largely "self-correcting" if something can be done about general economic problems.

Rosenberg said America's greatest success in the past was based on commercialization of new products. Many of the incentives to do well in this sphere have been allowed to erode. What is important for economic progress is to exploit and diffuse correct technologies, not simply to invent new ones. And it is necessary, for example, to maintain engineering and design skills in industry, to have highly motivated businessmen able to make shrewd business judgments, and to have ready access to capital. "Science is not unimportant," said Rosenberg, "but it's a single ingredient in a large complex of factors."

If the analysis from inside was astringent, the comments of two congressmen who came as after-dinner speakers had even harsher elements. The speakers were Representative George E. Brown, Jr. (D-Cal.), chairman of the House Science and Technology Committee's subcommittee on science, research, and technology, and Representative Clarence J. Brown (R-Ohio), who sits on two House energy subcommittees.

The message from both Browns was essentially the same. There are signs that the public's confidence in science is flagging and this will affect congressional support. People expect that expenditures on R & D will bring a recognizable result in avoiding or solving serious problems. Both congressmen support a strong R & D effort, but point out that at a time of heavy pressure on government spending, R & D comes under keen scrutiny. The gentleman from Ohio made the point most forcefully when he said, "we cannot afford to do without more R & D. Inevitably, much of it will be supported by the taxpayer's money. Consequently, the R & D will have to be done on topics the public can relate to. If the taxpayer is paying for R & D in a time of general austerity, he is going to want to get something out of it."—JOHN WALSH

No Cure in Sight for Loss of M.D. Researchers

The ranks of medical researchers have thinned in the past decade, and just what to do about it baffles even the experts

Chicago. Medical researchers are feeling unloved these days, and some of them recently got together at the Center for Policy Study at the University of Chicago to compare notes and air complaints. One problem they perceived was a drop in prestige, another was a fall in funding, a third was a loss of students. Not all the news was bad, however. A government administrator and others told the researchers to take heart—things may not be half as bad as they seemed.

That advice seemed to fall on deaf ears, however; a series of gloomy statistics had set up the audience for the worst. According to the American Medical Association, for instance, the number of physicians who reported research as a primary activity has dropped from 15,441 in 1968 to 7,944 in 1975. Just what this means for biomedical research is not clear, however, as the number of Ph.D.'s in the area has skyrocketed. The M.D.'s say that it takes physicians to translate the decade-long explosion of biomedical facts into therapies and cures, and that they are falling dangerously far behind. In 1967, for instance, the number of physicians who were listed as principal investigators on National Institutes of Health (NIH) grants was 59 percent. By 1976 that figure had dropped to 29 percent. More than anything else, this one fact, repeated over and over in the course of papers and presentations, hung over the conference like a dark cloud.

Debate among the 50 or so participants over what to do about it was sharp, some calling for increased lobbying and more federal dollars, others for squeezing more work out of existing funds. Not everyone was worried by the stark figures, however.

"It's just not that bad," said G. Donald Whedon, the director of the National Institute of Arthritis, Metabolism, and Digestive Diseases (NIAMDD), at the 5 to 7 June Conference on Clinical Research: Elements for a Prognosis. He said, for instance, that the number of M.D.'s doing research at NIH is shrinking only relative to the increasing number of Ph.D.'s. In *absolute* terms, the M.D.'s are holding their own. Another complaint that Whedon criticized was that a growing share of the NIH budget was earmarked for targeted research. At NIAMDD, a consultant for the conference found that targeted research had risen from 6 percent of the total human research in 1975 to 19 percent in 1978, and the rise was accompanied by a drop in clinical research on fundamental topics.

It seemed like an open and shut case—until Whedon stepped up. "In *absolute* figures, not percentages, clinical research in fundamental areas is *not* shrinking," he snapped. "Wherever I go, people talk about the bleak funding picture. But, in fact, funds are increasing, the number of investigators are increasing. . . . The doom and gloom which is being preached everywhere is no help in getting young people interested. They are getting grants. And they ought to be encouraged."

Upbeat efforts of this sort were rather rare, however, and the conference for the most part centered on depressing facts. One was supplied by William DeCesare, director of the General Clinical Research Center Program at NIH. His program, designed to support studies on normal subjects and patients, has slipped from 91 centers across the country in 1968 to 74 in 1979. This drop occurred while the number of U.S. medical schools was increasing from 100 to 125; thus many of the medical schools now have no facility for clinical studies.

For the collective ills of the clinical research community, real or imagined, Jeremiah Stamler of the Northwestern University Medical School had but one cure. More money. "We all have to put in our oars and pull together," he railed. "Fighting over the shrinking pie will get us nowhere. What we need is the billion dollars that the Defense Department lost last year in cost overruns and bungled budgeting." Not everyone was convinced by the plea. "I wish it were so simple as to shift a billion," said Scott Swisher of Michigan State University. "But I think it would not solve our problems but only increase them. What we

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need is a better return for the dollars that we now invest—more bang for the bucks." At least one person in the audience was not so sure that federal funding was the ultimate solution. "If NIH were to disappear tomorrow," said William Barclay, editor of the *Journal of the American Medical Association*, "clinical research would not go away. It might weaken for a while, but it would not disappear."

