33 specialists in the division, and in many cases two or more specialists made appraisals of specific projects and reports of progress in determining the amount of basic research involved.

Results

Figure 1 and Tables 1 and 2 present the results obtained from the analysis. The average for all stations for basic research was 22.3 percent, the range for the stations being from 3.2 to 46.1 percent. The relative ranking of each state is considered reliable, representing a composite rating of all fields by the several scientists who took part in the study.

It should be noted that the federal grants compose from less than 10 percent of the total funds available in some state stations to over 65 percent in others. A rather strong correlation exists between the level of nonfederal fund support and the amount of basic research supported by the federal-grant funds.

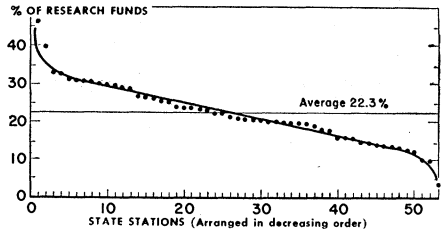


Fig. 1. Basic research in agriculture for fiscal year 1957 at the 53 state agricultural experiment stations, as estimated from an analysis of projects receiving federal-grant support. [U.S. Agricultural Research Service]

The sample of 5302 federal-grant experiment station projects can be considered representative of the total program of state station research, which, in 1957, involved an additional 6500 projects supported by state-appropriated and other funds. The total expenditures from federal-grant and nonfederal funds in 1957 were approximately $114 million. By applying the percentage figure obtained for basic research for projects supported by federal-grant funds to the total, it was found that the experiment stations used over $25 million of the funds available during the 1957 fiscal year for basic research (*4*).

References and Notes

1. "Funds for Research in Agricultural Experiment Stations, 1953–54," National Science Foundation, Reviews of Data on Research & Development, No. 8 (*NSF 57–37*, Nov. 1957).
2. J. C. Fisher, *Science* **129**, 1653 (1959).
3. "Basic research is that type of research which is directed toward increase of knowledge in science. It is research where the primary aim of the investigator is a fuller knowledge or understanding of the subject under study rather than a practical application thereof." (From a letter written by Alan T. Waterman, director of the National Science Foundation, to B. T. Shaw, administrator of the Agricultural Research Service, 22 Nov. 1957).
4. This article is an analysis of research undertaken at the state agricultural experiment stations with federal-grant support. It is adapted from an address presented before the Experiment Station Section of the American Association of Land-Grant Colleges and State Universities in Washington, D.C., 11 Nov. 1958.

Science in the News

Antarctic Treaty Signed by IGY Nations: Polar Region Established as Neutral Science Reserve

The United States and 11 other nations signed a treaty in Washington on 1 December which provides that Antarctica shall be used for peaceful purposes only and that the international scientific cooperation which characterized the 1957–58 International Geophysical Year shall continue. This is the first treaty in history to prohibit military operations and all forms of nuclear explosion in an entire continent, in this case an area of 5 million square miles, equal in size to the United States and Europe combined. This is also the first time that the Soviet Union has agreed to unrestricted inspection of an area as a guarantee of the enforcement of demilitarization provisions.

The importance of the treaty lies not only in what it covers but in what it implies. Many observers feel that it could set a precedent for an agreement about the use of outer space and for dealing with uninhabited and desert regions, including, for example, the moon. Newspaper editorials have pointed out that it might also set a precedent that would result in an easing of the U.S.S.R.'s concern about inspection of its lands in a disarmament arrangement.

Territorial Provisions and Membership

The treaty provides that all territorial and sovereignty claims, and the position of all governments regarding the recognition or nonrecognition of such claims, shall remain in *status quo* for the duration of the treaty. Seven of the 12 participants maintain that sections of Antarctica are parts of their homelands, and several of these claims overlap (see map on page 1643).

It was only a few years ago, in 1947–48, that Argentina and Chile were in bitter dispute with Britain over territorial rights in the Palmer Peninsula. Argentine and British naval vessels were even dispatched to the region. It was this crisis that led to an unsuccessful proposal by the United States in 1948 for an international agreement. Neither the United States nor the U.S.S.R. has attempted to establish claims in the Antarctic.

The new treaty is of indefinite duration, but after 30 years any party may call a conference for review and amendment. The pact is open to accession by other United Nations members and by such other states as may be agreed upon unanimously.

Thus, Communist China probably could not join, as it is not a U.N. member and its application for membership would probably be vetoed. But that would not prevent the Communist Chinese from sending a scientific expedition to the Antarctic if their intentions were peaceful. Of course, the treaty members would watch any such expedition carefully.

