ecules often do not diffuse or tumble rapidly enough for complete line narrowing. A significant increase in signal-to-noise ratio should increase the accuracy of nuclear magnetic resonance relaxation studies in complex systems. Despite the present limitations, the technique is already becoming very useful as one of the structure-determining tools in the biochemical field, and it should become even more useful when the higher resolution and the increase in signal-to-noise ratio anticipated with these new high-field magnets have been realized.

Operational Problems

In this discussion of the performance characteristics of a high-resolution nuclear magnetic resonance spectrometer with a superconducting magnet, little has been said about the operational problems—for example, the necessity of cooling the solenoid to liquid helium temperature and maintaining this temperature with an adequate supply of liquid helium and liquid nitrogen. While the procurement of cryogenic liquids may present no major problem for some research laboratories located in or near major industrial areas, these liquids are not in general supply. The shortage of liquid helium is even more acute in countries outside the United States which do not have their own source of the gas. Moreover, not every industrial laboratory has personnel who are familiar with the properties of liquid helium and trained in handling it. Some experienced person has to be on hand every day to see that adequate supplies of the liquids are maintained.

These factors may delay general acceptance of this type of instrument. However, the problem of maintaining the necessary low temperatures will be lessened to a large degree when dependable closed-cycle refrigeration becomes generally available. Ideally, such a refrigerator would supply all the liquid helium and probably all the liquid nitrogen needed, and it would operate continuously for weeks with very little attention or care.

Summary and Conclusion

The first high-resolution nuclear magnetic resonance spectrometer operated at 30 Mcy/sec (7.05 kilogauss). The magnets constituted the only major obstacle to raising the frequency, but by continuous development over 10 years this frequency for proton resonance was increased to 100 Mcy/sec (23.4 kilogauss). Now, in one step, a system has been made to operate at twice this frequency and field intensity. It is not expected that superconducting magnets will generally replace iron magnets, but it is interesting to note that very few laboratories use the 30- and 40-Mcy/sec proton systems today.

Notwithstanding the cost and operating problems of the superconducting magnet system for the nuclear magnetic resonance spectrometer, the fact that this is the only practical means of developing both a stable and a high-intensity field puts it in a class by itself. For this reason, even though the maintenance of spectrometers with superconducting magnets requires rather specialized skills, this type of instrumentation will clearly have an important role in advancing scientific knowledge, by making possible analyses which have not been possible with presently available instruments.

References and Notes

1. A. A. Abrikosov, *Soviet Phys. JETP (English Transl.)* **5**, 1174 (1957); A. L. Ginzburg and L. D. Landau, *Zh. Eksperim. i Teor. Fiz.* **20**, 1064 (1950); V. L. Ginzburg, *Nuovo Cimento* **2**, 1234 (1955).
2. For an excellent source of papers on current knowledge relating to type II superconductors, see *Rev. Mod. Phys.* **36**, No. 1, pt. 1 (1964).
3. M. A. R. le Blanc, *Phys. Rev. Letters* **6**, 140 (1963); *ibid.* **11**, 149 (1963).
4. H. C. Hitchcock and P. R. Aron, *Bull. Am. Phys. Soc.* **7**, (19 June 1962).
5. M. W. Garrett, *J. Appl. Phys.* **22**, 1091 (1951); ———, *ibid.* **34**, 2567 (1963); D. B. Montgomery, *Natl. Mag. Lab. Publ. AFOSR-1525.*
6. P. C. Lauterbur, *J. Am. Chem. Soc.* **83**, 1839 (1961).
7. W. D. Knight, *Solid State Physics* (Academic Press, New York, 1956), vol. 2, p. 93; see also C. P. Slichter, *Principles of Magnetic Resonance* (Harper and Row, New York, 1963), sect. 4.7, p. 89.

8. We gratefully acknowldge the contributions of our colleagues and supporting staff, which aided materially in the successful development of the instrumentation discussed in this article.

