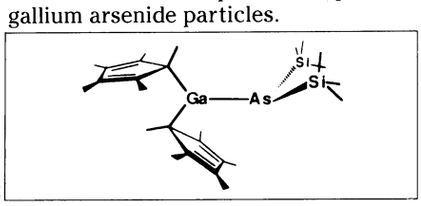
Stripping a molecule to gallium arsenide

The typical process for manufacturing the semiconductor gallium arsenide requires the use of a gallium compound and a highly toxic, arsenic-containing gas at a high temperature. Now a team of chemists has synthesized a molecule that represents a promising step toward an alternative, potentially better way of making gallium arsenide for electronic circuits and other applications. Their new compound contains both gallium and arsenic in the right proportions and reacts in solution at room temperature to produce gallium arsenide particles.



SCIENCE

Normally, molecules containing both gallium and arsenic atoms readily form into pairs or short chains, which are too large to vaporize easily. Chemist Klaus H. Theopold and his colleagues at Cornell University in Ithaca, N.Y., solved the problem by surrounding the gallium-arsenic pair of atoms with small molecular groups — cushioning one gallium-arsenic molecule from the effects of its neighbors (see diagram). They report their findings in the July 15 SCIENCE.

The compound, known as an arsinogallane, dissolves easily in organic solvents such as benzene and decomposes slowly when heated above 60°C or when exposed to air. With a chlorine-containing compound as a catalyst, the arsinogallane reacts with butanol to produce a reddish gallium-arsenide powder, which slowly settles out of solution. Theopold and his team also have succeeded in synthesizing molecules that contain indium and phosphorus and react similarly to produce indium phosphide.

"The molecular chemistry of these things turns out to be quite fascinating," Theopold says. The chemical reaction appears to strip away all the "cushioning" molecular groups surrounding the gallium-arsenic pair. "We might actually be making molecules of gallium arsenide, the smallest possible fragments of that material," he says. However, these rarely detected units are unstable, and they begin clumping together into larger particles. Eventually, the clusters become big enough to drop out of solution.

Even if this particular arsinogallane proves of little practical value in semiconductor fabrication, Theopold says, its chemistry points to an intriguing new group of chemical reactions that may have a variety of applications. The reaction may be useful in probing the properties of small atomic clusters. — *I. Peterson*

AIDS and antibodies: A too-specific fit?

New findings depict "one of the worst possible scenarios" for developing an AIDS vaccine, according to a coauthor of the study. The researchers report that the AIDS-causing virus (HIV) can, by changing only one amino acid on its surface, thwart certain antibodies that prevent it from infecting cells. These "neutralizing antibodies" are often the basis of effective vaccination.

A disturbing fact about HIV is that it frequently mutates, and neutralizing antibodies against one genetic strain of HIV will not necessarily work against a second strain. Since each AIDS patient may harbor a slightly different variety of HIV, one vaccine may not suffice in halting AIDS. Also, studies show that HIV cultures isolated periodically from a single AIDS patient may reveal changes, becoming more virulent with time (SN: 4/9/88, p.232).

Now, a study reported in the July 15 SCIENCE suggests that AIDS viruses that differ by only one or two amino acids elicit drastically different responses from neutralizing antibodies. David Looney of the Walter Reed Army Institute of Research in Washington, D.C., and his colleagues tested viruses that varied in the amino acids of their protein envelope, the HIV shell. To the viruses they added a variety of blood-serum samples that previous tests had indicated contained HIV antibodies. They then recorded each sample's geometric mean titer (GMT), a measure of its ability to neutralize a virus. They discovered that the various viruses, though almost identical, varied considerably in the degree to which the sera could neutralize them. A single amino acid change in the protein coat of a virus with a GMT of 2,000 for a particular serum sample could make the GMT drop to almost zero with the same serum.

Despite the findings' dismal implications for this approach to vaccine research, says one of the scientists, "they provide some hope by explaining why trials of neutralizing antibodies have not succeeded." According to the investigator, the study should warn AIDS researchers that their carefully cloned stock of virus may contain a mixture of HIV variants and that it only takes one amino acid change to abolish a virus' ability to be neutralized by a particular set of antibodies. — *M. Hendricks*

Winnie the Pooh and a language lift too

Parents who change the way they read picture books to their children, by adopting a few simple techniques designed to increase a child's active participation, may substantially boost the youngsters' language development.

Hard to believe? It's no fairy tale, say Grover J. Whitehurst and his colleagues at the State University of New York at Stony Brook. How parents talk to their children makes a big difference in language development, they maintain, and a child who actively responds to what a parent reads more readily acquires new language skills.

The psychologists recruited 30 middle-class parents and their 2- to 3-year-old children. Half the children participated in a month-long, at-home experimental reading program; the rest served as controls. In the experimental group, one of each child's parents — usually the mother — received a 1-hour training session. Rather than simply reading a story straight through, these parents were encouraged to ask open-ended questions. They were told to avoid asking children to point out objects or posing "yes/no" questions. One example is asking "What is Eeyore doing?" instead of "Is Eeyore lying down?"

Experimental-group parents also were instructed to expand on their children's answers, suggest alternative possibilities, praise correct answers and pose progressively more challenging questions.

Control-group parents read in their customary fashion.

All families taped their reading sessions at home. Analysis of the tapes demonstrated that experimental-group parents did indeed follow the training instructions.

Children in the two groups did not differ on measures of language development at the start of the study. But at the end of one month, those who completed the new reading regimen were 8.5 months ahead of control youngsters on a test of verbal expression and 6 months ahead on a vocabulary test, report the researchers in the July DEVELOPMENTAL PSYCHOLOGY. The verbal expression test requires the child to tell an experimenter as much as possible about various objects.

Nine months later, children in the experimental group showed a developmental advantage of 6 months.

Parents in the control group, notes Whitehurst, read as frequently to their children as did parents in the experimental group — nearly eight times per week. "[Language] differences," he contends, "were the result of a brief experimental reading program that required about an hour of direct training for parents."

— *B. Bower*