drugs, Moertel and his colleagues explain. In this study, the regression rate represented less than one percent of patients in the study.)

Regarding survival, 50 percent of the 156 patients died before five months, and only 20 percent were alive by eight months. (This survival experience, Moertel and his co-workers report, would be consistent with that expected if patients had received no treatment.)

Of the 156 patients, 140 had had symptoms of their cancer before Laetrile therapy, and of these 140, 19 percent claimed improvement in how they felt at some time during the study. At 10 weeks, only five percent of the patients were still on therapy and claiming improvement in symptoms. (This degree of benefit, Moertel and his team explain, is within the range of that anticipated with a placebo.)

As for weight gain and improvement in physical activity, only six percent of the 156 patients showed weight gain or improvement in physical activity at some time during the study, and only three percent were still on therapy and maintaining weight gain or improvement in physical activity at 10 weeks.

Of the 14 patients recently placed on very high doses of Laetrile, 10 have already shown progressive cancer.

Thus, Laetrile is "ineffective as a treatment for cancer," Moertel and his colleagues conclude.

At a press conference held in conjunction with the ASCO meeting, Moertel said that as the federal government and states make decisions regarding Laetrile use, he hopes they will consider the results of this trial. He also added that he hopes the results will influence cancer patients who are in doubt about whether they should seek Laetrile treatment or not, since "we have tried very hard to conduct a scientifically honest trial." In fact, a corollary study conducted by Karen Redding and co-workers at the University of Arizona on the attitudes of patients getting Laetrile in the trial, compared with the attitudes of cancer patients getting other investigational drugs, suggests that the results of the NCI trial *will* influence cancer patients' decisions regarding treatment. The reason is that patients getting Laetrile showed no significant difference from the other patients in their attitudes toward health, the medical profession, chemotherapy or unproved methods of cancer treatment. Where they differed was in the fact that their physicians had told them that nothing could be done for them.

For persons who adhere to Laetrile in spite of scientifically conducted trials, though, it is unlikely that the NCI trial results will influence their stance on Laetrile in any way. A good example can be found in a Laetrile advocate who popped up in the Laetrile trial press conference and, her voice edged with hysteria, declared, "I'm heartbroken with the results, Dr. Moertel." □

Forbidden fruit of chemical reactions

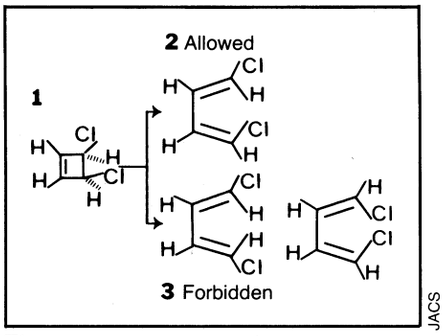
The molecules in a chemical reaction are a fairly predictable bunch. Because of this predictability, chemists depend on a set of laws that explain why molecules A and B will react to form C. Now, Robert M. Moriarty of the University of Illinois in Chicago and colleagues say they have broken one of those laws.

The law they have violated, the Hoffmann-Woodward rule, is one of the newest on the chemical books. For a long time, chemists relied on only two laws to predict the outcome of reactions: steric (two things cannot occupy the same space at the same time) and electric (like charges repel). But there was a need for "some other explanation for some reactions that couldn't be understood by these two sort of classical ways of explaining organic reactivities," Moriarty says, and the Hoffmann-Woodward rule was born.

The Hoffmann-Woodward decree pays attention to where the electrons fit on the complex energy picture of molecules in concerted, or one-step, reactions. Simply put, these electrons occupy certain energy levels called orbitals. According to the Hoffmann-Woodward rule, the conservation of orbital symmetry (a mathematical rather than a physical symmetry) can be used to predict the results of reactions. On the basis of orbital symmetry, therefore, there are allowed and forbidden reaction products. Moriarty and colleagues say they have synthesized such forbidden products in a way that violates the Hoffmann-Woodward rule.

In the April 22 JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, Moriarty and co-workers report zapping *cis*-3,4-dichlorocyclobutene (labeled "1" in the diagram) with the heat energy from a pulsed CO_2 (infrared) laser to open that molecule's ring. This resulted in Hoffmann-Woodward defined forbidden products (3), rather than the expected allowed product (2). To understand the mechanism involved, Moriarty says to think of the electrons in a chemical reaction as crossing a mountain. These electrons will travel the easiest route, the mountain pass, to reach the end of the reaction. Normally, adding more thermal energy will cause these electrons merely to travel more quickly. But, says Moriarty, "We hit the molecule with so much [heat] energy that the electrons shoot up the side of the path" to reach a "forbidden" destination.

Although Hoffmann-Woodward defined forbidden products have been synthesized before, they always resulted from light, not heat, excitation. (In this case, the electrons still are traveling on a pass, but they are crossing "a mountain in the sky," above the "ground state mountain," Moriarty explains.) Producing thermally forbidden products has implications for research on difficult syntheses. For example, thermal excitation may be useful for molecular systems unexcitable by light. But, says Moriarty, "I hasten to add that at this stage, it's mainly a theoretical interest that you can [thermally] divert the reaction to a non-allowed pathway."



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The top structures are isomers — compounds with identical components but different arrangement of them. Lower right compounds (3) are "forbidden isomers."

Moriarty's claim that he can thermally divert the reaction to a non-allowed pathway has met with some criticism in the chemistry community. In fact, he says, "We had a tough time getting it published." Reviewers of his work suggested, for example, that the forbidden products were synthesized via an intermediate product that formed on the walls of the experimental vessel. In such a case, the reaction is not concerted, and the Hoffmann-Woodward rules do not apply. The reviewers also suggested that the forbidden products resulted not from electrons traveling the sides of an energy path, but rather from a rearrangement of an initially formed allowed product. Says Moriarty, "A variety of tests were carried out to eliminate [those] possible artifacts in our experiments." □

Culturing cancer cells

A cancer patient's particular cancer cells can now be grown in the laboratory within 10 days to two weeks, Sydney Salmon of the University of Arizona Cancer Center in Tucson reported in Washington last week at the annual meeting of the American Association for Cancer Research. These cultured cells can be used to test which drugs are most effective. This is important because cancer cells differ from person to person, and a drug that works for one patient may not work for another. In advanced cancer of the ovaries, one of the first cancers to which the method has been applied, Salmon has quadrupled patient survival time.

Salmon uses special nutrients to encourage the growth of cancer cells. In similar work, Israel Vlodavsky and Zvi Fuks of the Hadassah-Hebrew University Medical Center in Jerusalem culture cancer cells on a plastic matrix. □