properly very long under such conditions as these?"

Felix Bloch: "To quote a specific example in which I have first hand experience, I want to mention the circumstances under which I made the discovery of nuclear induction. My previous work had been in the field of atomic and nuclear physics and it was only my occupation with radar problems during the war which made me familiar with the, then, highly restricted information of radio techniques. The discovery consisted in the application of these techniques to some properties of atomic nuclei and could not have been made without the knowledge of both. It occurred to me only because I worked fortuitously in the one of the many small and separated compartments of war research which happened to contain the information which I needed."

Glenn T. Seaborg: "I think that if there is any conclusion upon which all scientists have complete agreement it is that exchange of information is vital for maximum progress and elimination of waste motion. Also, since, among human pursuits, science is almost unique in being immediately transferable across national boundaries, exchange of information must be considered on a global basis. As chairman of a committee of the United States Senate, you are properly concerned with the implications of free international exchange of information on our position as a nation. Contrary to what one might guess, it is the nation in which science is already flourishing that stands to gain greatly. The probability that a new idea or development in methods can be exploited in generating new ideas and developments is proportional to the number of receptive ears which hear about it and to the adequacy of facilities for doing something about it."

Edward C. Kendall: "The objective of all creative research is to enlarge the horizon which circumscribes the fund of knowledge in the world of science. The best situation in the best of possible worlds would be rapid dissemination of all new work. The information thus made available would, of itself, be a powerful stimulus. This would lead to a constantly increasing acceleration and would indeed be the tangible evidence of what Prof. Charles Beard has cited as the 'invention of invention.'

"As a dismal contrast one merely has to go to the other possible extreme. In such a world, investigators in all research laboratories and medical institutions would work behind locked doors. No results would be published, all workers would be isolated, all publicity by the association of science writers would be suppressed. Interest in science would decrease, the tempo and scale of research would slow down, a feeling of indifference and hopelessness would crush initiative, a moratorium on progress would ensue."

Percy W. Bridgman: "The scientist feels so strongly about this [freedom of communication] that I believe it may well be a decisive factor deterring a young man about to choose his career from entering a [field] subject to such restrictions. A manifestation of this same feeling is the decision of Harvard University, and of other universities also, not to engage in any work with government money under government contract which was not freely publishable. I myself have not had close connection with government work, but in one instance I was decisively influenced by considerations of this sort. At the close of the war I declined to continue work under government contract on a subject of some real scientific interest to me because I found association with the government, and in particular the probability of secrecy restrictions, too distasteful."

William P. Murphy: "It is my impression that the effect of restrictions on the free exchange of information on science developments is at least somewhat exaggerated and that it is actually rather minimal. Much of the complaint has come from a few physicists who are perhaps influenced by a more radical group who are more vocal in their objections because of their basic beliefs.

"It is my belief that restrictions should be continued and perhaps increased in those branches of science which are concerned with the sensitive areas of scientific development where restriction may be more important than would be the benefits which might be derived from the free dissemination of information."

Bill to Spur Private Philanthropy Introduced in Senate

A Congressional move to stimulate private philanthropy for education has been strengthened by the introduction in the Senate of a companion bill to one introduced earlier this year in the House of Representatives. The Senate bill, S 2241, was entered 24 June by James Murray (D-Mont.). The earlier bill, HR 2440, was introduced 15 January by Representative Frank Thompson (D-N.J.). The two bills, which are identical, are designed to equalize the out-of-pocket costs, to individuals as well as corporations, of gifts to institutions of higher learning. Under the present laws it costs a wealthy man considerably less to give away a dollar than it does a man of moderate means. When a person with a taxable income of over $400,000 a year gives a dollar to philanthropy, 9 cents comes from his pocket and 91 cents from the tax that he would otherwise have had to pay. When a person with a taxable income of $5000 gives away a dollar, 80 cents comes from his pocket and 20 cents from his tax payment.

At this writing the Ways and Means Committee, to which Thompson's bill was referred, is waiting for reports on the measure from the departments of the Treasury and Health, Education, and Welfare. After these reports have been considered the committee will decide whether to send the bill to the House floor.

Murray's companion bill has been referred to the Senate's Finance Committee, chaired by Harry Byrd (D-Va.). There, as in the House, reports will be requested from the pertinent departments of the government, in this case probably the Budget Bureau and the Treasury. Beyond this, the Senate will probably do little more until the House acts, since the House alone has authority to initiate taxation and revenue-raising bills. Murray's action, however, is important because it gives the bill greater publicity and allows the Senate to become familiar with the provisions of Thompson's proposal. Also, with both chambers considering the measure, earlier action is possible.

$53 Million Asked for 2-Year Seismic Research Program

The Panel on Seismic Improvement, a subgroup of the President's Science Advisory Committee, recently submitted a detailed report on the need for fundamental research in seismology. The report consists of the panel's recommendations for a research program that would resolve many of the present uncertainties over detection and concealment of underground nuclear blasts. The panel points out that the program, which might be directed by the National Academy of Sciences, would greatly advance seismology. Excerpts from the report follow.

