airflow when bronchial muscles constrict. Most people might notice a little more difficulty breathing but wouldn't experience any discomfort, he adds.

When the team looked at a model of an asthmatic lung, with its thickened and inflamed airway walls, a dramatic increase in airflow resistance occurred with the same constriction of smooth

muscles, he says.

"The smallest airways had constricted so far down that they had collapsed," Wiggs says. The collapse of the very smallest bronchial tubes corresponds to the severe symptoms of asthma, he notes.

Healthy lungs can handle periodic muscle constrictions, which often occur in order to expel pollutants, Wiggs says. However, the effects of muscle spasm on airways already swollen with chronic inflammation are magnified, he notes.

The Canadian team's findings fit in with a growing body of scientific evidence that shifts the focus in asthma research away from the muscles surrounding the airway tubes.

"We still think that muscle constriction is important," comments asthma researcher Jeffrey M. Drazen of Harvard Medical School in Boston. Yet, Drazen and others now believe that muscle spasm alone doesn't explain the asthmatic's wheeze. "If you sit down and work out the fluid dynamics, you find that a little wall thickening has a big effect" on breathing ability, he says.

The new study, published in the June AMERICAN REVIEW OF RESPIRATORY DISEASE, underscores a recommendation made last year by a federally appointed panel. That group urged U.S. doctors to rely on anti-inflammatory drugs such as inhaled steroids as their first line of defense against asthma (SN: 2/9/91, p.86). However, Drazen says many doctors still rely on bronchodilators, drugs that temporarily improve breathing but do nothing to ease the underlying inflammation. —K.A. Fackelmann

A similar number of countries signed the Biological Diversity Convention. Once ratified by 30 of them, this treaty will bind signatories to protecting genetic resources harbored within indigenous plants and animals. For instance, it calls for cataloging species and supporting activities that foster survival of threatened ones. Wealthier nations would help finance such efforts in poorer ones.

The convention also argues that nations should be allowed to share in the technology or some unspecified "fair" share of profits—or both—that others derive from exploiting their species. While industrial nations have questioned how such provisions might ultimately be interpreted, only the United States pronounced them grounds for rejecting the convention.

Predicting that U.S. "efforts to protect biodiversity itself will exceed the requirements of the treaty," President Bush refused to sign the document. He argued at Rio that its provisions "threaten to retard biotechnology and undermine the

protection of [patentable] ideas. And unlike the climate agreement," he added, "its financing scheme will not work."

Among other developments emerging from the Rio meeting:

- A nonbinding "statement of principle" outlining the need for preserving forests. The document, which many officials described as the first step toward a potential treaty, sets no timetables or standards for assessing compliance.

- A comprehensive environmental action plan. Known as Agenda 21, its roughly 800 pages call for integrated activities to reduce waste, improve energy efficiency and promote sustainable economic development. It also sets guidelines for who will finance such changes and how.

"Rio was clearly a great success," concluded UNCED organizer Maurice F. Strong of Canada. However, he warned at the meeting's close, "whether [UNCED] succeeds in its purpose of setting the planet on a new track remains to be seen. . . . People can't allow their leaders to forget what they promised here." —J. Raloff