News and Comment

The Election: Partisan Activity of Scientists Unlikely to Sow Discord in Scientific Community

The formation of groups of scientists in the camp of each presidential candidate (*Science*, 21 August, 25 September) has raised some concern about the possible divisiveness that may ensue in the scientific community from these ventures into national politics. It is just such concern that has caused some well-known scientists to decline invitations to become involved with either party in the campaign. And fear of divisiveness may well have played a part in the establishment this week of the latest scientific group to grow out of the presidential campaign. This is the 1964 Scientists Committee for Information, a ten-member body chaired by Edward L. Tatum, a Nobel laureate and geneticist at the Rockefeller Institute. The committee, which describes itself as "non-partisan"—though it is a safe assumption that most, if not all, its members favor Johnson—intends to stay above the fray and offer "impartial and accurate information" on scientific issues that may arise in the campaign. Tatum and other members insist that the committee originates from nothing more than a feeling that a politically neutral group of scientists might be useful for illuminating scientific-political issues, but implicit in the committee's existence is the feeling that science may be encouraging dangerous divisions within its own ranks by getting mixed up in partisan politics.

It is difficult, however, to see in what way partisan political preferences might be related to the internal affairs of the scientific community. That lots of scientists don't like each other can easily

be concluded by listening to the coffee-break chatter at professional meetings. (At times the virulence of remarks suggests that some not only disagree with what their colleagues say but disagree with their right to say it.) But the antagonisms that exist in the scientific community appear to have no connection whatever with party choice, and when it comes to issues and problems of direct concern to the professional interests of the scientific community, it is hard to distinguish the Republicans from the Democrats or the liberals from the conservatives. The most conspicuous political parting of ways within the scientific community appears to involve scientific judgments on weapons technology, with those to the right side of the political spectrum generally maintaining that national salvation lies in vigorous exploitation of all weapons possibilities, while those to the left tend to consider the arms race as dangerous as the Russians. But even in the weapons area it is impossible to make neat divisions.

While the arms controllers stress the importance of dampening the arms race, many of them played important roles in the initiation of the missile program under Eisenhower and its rapid acceleration under Kennedy. Their motives, of course, were far different from the motives of those who advocate an open-ended arms race, but it can hardly be argued that they were relying on trust rather than strength to induce the Soviets to behave. In any case, there appears to be no correlation between party preference and attitudes on such matters as geographical distribution of research funds, accountability requirements, the division of support between basic and applied research, and the granting policies of the major research agencies. In congressional appearances on federal relations with science, many of the scientists who have since taken sides in the campaign could easily have delivered each other's testimony—the gist of which in virtually all cases was that science is essential to the nation, it needs ample federal support, and federal bookkeepers should leave the scientists alone.

Thus, there is little if any evidence to support the fear that participation of scientists in the current campaign will produce splits that will affect the internal administration of science or its relations with the outside world.

The participation, however, is not without considerable significance as a phenomenon in the life of the scientific community. One does not have to be a tool of the "rat fink Eastern press" to come to the conclusion that opposition to Senator Goldwater's candidacy is widespread among basic researchers, that this opposition has caused many of them to make their first contribution of money or labor to a political campaign, and, finally, that of all the professional groups that have declared themselves in the presidential campaign, the scientists on the Democratic side may well qualify as the most gung ho.

Scientists and Engineers for Johnson, which was one of the first grass-roots organizations in the current campaign, if not the first, has turned out to be something of a joy to the party professionals, who frequently find citizens organizations painfully amateurish. In little over 5 weeks, Scientists and Engineers for Johnson has established offices in 32 states, staffed each with a full-time, paid manager and secretary, and signed up about 20,000 members. It also reports that new members are coming in at a rate of over 1000 a day.