The problems of detection and identification of underground nuclear explosions have focused attention on the need for increased support of seismological research. At present (neglecting private research in petroleum exploration geophysics, most of which does not apply to the present problem), the annual budget in the United States from all sources for seismological research amounts to roughly several hundred thousand dollars. This supports investigations at a modest level of the earth's internal constitution and limited analytical studies on seismic wave propagation. Research at this level and less over the last half century has been sufficient to delineate the major elements of the earth's internal constitution and to explain many features of seismograms. . . . However, seismologists have long recognized that major advances in their field could be realized only if the level of research were significantly increased. . . .

[In this report we treat] conditions at the source, effects of transmission through the earth, instrumentation for recording seismic signals, and certain suggestions for more sophisticated processing of the recorded data. . . .

Our present state of knowledge in this field [of source phenomena] results from a variety of approaches, all of which have been explored to only a minor degree. The radiation pattern from the source has been studied for, at most, a few hundred earthquakes, the majority of which were large shocks recorded throughout the world. . . . Further studies, based on large shocks and on a world-wide network with improved instrumentation, should be conducted to improve our understanding of the fundamental tectonic processes in the earth. It is equally important to conduct studies of the radiation pattern on a smaller scale in seismic localities. Semi-permanent installations should be concentrated in a region of known seismicity, operated until sufficient data on shocks in the region are obtained, then moved to a new locality. Data collected in such a manner would provide information, not only on the radiation pattern of the source, but also on the depth of focus and on aftershock sequences. . . . .

Our knowledge of seismic wave generation by large explosions, particularly nuclear explosions, is very limited. Only three completely contained underground explosions with yields greater than one kiloton have been fired, all under very similar environmental conditions. . . .

The following experimental nuclear shots should be carried out as soon as feasible: (a) a 5 KT [kiloton] shot in granite for information on the effect of shooting in another medium, (b) a shot in an environment situation designed to decouple explosion-energy from seismic energy, (c) two 5 KT shots near the Rainier site but at appreciably greater depths. Theoretical studies which suggest the possibility of concealment by reduced coupling should also be experimentally tested as soon as feasible. . . .

Propagation To Be Studied

An earthquake relieves strain over a volume measured in cubic kilometers and behaves like an extended source. An explosion is essentially a point source. This essential difference may show up in differences in the spectra of seismic waves radiated from earthquakes and explosions. Similar effects may also result from the difference in the shallow depth of the explosions as compared with the greater depth of most earthquakes. Further investigations should be conducted for proper understanding and exploitation of such effects. . . .

A program of crustal exploration based on explosion seismology, and including supplemental studies such as gravity traverses, etc., should be begun which draws on the skills, instrumentation and manpower of commercial geophysical exploration and which takes advantage of the experience and judgment of geophysicists specializing in the broader aspects of crustal structure. Such a program is certain to produce information on such basic questions as the modification of seismic waves by earth structure, the origin and manner of growth of continents, the mechanism of orogeny and isostatic compensation, and the composition of the crust and upper mantle. . . .

The basic data of seimology are recordings of earthquakes and explosions as gathered by first class seismograph stations. Advances in research would accompany an increase in the number of such stations in the world and the most effective way to accomplish this is to upgrade existing stations. It is recommended that 100–200 of the existing stations in the world be equipped with modern instruments as soon as possible, without obligating the grantee beyond agreeing that the station would be maintained and operated at his expense. Existing traditions in seimology provide for access to records by qualified investigators. It seems desirable as a step in improving the U.S. seismic capability to first equip existing American stations with the best instruments now available, and to establish new stations. . . . It should be made clear that this action should in no way justify a decrease in the number of stations in a monitoring network. . . .

Special Detectors Needed

A specific program for the development of improved general purpose seismographs is recommended. It may be noted that sufficient information now exists to commence with certain parts of this work particularly those parts which deal with the incorporation of advanced engineering concepts into the design of new equipment. Other parts of the work can be most profitably undertaken only after new information has been accumulated on properties of noise and signals.

Certain special purpose detectors are also recommended. The development of unattended telemetering seismic detectors would permit the establishment of a network of auxiliary stations around selected primary stations. These proposed auxiliary units would be capable of receiving, storing and transmitting seismic data, either continuously, on an internally programmed basis, or upon demand by the primary station. They should be sealed, tamper-proof devices, capable of operating for 30 to 60 days without servicing. . . .

A second special purpose instrument is the "throw-away" or portable seismic detector. Such detectors, designed for rapid deployment in as many environmental situations as possible, could be used both for research purposes and by inspection groups for investigating unidentified events. They could provide comprehensive information on first-motion patterns as well as on the areal extent of occurrence and on the size of aftershocks. The instruments must be capable of continuous operation and transmission of data in analog form to a central recording station over periods of several days. . . .

