Why Is Calculus Such a Hurdle?

Calculus is a main stepping stone to careers in science and engineering, but, for too many U.S. students, it is also a major stumbling block. This was the problem posed at a colloquium at the National Academy of Sciences (NAS) organized to explore what to do about it.

The meeting on 28 and 29 October concentrated on calculus at the college level where the crucial winnowing is done. Several speakers sought to illustrate the "crisis in calculus" in terms of the casualty rate, particularly in the first semester of so-called "mainstream" calculus—"Calc I." Mainstream calculus provides access to upper division mathematics courses, as distinct from specialized courses such as business calculus. Surveys show that a third or more of the roughly 300,000 who took mainstream courses in the past academic year failed to get grades of C or better. Speakers at the meeting cautioned that things are probably worse than the data indicate because withdrawals from courses are not fully reflected. The record is even more dismal in some institutions, particularly large ones, it seems, where the proportion of students who do not satisfactorily complete the course can be 50% or more.

A strong mood of self-criticism prevailed at the meeting with both the calculus curriculum and the quality of teaching being questioned. There appeared to be a consensus that the teaching of calculus has been focused for too long on routine problem solving. New approaches are needed, for example, to come to terms with the use of sophisticated hand-held calculators and computers and, particularly, to give students a better conceptual understanding of the subject.

In the meeting's keynote speech, National Academy of Engineering president Robert M. White said the "national spotlight is on calculus" because of the "linkage between mathematics and economic growth." Calculus "must become a pump rather than a filter in the pipeline," said White.

Concern about U.S. economic competitiveness has spurred the NAS organizations to take a broader and more active interest in science and mathematics education in recent years. Main sponsors of the calculus meeting were the National Research Council's Board on Mathematical Sciences and Mathematical Sciences Education Board.

The latter was established in 1985 with the mission of helping to revitalize mathematics education at every level. The colloquium, which was funded by the Sloan Foundation, is the first major initiative under a joint project of the two boards known as MS 2000—The Mathematical Sciences in the Year 2000. The aim of MS 2000 is a comprehensive review of the mathematical sciences in colleges and universities over several years.

The calculus colloquium outdrew its organizers' expectations with some 600 showing up, mainly teachers of the subject and "clients" of calculus from other disciplines and from industry. Part of the meeting was devoted to workshops on particular aspects of the subject and the proceedings of the meeting will be published.

A main purpose of the colloquium was to provide an "information base" for pilot projects in calculus teaching. The National Science Foundation is offering a direct incentive for proposals for such projects with a planned "calculus initiative," which will provide $2 million to support improved undergraduate calculus instruction, the federal budget willing. ■ JOHN WALSH

Briefing:

China Renews Pledge to Boost Basic Research

China's highest ranking science official on 27 October declared a new commitment to basic research in China. Song Jian, minister of the state science and technology commission, made the remark at a press conference in Beijing while the party congress was in session.

China's commitment to fundamental research has waxed and waned during the past few years as the country has tried to modernize. The party increasingly has emphasized applied research to speed up China's economic growth. But now, Song says, basic research will be strengthened "to raise the country's scientific level as a whole and prepare necessary scientific and technological reserves for China's economic development in the future," China's official news agency *Xinhua* reported. The article made no mention of increased research funding, however.

Song's comment represents "a return to an earlier goal. That's new," says Merle Goldman, professor of Chinese history at Boston University and a scholar of the Chinese intellectual community.

Song also asserted that there is no discrimination against intellectuals in China. He pointed out that astrophysicist Fang Lizhi, who was expelled from the Communist party earlier this year for his outspoken support of academic freedom, "still enjoys respect as a gifted scientist, whether he is a party member or not." But he added that Fang is an expert in science, not politics. Fang became a hero for many Chinese intellectuals after his expulsion from the party.

But Goldman says that Song's denial of discrimination against Chinese intellectuals is a remark "for public consumption." The party, for example, allowed Fang to attend a scientific conference in Rome this summer, but barred him from attending subsequent meetings in Britain and the United States. "But at least the party hasn't sent him off to Chinese Siberia," Goldman said.

Song also said that the government has taken "effective measures" to improve the standard of living and working conditions for Chinese scientists. But Goldman said that progress has been very slow and that the standard of living for many scientists is still "less than what it is for menial workers." ■ M.S.

New Vice President and Trustee Named at Hughes

Australian-born financier James D. Wolfensohn and Washington University provost W. Maxwell Cowan have just been named to positions with the Howard Hughes Medical Institute.

Wolfensohn, who heads his own company in New York, and is a director of CBS, Inc., and Timeplex, Inc., has been elected as the ninth member of the HHMI trustees, thereby filling out the institute's board. He is also chairman of the board of Carnegie Hall, chairman of the Institute for Advanced Study at Princeton, and a trustee of the Brookings Institution and Rockefeller University.

Cowan, South African–born, was on the faculty of Washington University from 1968 until 1980 when he moved to the Salk Institute as director of developmental neurobiology. He returned to Washington University as provost in 1986. He will now take on the full-time position as vice president and chief scientific officer of Howard Hughes, the post held by Purnell Choppin until he was named president of Hughes in August.

Cowan is a member of the Institute of Medicine and a foreign associate of the National Academy of Sciences. ■ B.J.C.