

The higher reaction rate between nitric oxide and hydroperoxyl radicals better fits observations in experimental smog chambers, Howard relates.

Laboratory experiments using the laser magnetic resonance technique may soon update other reaction rates. Howard predicts that his method will be applicable to "a tremendously long shopping list of hydroperoxyl reactions" that are now assumed to be slow.

"This high rate constant is a head-kicking effect, it completely changes predictions," Howard said in an interview. "But things can still change. We are learning at a rapid rate and expect major uncertainties. If we need to make long-term decisions, we need to use the best scientific evidence available." □

## Academic science: Quality decaying

A two-year-long study concludes that while American academic science still enjoys a position of world preeminence, "sufficient warning signs of emerging problems have arisen to alert policymakers to ensure these downward trends do not worsen." The 264-page report, based on interviews with scientists, deans and graduate students at 36 universities and numerous government officials, makes no specific recommendations for remedial action. It was sponsored by the National Science Foundation and published by Change Magazine Press.

Reacting to the report, Sen. Daniel P. Moynihan (D-N.Y.) said, "In the years since World War II, the United States developed the world's premier scientific research enterprise, primarily because of an extraordinary and mutually beneficial partnership between the national government and the great public and private universities. No public policy issue today is more compelling . . . than the future of that relationship."

Authors Bruce L. R. Smith of Columbia University and Joseph J. Karlesky of Franklin and Marshall College conclude that a decrease in federal and state funding of university research has provoked tension between all the parties involved: government officials, university faculty, graduate students and administration. The authors express concern that a greater share of an already dwindling R&D budget in the United States—decreasing from about 3 to 2.4 percent of the gross national product during the past decade—is being invested in the work of a smaller group of "elite" universities. This is causing a widening breach between the few well-financed and well-equipped research institutions and the great majority of others, which are not being as generously supported. Consequently, many universities may find it ultimately necessary to curtail certain educational and research programs due to lack of funds. □

## Cytomegalovirus: The newborn's enemy

Cytomegalovirus infection, particularly of the genital tract, is common among American women. If present when a woman gives birth, the virus may not only infect her offspring but also damage its brain. Some 3,700 American newborns are mentally impaired each year from congenital cytomegalovirus infection. Thus, medical researchers would like to prevent this major public health problem by vaccinating women of childbearing age against the virus.

Before vaccination can become clinically available, however, scientists need to learn more about the infection in pregnant women and their progeny and particularly about the role of maternal and fetal immunity to it. A vital contribution toward this end is reported in the June 2 *NEW ENGLAND JOURNAL OF MEDICINE* by Sergio Stagno of the University of Alabama Medical Center in Birmingham and his pediatric and microbiology colleagues.

Stagno and co-workers examined levels of antibody against the virus in the blood of 239 pregnant women. They found that 208 out of 239 (82 percent) showed antibodies against the virus, indicating that they had been infected with it at some time or another. This result confirmed previous findings—that cytomegalovirus is indeed rampant among American women.

A more crucial finding came next. The women who had antibody immunity against the virus during pregnancy were still able to give birth to cytomegalovirus-infected infants. Seven of the 208 immune women's infants (3.4 percent) were infected, compared to 3 of 31 women (10 percent) without antibodies. In other words, maternal antibodies may provide only limited fetal protection against infection, if any, suggesting that vaccinating women against the virus might not shield their offspring.

None of the infected infants born to women with antibodies were mentally retarded, however. They eventually recovered from the virus infection. Thus, while vaccination (antibody immunity) may not protect newborns from cytomegalovirus infection, it might still safeguard them from viral damage.

Other valuable information has also come from the study by Stagno and his colleagues. Not only primary cytomegalovirus infections but also recurrent infections can infect women and harm their offspring. In fact, the results suggest that recurrent infections may pose even more of a danger than a primary one. Such viral behavior stands in stark contrast to other microbes that infect fetuses almost exclusively as a result of primary maternal infection. Stagno and his co-workers believe that these data demand that viruses be used in the vaccines prevent primary maternal infection or reduce the chances for transmission to the fetus or subsequent

infection. (Live cytomegalovirus vaccine trials are already underway in England and Switzerland and are being considered in the United States as well.)

In spite of the insights provided by this study, some crucial questions about cytomegalovirus infection and damage of offspring press for answers. This is emphasized by Donald N. Medearis Jr. of Cleveland Metropolitan General Hospital in an editorial in the same *NEW ENGLAND JOURNAL OF MEDICINE* issue. For one, what is the role of cellular immunity (immunity provided by white cells known as T cells) in cytomegalovirus infections? A 1975 study suggested that mothers who give birth to congenitally infected infants have a specific impairment of cellular immunity. However, cellular immunity has not yet been studied in mothers and infants to determine whether it might protect against either congenital infection or mental retardation.

Also to be studied is whether an offspring can only be infected during birth or whether it can also be infected in the womb. For the first three months of life, a fetus has few antibodies of its own, and because two other microorganisms—rubella (German measles) and toxoplasmosis—can damage a fetus during the first trimester in the womb, cytomegalovirus may be able to do so, too. □

## Unprovable problem in arithmetic

One of the most profound achievements of 20th century mathematics was the proof given by Kurt Gödel in 1931 that the axioms of elementary arithmetic are incomplete: There will always be true statements of arithmetic that cannot be proved from the axioms. Gödel's discovery meant that, in principle, some of the famous unsolved problems of mathematics might be so not just because they are difficult, but because they are theoretically undecidable. Unfortunately, the only examples of undecidable propositions produced by Gödel's method—or in the 35 years since his proof—are exotic statements created solely for the purpose of exhibiting an example.

Last month Jeffery Paris at the University of Manchester proved for the first time that one of the important unsolved problems of arithmetic is really undecidable. He showed that a certain rather famous conjecture concerning the numbers of ways objects can be arranged in patterns cannot be proved from the axioms of elementary arithmetic. Perhaps more surprising, this conjecture is known to be true—by virtue of reasoning with infinite sets that lie outside the purview of elementary arithmetic.