The Panel places great emphasis on the immediate need to construct a complete experimental station incorporating all features of the seismic stations recommended by the Geneva Conference of Experts. Operating this station for a period of time would serve the two immediate objectives of providing experimental evidence on the capability of such stations to detect and identify earthquakes, and of assisting in working out installation and operational problems which would be encountered in establishing a control network. Subse-

quently the station should be expanded to include facilities for testing other detection methods proposed by this Panel or methods which may be developed through future research programs. A high priority should be given to testing arrays of up to 100 seismometers and testing a system of unmanned auxiliary stations. . . .

Finally, research should be stimulated to develop new methods of detection. The Panel suggests two specific approaches. One method is based on a line of theoretical reasoning, supported by some experimental data, which suggests that seismographs installed and operated at depths of several thousand feet below the earth's surface may have the capability to detect smaller P-waves than those detectable at the surface. This approach is suggested by considerations which show that the surface noises, which now limit detection, may die off more rapidly with depth than do the signals of interest from explosions and earthquakes. A second approach, based on a somewhat similar line of reasoning, suggests that there may be extremely low noise levels at the bottoms of the oceans, at least at some frequencies. The development of a reliable operational detection system, based on either of these approaches, involves the solution of some major engineering problems; the expected signal-to-noise improvements, however, are potentially so great that the experiments necessary to test the basic theories should be conducted as soon as possible. Work is in progress at the present time on the first method, and some preliminary equipment design work has been completed on the ocean-bottom seismometer. . . .

Data Processing Must Be Centralized

The Panel recommends the establishment of a central computer facility, available to all seismologists, where the computations necessary to the research outlined in this report can be made. Allowance should be made for supplementary computing facilities which will also be required by individual research projects. A library of digitalized seismograms, to include earthquakes, explosions and noise samples should be maintained at the computing center. . . .

Since there are many thousands of events recorded per year at some seismic stations, to perform this analysis adequately by manual methods will require a large skilled staff. The use of computers should be investigated as a means of performing at an adequate rate the tasks of filtering and decision making that are required of the Geneva system. . . .

New Panel Recommended

It is recommended that an advisory panel be established, perhaps through the National Academy of Sciences, to perform these functions. The Panel has demonstrated how effectively a group drawn from research seismologists, physicists, mathematicians and enginers can function in advancing seismological research and it is recommended that the advisory panel be similarly constituted.

It is strongly recommended that this program be viewed as a "package," one centrally funded and directed, in order to derive the fullest benefits. . . .

The Panel believes that the research program can best be carried out by various existing private, university and government laboratories, coordinated by a panel of scientists, possibly under the aegis of the National Academy of Sciences. In contrast to this arrangement for research, the Panel recommends that the "system development" responsibility be assigned to a *single* well organized central laboratory. Such a laboratory should have competence not only in seismology, but also in development, engineering, and large system operation. The laboratory would [probably] sub-contract with private industry for much, or perhaps all, of the specific hardware develment and procurement. However, it is essential that the laboratory have full responsibility for the planning of the system (including its orderly metamorphosis with time), for field trials, for implementation, and possibly for the American portion of its operation. . . .

The Panel . . . recognizes that this program will result in dramatic advances in our knowledge of the earth's interior, of the mechanism of earthquakes, and of elastic wave propagation. Now that seismographic stations are being planned for placement on other planets, seismological research will bear on new questions relating to the origin of the solar system. . . .

It is the opinion of the Panel that [such] research studies will certainly improve detection capabilities of underground nuclear detonations. However, the improvements are not likely to be evaluated adequately . . . in a detection system before one year of research activity at best. Most of them will undoubtedly require more time, perhaps three years. Thus, it is important to conceive of the detection system as one which will gradually evolve with time and reach a high level of detection capability only after several years.

(In a table accompanying the report, the panel gave an estimate of approximately $53 million as the cost of its basic 2-year research program in seismology. This figure includes the costs of individual research projects, system development, and nuclear and high-explosive detonations but excludes the cost of implementing a detection system. The panel suggested that the program should continue after the conclusions of the basic program at least at the level of expenditure of the first two years.)

Deadline for Euratom Proposals Extended

The U.S. Atomic Energy Commission and the Commission of the European Atomic Energy Community have extended from 1 September to 20 October 1959 the deadline for definitive proposals for nuclear power projects under the U.S.-Euratom Joint Program. The date was extended at the request of President Etienne Hirsch of the Euratom Commission. The extension will give interested utilities within the Community additional time to evaluate fully the bids of prospective reactor manufacturers, to make necessary arrangements with their respective governments, and to prepare their final proposals for submission to the Joint Reactor Board. Letters of intention to participate in the program have been received from five such utilities, but several of these groups requested a short extension of the deadline in order to complete the preparation of their proposals.

Controversy in New Jersey

A small, private research laboratory, set up in farm buildings in the residential section of Morristown, New Jersey, has embroiled its owner, George Mangun, in a controversy that may have to be resolved in the higher courts of the state. Two questions are at issue: Does Mangun's small medical research laboratory violate the zoning laws of Mendham Township? And, if so, are the laws, which allow physicians, surgeons, and engineers to maintain offices in the area, being unduly applied against Mangun's activities? The Township Committee has given an answer, an affirmative one, to the first question. It has given Mangun