can continue to do so. Although faced with competition, NIH is still the best as far as many young researchers are concerned. Willa Hsueh, president-elect of the American Federation of Clinical Research, whose members become emeritus on their 41st birthdays, thinks most researchers, especially physician-scientists, still long for a stint at NIH. Or, as Judy Kim, a Johns Hopkins medical student who is spending a year at NIH as one of 30 Howard Hughes–NIH student scholars, said recently, "We all came here because NIH is Mecca." A fellow Hughes scholar offered an additional thought. In one specialized area or another, it might be possible to say that the best lab in the country is at this institution or that, "but there is nowhere else where the whole spectrum of research is spread out before you in one place—everything," she says. One of the greatest justifications for changing NIH to save it may be to maintain it as a premier institution for training young researchers.

Fredrickson suggests another special niche for intramural NIH—clinical trials. "We haven't even begun to appreciate the need for the clinical trials of the 21st century when we'll be testing countless new products of biotechnology," he says, adding that with researchers' increasing ties to industry, "everyone but NIH will be up to the hilt in conflict of interest."

And there is the intangible link between intramural and extramural NIH. About 90% of NIH's $6.2-billion budget is spent on extramural grants and contracts, managed by a large staff of administrator-scientists. There is a strong presumption that quality is enhanced overall by the intellectual and physical proximity of researchers and grant-givers. Institute directors, for instance, are responsible for both intramural and extramural research, giving them a certain closeness to ongoing science that their counterparts in agencies like the NSF do not have.

Part of the challenge to the Institute of Medicine will be to get a grip on these and other issues during the course of its upcoming study, which is expected to take only 6 months from start to finish. NIH has just now completed the paper work for the contract with IOM, whose president, Samuel O. Thier, is planning a broad study of "all the possible options"—not just those suggested by NIH.

Originally, OMB hoped the study could be done by May—in time for internal discussions about the budget for fiscal year 1990. But that cannot be done. The goal now is to have it in hand before the presidential election in November. ■

BARBARA J. CULLITON

Doubts Over Fermat Proof

A final verdict is still not in on a recently announced proof of Fermat's Last Theorem, but experts in the theory are skeptical. Early this month, Yoichi Miyaoka of the Tokyo Metropolitan University, who is currently at the Max Planck Institute for Mathematics in Bonn, West Germany, captured public attention when he completed a proof of the famous open problem in number theory. His final manuscript is only now being circulated, but based on preliminary lecture notes, some mathematicians think there is an error at a critical point in Miyaoka's complicated argument. Miyaoka, however, has reportedly addressed some of the skeptics' questions in the final manuscript.

Fermat's Last Theorem is a deceptively simple assertion. Around 1637, Pierre Fermat observed that, while the equation $x^2 + y^2 = z^2$, which is familiar from the Pythagorean Theorem, has infinitely many positive integer solutions (such as $x = 3$, $y = 4$, $z = 5$), analogous equations with higher exponents—$x^n + y^n = z^n$, with n larger than 2—seemed to have none. Fermat wrote this in the margin of a book, adding the comment, "I have discovered a truly remarkable proof, which this margin is too small to contain." Mathematicians are of three opinions as to Fermat's comment: he was joking; he was mistaken; or he was very very smart. In any event, a proof of Fermat's Last Theorem has eluded mathematicians for the last 350 years.

Because of its simplicity, Fermat's Last Theorem has attracted numerous attempts to solve it, ranging from the sublime to the ridiculous. Mathematicians have learned to take announcements of solutions with a sizable grain of salt—most of these "proofs" are amateur attempts that repeat mistakes made many times before. However, in the last 2 years, Fermat's Last Theorem has been shown to have deep connections with some modern developments in number theory and geometry. Miyaoka's proof is being taken seriously because it is based on one of the new approaches.

Miyaoka's work involves new ideas from a program to "translate" results in differential geometry into an arithmetical setting. This program gained prominence in 1983, when Gerd Faltings, now at Princeton University, proved several major results culminating in the solution of another important problem in number theory known as the Mordell conjecture. Faltings' breakthrough has a direct bearing on Fermat's equation, which persuaded many mathematicians that Fermat's Last Theorem might be accessible by the new methods.

A step in this direction was taken about a year ago by A. N. Parshin, a Russian mathematician, who proved that if the arithmetical analogue of a certain fundamental inequality in differential geometry—which Miyaoka himself had proved in the original setting—is true, then Fermat's Last Theorem is also true. Miyaoka's current work is an attempt to prove the arithmetical version of the inequality. But experts, including Faltings, are skeptical.

Enrico Bombieri of the Institute for Advanced Studies at Princeton has identified a serious problem in Miyaoka's proof. If a certain step is "translated" back into the geometric setting, the corresponding assertion is false. That does not necessarily invalidate the arithmetical step, but it violates the guiding philosophy of "parallelism" between geometry and number theory.

Faltings and Bombieri point out that they have only seen lecture notes on Miyaoka's proof and not an "official" manuscript, but the notes are enough to raise doubts. "The way a mathematician checks a proof is by looking at the concepts and how they are related," Bombieri says. "If the concepts look OK, then we start on a line-by-line check." Miyaoka's proof, according to Bombieri, is still at the first stage.

But according to Don Zagier, who is working with Miyaoka in Bonn, Miyaoka has taken care of many of the doubts, and the final manuscript is quite different from the lecture notes. Zagier, who is an expert in number theory but not in the type of mathematics that Miyaoka uses in his proof, says that Miyaoka's lecture was intentionally simplified for purposes of exposition, so that some parts of it were not precisely correct. "I wouldn't worry about anything too much until people have seen the proof."

Debate over the correctness of a mathematical proof usually takes place in a relatively quiet academic background, but interest in Fermat's Last Theorem runs unusually high. Even if Miyaoka has not proved the theorem, his ideas are bound to have an impact. "Some parts of the proof are of independent interest," Bombieri says. "This work certainly will help to understand better the analogies between geometry and number theory." Bombieri also does not dismiss the possibility that Miyaoka actually has proved Fermat's Last Theorem. "If Miyaoka's work turns out to be correct, it will be a fantastic achievement." ■

BARRY A. CIPRA

Barry A. Cipra is a mathematician and writer based in Northfield, Minnesota.