His sentiments were not widespread, however, and one recourse alluded to over and over was an effort at increased lobbying in a Congress that is not sympathetic to the plight of clinical research centers. Some said they had tried as much. Robert Levine of the Yale Medical School complained that his trips to Capitol Hill were frustrating, that he talked to aides over and over, but that they couldn't understand what he was getting at—a comment that rubbed at least one member of the audience the wrong way. A staff assistant to Representative Richardson Preyer (D-N.C.), who sits on the House health subcommittee, said that he and his colleagues were indeed interested in hearing about the research story, and would like to hear more, if anyone was able to tell it.

One who did graphically describe the growing pressures on faculty was David Skinner of the University of Chicago medical school. He pointed out that as drops in federal funding have occurred, professional fees and service programs have had to take up the slack. Between 1964 and 1974, he noted, these fees went from 4 to 22 percent of the total funding for academic medical centers. In a study of academic surgeons that he conducted, Skinner found that on the average last year they performed 222 major operations plus a number of minor procedures, published six papers, had a heavy teaching load, maintained a research grant and a laboratory, and were away from home 41 days. These pressures are apparently taking their toll. Budgeted vacancies in clinical departments have grown about 11 percent per year since 1971, while openings in basic science departments at medical schools have grown at a rate of 4 percent a year. "The faculty," said Skinner, "are being stretched further and further."

Increasing demands on faculty have not gone unnoticed by students, and fewer are following in their teachers' footsteps. According to the Committee on Personnel Needs at the National Academy of Sciences, the number of medical students assigning high priority to research dropped from 49 percent in 1963 to 2 percent in 1976. For many, the lures of private practice have become too compelling. It has been estimated that there is a $30,000 differential between the income of a physician starting a research fellowship and one beginning clinical practice. John Sherman, vice president of the Association of American Medical Colleges, pointed out at the meeting that the introduction of Medicare and Medicaid in the mid-1960's for the first time removed the financial ambiguities for those in private practice. Since then, physicians have grown to expect to be paid with regularity. Not just the poor financial incentives of clinical research were questioned. Leslie DeGroot of the University of Chicago medical school performed a survey of student attitudes and found that many had tried research and didn't like it. Upon being pressed, however, they said that the exposure had only been for a month or two—apparently not long enough for the slow returns of research to be felt. "These short experiences in the laboratory," said DeGroot, "which we thought would be good, may in the long run turn out to be counterproductive." He also mentioned that many students seemed put off by the prospect of working at large research centers that are emerging. A private practice, says DeGroot, gives them more immediate gratification and more certainty. "They just can't see how they can fight their way through the forest of research in a large center."

To Edward Kass, of the Harvard Medical School, the information explosion of the past 20 years may in itself be an impediment. "There is no longer a sense of discovery," he said. "We have moved from inquiry to delivery of factual content. What the students don't understand is that half the time we don't know what we are talking about."

Paul Beeson of the Veterans Administration hospital in Seattle got specific about solutions. "What can we offer a resident to start research—$12,000 to $20,000? It's peanuts. We should take fewer research trainees and pay them more." He also suggested that a 3-year stint should be the minimum training period, so there would not be constant pressure to publish, and that trainees should be freed from academic chores. "If you know that you've got a real pro, a real potential contributor to medical knowledge, then let him do it. Skip the duties such as admissions committees and faculty senates that can best be done by other people."

The rise in red tape was seen as one of the chief reasons that students turn away from research. What to do about it was a hot topic at the conference, and, indeed, six of the 50 participants were lawyers. (One of them quipped that if the same conference were held 5 years from now, given the probable growth in regulations, lawyers would take up half the room.) The mood was often bitter. The courts, regulators, and legislators were criticized as having increasingly substituted their judgment for professional standards. "This process," said Michael Sonnenreich of Chayet and Sonnenreich in Washington, D.C., "has assumed a self-perpetuating, somewhat evangelical, character and will require a great deal of careful, persistent effort to halt its snowballing effect." He especially complained about the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, saying, for instance, that their recommendations on informed consent will lead to the testing of all subjects on their comprehension of research risks—and that the resulting paperwork will be staggering. Given the general theorem that a regulation in effect tends to stay in effect and grow, that bureaucracy tends to beget more bureaucracy, it was agreed that clinical researchers will have to make a very strong case before regulatory growth can be arrested. No one present, however, had any astounding ideas on how that case should be made, and for the most part discussion centered on pinpointing the ever-increasing pressures.

It was felt by many that the mounting tangle of legal, financial, and administrative burdens would in the not-so-distant future force clinical research into large centers—and only those that had strong legal personnel, facilities, and funding. The smaller, newer, and fiscally weaker medical schools would probably not be

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able to compete. "Soon we will have two classes of medical schools," said Swisher. "Those which do research and those which can't, even if they are so motivated. It is a situation that now must be considered seriously."