On the Goldwater side, the effort to enlist the support of scientists and engineers had a late start and has made considerably less progress. When the Johnson science-engineering group was in the works but had not yet been announced, an inquiry to Goldwater headquarters brought the response that there were no plans to set up a scientists and engineers group. Several weeks later, however, a number of well-known scientists were asked whether they would serve on what eventually became Goldwater's Task Force on Science, Space, and the Atom. It appears that the response to this inquiry was poor, and public announcement of the Task Force was delayed for approximately 10 days before six prestigious names could be collected.

Scientists and Engineers for Goldwater

Meanwhile, the staff at the national headquarters of Citizens for Goldwater was at work setting up an organization of Scientists and Engineers for Goldwater, which, in contrast to the small advisory task force, is intended to be a grass-roots counterpart of the Democratic group. There have been a number of delays in announcing this new group, but at this time public announcement of Scientists and Engineers for Goldwater is scheduled to take place momentarily, with the following persons as charter members.

William H. Lycan, vice president, Johnson & Johnson; Frederick O. Hess, president, the Selas Corporation; Allen Abrams, a chemist with Arthur D. Little, Inc.; Paul W. Bachman, vice president, Koppers Company; James W. Hackett, vice president, Owens-Illinois Glass Company; P. Willard Crane, vice president, Cincinnati Milling Machine Company; Homer J. Stewart, professor of aeronautics, California Institute of Technology; Charles W. Walton, vice president, Minnesota Mining and Manufacturing; Donald B. Keyes, chemist and industrial consultant; General K. D. Nichols (ret.), former General Manager of the Atomic Energy Commission, now a consultant; and Abbott Lawrence Penneman, Jr., former vice president, Baltimore Gas & Electric Company.

This group is obviously weighted more toward the engineering and industrial management side than is the Johnson scientist-engineer organization, a fact which supports the impression that the scientific community is showing little sympathy for the Senator's campaign. With election day less than a month off, Scientists and Engineers for Goldwater does not have much time to make itself felt at the polls. There are no plans to duplicate the Democratic pattern of state chapters; rather, the Goldwater group intends to work through the general Citizens for Goldwater organizations in each state.

An interesting question, but one on which there can only be speculation, is why so many scientists have responded with gusto to an opportunity to involve themselves in the campaign through Scientists and Engineers for Johnson. As with so many Johnson supporters, a large part of the answer seems to lie not in affection for the incumbent but in reaction to the challenger. (What is perhaps one of the nastiest, but most revealing, slogans of the campaign reads: "Even Johnson Is Better Than Goldwater.")

But the extent and vigor of support for Johnson among scientists suggests the possibility of concerns directly related to the professional interests of the scientific community. In the course of the campaign, neither candidate has yet said anything about federal relations with science. And though Senator Goldwater has pitched much of his political appeal on proposals to bring about changes in relations between the federal government and various sectors of our society, he has not even hinted

that he would alter the present system of large-scale federal support for scientific research and related educational activities. Nevertheless, in conversations with many scientists who are contributing time and money to the Johnson cause, it is evident that there exists a great concern about what might happen to the federal-science relationship under Goldwater. When those who hold this concern are asked to point out anything that the Senator has said or done that might suggest hostility to the scientific community, or even lack of sensitivity to its interests, they are hard put to come up with anything significant. Often cited is a vote here or there against increased appropriations for a research-supporting agency, but the curious fact is that many of the scientific community's best congressional friends have for one reason or another cast economy votes on matters of money for science. Still, whatever the origins of its reaction to the Senator's candidacy, the scientific community equals and probably exceeds any other professional group in its feelings about the election. The cause of this intensity is not altogether clear, but it would seem to merit examination as an interesting and significant development in the life of the scientific community.

—D. S. GREENBERG

Elliott Committee: Latest Study Calls for Improvement in Data on Scientific Manpower Problems

The season is now at hand for a rush of reports and other publications from the two House committees that have spent the past year studying federal relations with science; these are Representative Carl Elliott's (D–Ala.) Select Committee on Government Research, and Representative Emilio Q. Daddario's subcommittee on Science, Research, and Development.