IGY Sets the Stage

It was the very successful cooperative scientific activities of the IGY that set the stage for the pact. With the increase in the number of expeditions to the Antarctic, the nearest overseas neighbors—particularly Chile, New Zealand, South Africa, and Australia—became increasingly disturbed about the possible establishment of threatening military bases. Furthermore, they were worried about the use of the region for nuclear tests and waste disposal. Weather conditions in these countries originate in Antarctica, and there has been a growing fear, especially in South America, that winds might carry radioactive materials.

The treaty provisions against nuclear testing were not introduced until quite late in the negotiations. Many observers feel that the inclusion of these provisions will help bring about speedy ratification of the treaty by the Latin American countries in which Antarctic affairs have constituted such a tense political issue.

Treaty Evolution and Operation

The conference called to negotiate the treaty was convened at the suggestion of the United States. On 3 May 1958 President Eisenhower announced that invitations had been extended to the governments of the 11 nations that had carried on scientific research programs in Antarctica during the International Geophysical Year to participate in a conference with a view to writing a treaty "dedicated to the principle that the vast uninhabited wastes of Antarctica shall be used only for peaceful purposes." The following nations were invited: Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, the Union of South Africa, the U.S.S.R., and the United Kingdom.

The treaty, the result of 15 months of preparatory talks and 7 weeks of formal negotiation, will not go into effect until it has been ratified by the 12 governments. In the United States, the instrument of ratification is issued by the President after a resolution of approval is agreed to by a two-thirds vote of the Senate.

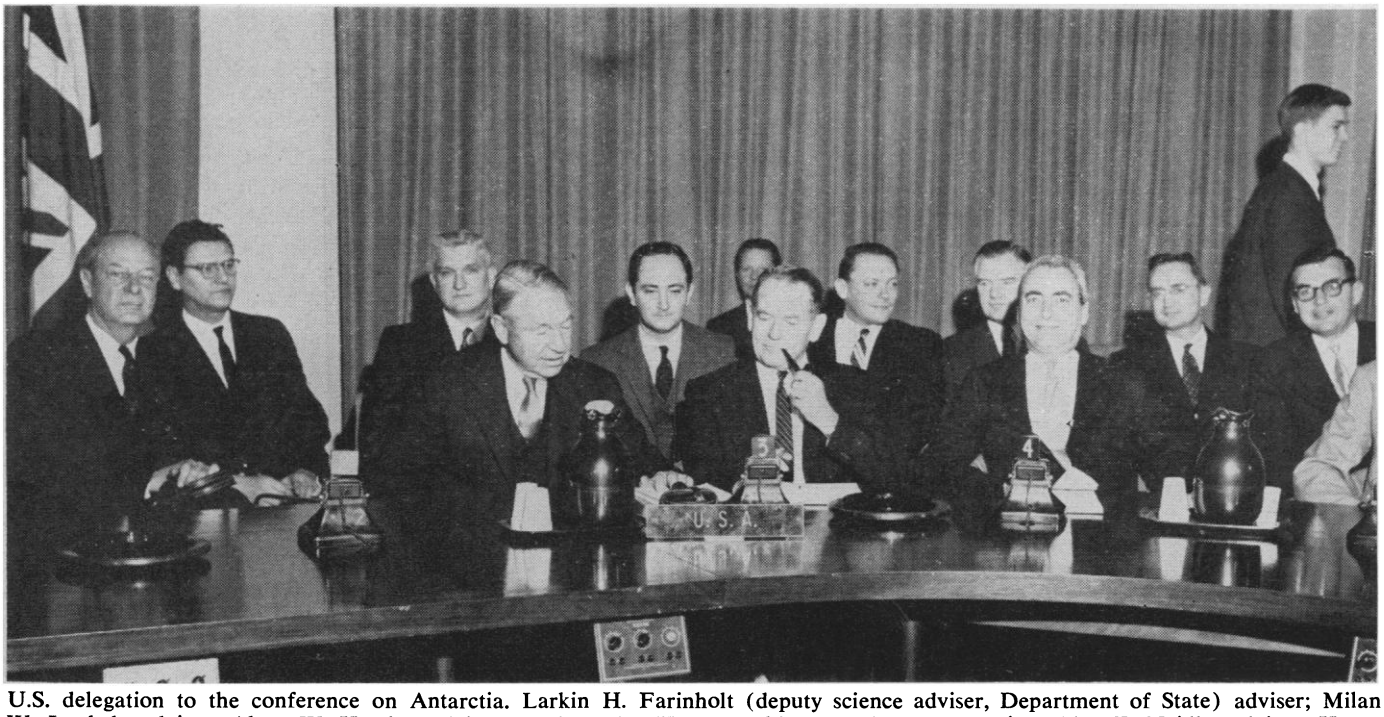
In order to further the purposes and the objectives of the treaty, a consultative committee will be established and will meet within 2 months of the date on which the treaty becomes effective, and at suitable intervals thereafter, to recommend measures to the participating parties. The first meeting will be held in Canberra, Australia. In the meantime, the conference recommended that representatives of the governments meet in Washington at convenient times to discuss such arrangements as seem desirable.