For a generation of physicians who grew up in the golden era of clinical research, however, notions of scarcity do not go down easily. The bleak pictures painted by Sonnenreich especially rubbed some the wrong way. "I've always suspected that what we are doing was illegal," joked Albert Sjoerdsma, vice president of the Merrell Research Center in Cincinnati, Ohio. "But to hell with it. I'm not going to go running to my senator, to Congress. After all, what's the worst that could happen if we do nothing?" To this, Sonnenreich paused for a minute and then went through a long list of "if's" (for example, if all the commission's pending regulations go into effect). "If these things come to pass," he said, "then I think that in the near future no doctor in his right mind will go into this business." Judging from the nods of agreement in the sea of assembled faces, he had struck a sympathetic note.—WILLIAM J. BROAD

Will New Training Grants Lure M.D.'s?

To help offset the shortage of M.D.'s in clinical research, the National Institute of General Medical Sciences (NIGMS) is considering a proposal that would fundamentally alter the ground rules for the entry of M.D.'s into postdoctoral training.

It would permit only holders of an M.D. degree to apply for training grants, and only holders of a Ph.D. to apply for fellowships. The differences are significant, and within NIGMS and at some academic centers the proposal has caused quite a stir.

Training grants go to students through institutions whose academic training programs have been deemed worthy of support. Fellowships go directly to individuals who compete for them on a national basis and who can take their fellowship money to whatever institution they wish. Currently at NIGMS, which in 1978 supported the training of 678 postdoctorals and is ranked number three at NIH in postdoctoral training support, holders of either type of degree can apply for both training grants and fellowships. The proposal to limit their choice is the first of its kind in NIH history.

"We had been concerned for some time that postdoc training differentiate between Ph.D. and M.D.," Ruth Kirschstein, director of NIGMS, told *Science*. "People with a Ph.D. have already had rigorous training in research. With an M.D., however, there is often little or no research experience." Dividing their ranks, she said, would make for more equitable competition. And since training grants are awarded first to institutions and only then to individuals, a training grant is "easier from the point of view of recruitment. A decision can be made by a program director at an institution more quickly [than at the national fellowship office]." Teaching approaches are also different. A fellowship stresses the individual's ability and initiative, as shown by his or her past academic performance. A student often works alone or with a researcher. A training grant, on the other hand, encourages multidisciplinary programs, group discussions, special seminars, and close overview by the program director.

It is estimated that Ph.D.'s in postdoctoral training supported by NIGMS currently outnumber M.D.'s by more than six to one. In 1977, for instance, 125 individuals were supported by postdoctoral training grants for studies of the cellular and molecular basis of disease. Only 16 percent of these individuals were M.D.'s. Changes in who could apply for such grants, says Kirschstein, would not affect the overall number of Ph.D.'s and M.D.'s being supported. "We would make equivalent funds available so that the number of Ph.D.'s we support postdoctorally would stay the same. It would only be a difference in mechanism."

Critics within NIGMS charge that this is a ruse, and that the proposal is obviously a play for more M.D.'s. One likened it to babying the M.D.'s and "letting the Ph.D.'s fend for themselves." The main criticism is that such plans have not worked in the past, and that they will not work now. In 1974, for instance, an NIGMS program for training medical geneticists was set up in medical schools. It asked for M.D.'s. In the end, however, the ratio of Ph.D.'s to M.D.'s was two to one.

Other critics, including Leon E. Rosenberg of Yale medical school, who is the program director for an NIGMS postdoctoral training grant at Yale, claim that a new fact of life in the support of training will defuse this or any other proposal. This is the payback provision. Under the current law, the National Research Service Act of 1974, all stipends are subject to payback in one form or another. Usually, the payback is in the form of time to be spent in the laboratory, with a researcher receiving training support for 3 years, for example, being obligated to spend the next 3 years in academic research or teaching. Alternatively, the stipend money may be returned, or, in the case of an M.D., the debt may be worked off by service in ghettos, rural areas, or in the Public Health Corps. This provision was meant to prevent the free ride that many M.D. trainees once took. Their research training was paid for, often during their residency, and they would then go directly into private practice. It is unlikely, say the critics, that any arrangement will pull in more M.D.'s because of the current law. On graduating from their residency program, usually with little or no research experience, M.D.'s will usually avoid a decision to devote the next 5 or 6 years to a profession about which they know so little, except that the pay is poor. The NIGMS proposal will not work, say the critics. "Simply excluding Ph.D.'s from training grants," says Rosenberg, "is to my mind an overly simplistic solution, and one that is likely to fail."

Kirschstein does not agree, of course, and says that the proposal to give training grants exclusively to M.D.'s is a specific recommendation of the Committee on Personnel Needs of the National Academy of Sciences. There has, nevertheless, been a fight over it at NIGMS, where at least two advisory groups—the Genetics and the Cellular and Molecular—voted against it. The proposal was taken to the full council at NIGMS, however, and approved. Kirschstein says the changes will probably go into effect by the end of the summer.—W.J.B.