Last week, Elliott's committee released the second in a series of ten reports that it expects to publish before the committee's mandate expires in January. The latest report, *Manpower for Research and Development* (71 pp., available for 25 cents from the U.S. Government Printing Office, Washington, D.C. 20402), takes a look at the warmly contended question of the adequacy of the nation's supply of scientific and engineering manpower. The committee concludes that the subject is a difficult one, that not enough is being done to study it, but that, on the basis of the best available information, "it would appear that at this point in the mid-1960's the Nation is not suffering a severe general shortage of trained scientists and engineers." The committee added that it found "selective shortages (among them, college and university faculty)," and that "there is no field that can be said to be adequately staffed. But even this is not a static condition; 6 months may see a drastic shift."

Throughout its study the committee paid its respects to the difficulties of trying to match up far-off and uncertain scientific and technical goals with the lengthy educational process required for producing scientists and engineers. It warned that "there may be a tendency to generalize from some specific or selective shortages," and went on to caution that, "above all, we should be wary of leaping to a hasty conclusion that there is a crisis or that we are heading for a crisis."

Elliott's report tended to emphasize the uncertainties involved in manpower planning (it argued, for example, that "a change of as little as one-tenth of one percent in the estimated proportion of research and development spending to the gross national product would alter the number of personnel needed, say in 1970, by more than 20,000—almost three times the number of science and engineering doctorates granted in a single recent year"). Curiously, the report had nothing to say about an executive branch study that, as much as anything can, stands as the U.S. government's grand design for the federal role in developing scientific and engineering manpower. This is the so-called Gilliland Report, produced in 1962 under the chairmanship of Edwin R. Gilliland, of M.I.T., for the President's Science Advisory Committee. That report paid little heed to the uncertainties and came out emphatically for raising the annual production of engineering, mathematics, and physical science doctorates 150 percent by the end of this decade.

Elliott's group made no comment on this proposal—which, incidentally, has been incorporated in bits and pieces in the fellowship programs of various agencies; rather, the Elliott study limited its recommendations to proposing the establishment of a single agency to coordinate the manpower studies that are now conducted by the Department of Labor, the Office of Education, the National Science Foundation, the Bureau of the Census, and a number of other offices in the federal government.

The proposal was not spelled out in detail, but, in general, it conforms to the sentiments of many government people who have been attempting to deal with scientific and engineering manpower problems, and it is possible that the idea will enlist the support necessary for its implementation.—D.S.G.

C. P. Snow: Corridors of Power Is Novel about Nuclear Policy and Politics, Closed and Open

With national elections imminent in both the United States and Britain and the nuclear question emerging as the livest issue so far in the presidential campaign, the American publishers of C. P. Snow's new novel, *Corridors of Power*,* should profit from coincidence or good timing.

The "corridors" of the title can be taken literally to refer to the halls of the government offices of Whitehall and the houses of Parliament or figuratively to mean the labyrinthine ways of "high politics." The novel is set in the years before and after the Suez crisis and centers on a young Tory politician's rise and at least temporary fall because of his attempt to alter British nuclear policy.

Corridors of Power is the ninth book in a planned sequence of 11 novels dealing with the life and times—from 1914 to the present—of Lewis Eliot, whose experience and views happen to have much in common with those of the author, who from provincial beginnings became a Cambridge scientist, a civil service commissioner, a company director, a successful man of letters, and a knight.

By now the reviewers have Snow bracketed as a novelist, and the notices of his latest book indicate that he is viewed with respect, gained partly by his "Two Cultures" lecture, but without excitement. It is a commonplace to compare him, in technique and tone, with the Victorians. Certainly he is without the implied anarchism of Britain's angry young authors or the angst of many contemporary American writers. Like the Victorian novelists, Snow is a storyteller. He has their keen interest in the effects of the class system on British life, and his characters tend to be social types. He even has some of the minor mannerisms of the Victori-

**Corridors of Power*, by C. P. Snow, Scribners, $5.95.