The Conference on Antarctica convened in Washington on 15 October. At the first plenary session, held that day, Ambassador Herman Phleger, the U.S. representative, was named chairman of the conference, and Henry E. Allen was named secretary-general. Ambassador Paul C. Daniels and George H. Owen served as alternate U.S. representatives. It is reported that Daniels has, for a year and a half, carried out, quietly and anonymously, the negotiation that led to the conference.

The United States in Antarctica

The United States' interest in Antarctica dates from the early part of the 19th century. One of the earliest achievements was the 1838–42 expedition of Lieutenant Charles Wilkes, which made sightings extending for 1500 miles, thus proving the existence of the antarctic continent.

The period from 1928 to the present has been one of great activity in Antarctica, chiefly because of the work of such men as Rear Admiral Richard E. Byrd, Lincoln Ellsworth, Captain Finn Ronne, and Rear Admiral R. H. Cruzen. The U.S. Navy in 1946–47 organized the largest of the expeditions to Antarctica. During the International



U.S. delegation to the conference on Antarctia. Larkin H. Farinholt (deputy science adviser, Department of State) adviser; Milan W. Jerabek, adviser; Alton W. Hemba, adviser; Ambassador Herman Phleger, U.S. representative; Alan F. Neidle, adviser; Henry C. Reed, adviser; Ambassador Paul C. Daniels, alternate U.S. representative; Arthur H. Rosen, adviser; Captain Eugene W. Davis, U.S.N., adviser; George H. Owen, alternate U.S. representative; Wayne W. Fisher, secretary; and Robert M. Schneider, adviser.

Geophysical Year the United States established seven stations in Antarctica under the leadership of Rear Admiral George Dufek. At the present time four stations are being maintained, including one at the South Pole.

The Soviet Union also has four scientific bases. Altogether, the 12 treaty nations operate 58 stations in the antarctic region.

United States research in Antarctica is coordinated and planned by the National Science Foundation. Thomas O. Jones heads the foundation program, which is made possible through the logistic support of the Navy Department. The U.S. Naval Support Force is commanded by Rear Admiral David N. Tyree.

The Treaty

The preamble and some of the more significant provisions of the 14-article treaty appear below.

The [12] Governments . . . recognizing that it is in the interest of all mankind that Antarctica shall continue forever to be used exclusively for peaceful purposes and shall not become the scene or object of international discord;

Acknowledging the substantial contributions to scientific knowledge resulting from international cooperation in scientific investigation in Antarctica;

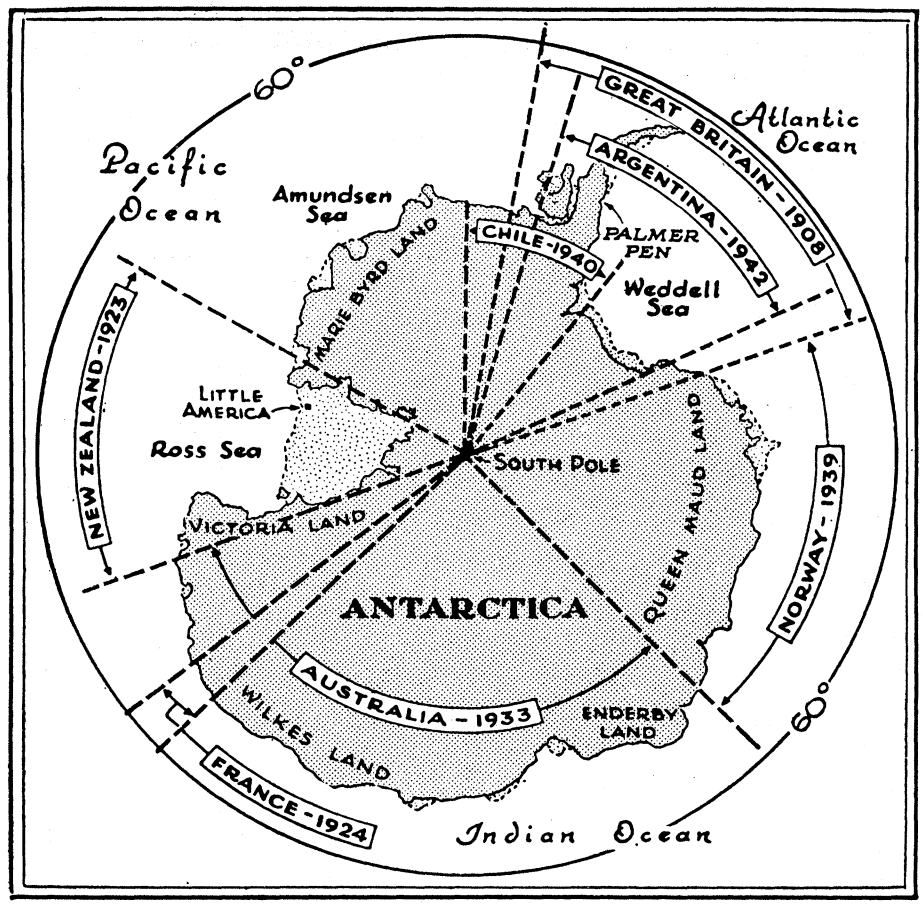
Convinced that the establishment of a firm foundation for the continuation and development of such cooperation on the basis of freedom of scientific investigation in Antarctica as applied during the International Geophysical Year accords with the interest of science and the progress of all mankind;

Convinced also that a treaty ensuring the use of Antarctica for peaceful purposes only and the continuance of international harmony in Antarctica will further the purposes and principles embodied in the Charter of the United Nations;

Have agreed as follows:

Article I. 1. Antartica shall be used for peaceful purposes only. There shall be prohibited, *inter alia,* any measures of a military nature, such as the establishment of military bases and fortifications, the carrying out of military maneuvers, as well as the testing of any type of weapons.

2. The present Treaty shall not prevent the use of military personnel or equipment for scientific research or for any other peaceful purpose.



Territorial claims in the Antarctic.

Article II. Freedom of scientific investigation in Antarctica and cooperation toward that end, as applied during the International Geophysical Year, shall continue, subject to the provisions of the present Treaty.

Article III. 1. In order to promote international cooperation in scientific investigation in Antarctica the Contracting Parties agree that, to the greatest extent feasible and practicable:

(a) information regarding plans for scientific programs in Antarctica shall be exchanged to permit maximum economy and efficiency of operations;

(b) scientific personnel shall be exchanged in Antarctica between expeditions and stations;

(c) scientific observations and results from Antarctica shall be exchanged and made freely available.

2. In implementing this Article, every encouragement shall be given to the establishment of cooperative working relations with those Specialized Agencies of the United Nations and other international organizations having a scientific or technical interest in Antarctica. . . .

Article V. 1. Any nuclear explosions in Antarctica and the disposal there of radioactive waste material shall be prohibited.

2. In the event of the conclusion of international agreements concerning the use of nuclear energy, including nuclear explosions and the disposal of radioactive waste material, to which all of the Contracting Parties whose representatives are entitled to participate in the meetings provided for under Article IX are parties, the rules established under such agreements shall apply in Antarctica. . . .

Article VI. The provisions of the present Treaty shall apply to the area south of 60° South Latitude, including all ice shelves, but nothing in the present Treaty shall prejudice or in any way affect the rights, or the exercise of the rights, of any State under international law with regard to the high seas within that area.

Article VII. 1. Each Contracting Party shall have the right to designate observers to carry out any inspection provided for by the present Article. Observers shall be nationals of the Contracting Parties which designate them.

2. Each observer shall have com-

plete freedom of access at any time to any or all areas of Antarctica.

3. All areas of Antarctica, including all stations, installations and equipment within those areas, and all ships and aircraft at points of discharging or embarking cargoes or personnel in Antarctica, shall be open at all times to inspection by any observers. . . .

4. Aerial observation may be carried out at any time over any or all areas of Antarctica. . . .

5. Each Contracting Party shall . . . inform the other Contracting Parties . . . of

(a) all expeditions to and within Antarctica, on the part of its ships or nationals, and all expeditions to Antarctica organized in or proceeding from its territory;

(b) all stations in Antarctica occupied by its nationals; and

(c) any military personnel or equipment intended to be introduced by it into Antarctica. . . .

Article XI. 1. If any dispute arises between two or more of the Contracting Parties concerning the interpretation or application of the present Treaty, those Contracting Parties shall consult among themselves with a view to having the dispute resolved by negotiation, inquiry, mediation, conciliation, arbitration, judicial settlement or other peaceful means of their own choice.

2. Any dispute of this character not so resolved shall, with the consent, in each case, of all parties to the dispute, be referred to the International Court of Justice for settlement; but failure to reach agreement on reference to the International Court shall not absolve parties to the dispute from the responsibility of continuing to seek to resolve it by any of the various peaceful means referred to in paragraph 1 of this Article.

Article XII. 1. (a) The present Treaty may be modified or amended at any time by unanimous agreement of the Contracting Parties. . . . Any such modification or amendment shall enter into force when the depositary Government has received notice from all such Contracting Parties that they have ratified it. . . .

Article XIII. 1. The present Treaty shall be subject to ratification by the signatory States. It shall be open for accession by any State which is a Member of the United Nations, or by any other State which may be invited to accede to the Treaty with the consent of all the Contracting Parties. . . .

Minneapolis Newsman, "Fortune" Editor, Win Science Writing Awards

Victor Cohn, science writer for the Minneapolis *Tribune*, and Francis Bello, a member of *Fortune* magazine's board of editors, will receive the AAAS-Westinghouse Science Writing Awards of $1000 each. The prizes will be presented 27 December at a dinner in Chicago during the annual meeting of the AAAS, which administers the annual awards.

The judges also selected three additional science writers to receive honorable mention citations for excellence in science reporting in the newspaper field. An equal number were awarded honorable mention for science writing in magazines.

William Hines, science writer for the Washington (D.C.) *Evening Star*, Earl Ubell, science editor of the New York *Herald Tribune*, and Doug Walker, writer for the Dayton (Ohio) *Journal Herald*, received the honorable mention newspaper citations. Winners of honorable mention in the magazine field included James R. Newman, member of the editorial board of *Scientific American*; Walter Sullivan, science writer for the New York *Times*; and Georg Zappler, a graduate student in zoology at Columbia University.

News Winner

Cohn won his award for a series of articles on the state of Russian science entitled, "Year of the Sputnik," which appeared in the Minneapolis *Tribune* 6–22 October 1958. His series, written after a 5-week tour of Russian facilities for physical research, analyzed and reported on the recent upsurge of Russian science and technology.

"The Year of the First Sputnik has ended," he wrote, "and in that year the Russians have advanced more in science than we. . . . Russia will lead the United States in most important fields of science—not just space or Sputniks—in 10 years, in the opinion of many informed Americans." His articles then describe various scientific and technological fields in which the Soviets are making major advances.

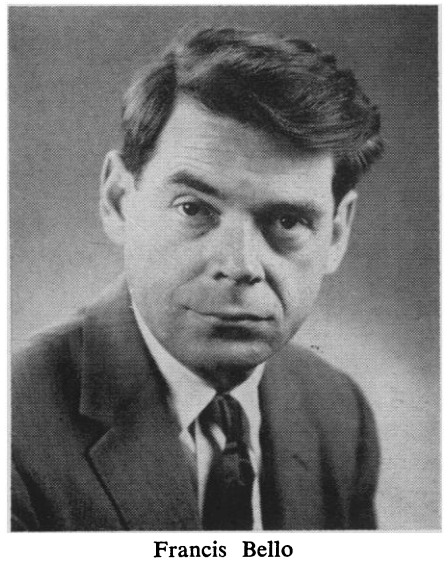
Born in Minneapolis in 1919, Cohn attended South High School there and in 1941 graduated from the University of Minnesota. After brief service on the picture desk of the Minneapolis *Star*, he served in the U.S. Navy from 1942 to 1945.

Returning to civilian life, Cohn became a copyreader, then a science reporter for the *Tribune*, and he has held this position ever since. He is secretary-treasurer of the National Association of Science Writers. Cohn and his family live in Minneapolis.

Magazine Winner

Francis Bello's prize-winning article, "An Astonishing New Theory of Color," which appeared in the May 1959 issue of *Fortune*, describes in graphic detail a new theory about the way the human eye sees color. The new theory is the result of the experimental work of Edwin H. Land, founder and head of the Polaroid Corporation. Bello contrasts the new theory with the commonly accepted one based on the early work of Sir Isaac Newton three centuries ago. For all this time, Bello's article points out, we may have been com-

Victor Cohn



Francis Bello