Chemists and society: A call for involvement

Harvard Univ.
Kistiakowsky: Involvement is a must.

Spring brings new things. Among them are the most recent advances in science, communicated at the annual spring round of scientific conventions. This week more than 6,000 chemists came to Boston for the 163rd annual meeting of the American Chemical Society. They listened to and delivered about 1,500 scientific papers. But more than a forum to exchange scientific data, these meetings allow scientists to exchange ideas and debate new trends.

For example, one contingent of the ACS discussed moving away from the traditional educational and scientific aspects of the Society's original charter toward a more professional outlook like that of the American Medical Association. This movement to have the ACS become more aggressive in speaking out on behalf of the interests of its members has been gaining momentum in the past year and has caused much controversy. Another growing movement in the ACS was represented by the presence of the Scientists and Engineers for Social and Political Action (SESPA). This was the first time the Science for the People group attended a national ACS meeting. Their number was small and their activities low-keyed compared with what they have done at other meetings (SN: 1/1/72, p. 5), but their basic attitude was well represented at the meeting. The movement toward social involvement by scientists is growing among the chemists.

This was evident in the number of papers devoted to the environment, consumer affairs, medical and nutritional advances. It was more evident when the chemists presented their highest award, the Priestley Medal, to Harvard chemist George B. Kistiakowsky. He discussed "this extraordinary change in the attitude of scientists" and said he hopes to give it a boost.

"The exalted status of science has disappeared," said Kistiakowsky. "The social upheaval around us and the changing role of science in society make our involvement imperative," he said. Among the problems he noted were population growth, depletion of natural resources, degradation of the environment and poverty.

He especially attacked science's heavy emphasis on military and private gain. An authority on explosives, Kistiakowsky himself is his own best example. "As a stooge of the military," as he puts it, he helped design the trigger device of the first atomic bomb. But as a special assistant to President Eisenhower for science and technology, and chairman of Eisenhower's Science Advisory Committee, he started thinking about the role of technology versus humanity. These ideas developed out of private conversations with Eisenhower and discussions of the danger of a military-industrial complex. Kistiakowsky came to the conclusion that "we as scientists cannot continue on the same scale without being of service to society . . . especially in an involvement in converting new scientific knowledge into practical uses for mankind. We must join with nonscientists to fight the evil and support the good uses of science."

Kistiakowsky is against classified research in universities, but he said scientists must continue to accept such military contracts. If they do not accept, someone else will, and it is increasingly important that the scientists know what the military is doing. Scientists must, however, be selective in their research for the military, discuss their findings and possible applications with colleagues and insist on the right to publish. "It would be too simplistic," he said, "to just stop taking military money." The military needs the input of the rest of society in order that it not grow too strong and not become totally self-contained.

"The most dangerous possible development for our free society is the growth of a totally self-contained 'military-industrial complex' that comprises all elements of the technological arms race," he said.

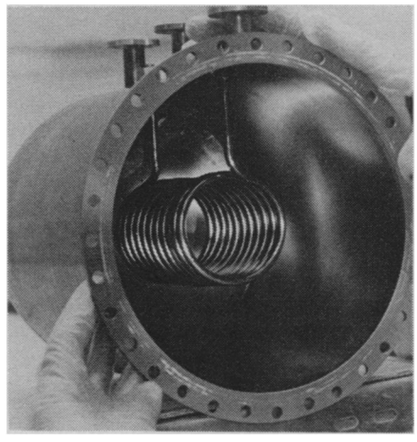
Kistiakowsky says he hopes to help change the role of science in society. "I hope this is not just rhetoric. I am preaching evolution not revolution." □

Argonne aims at a superconducting accelerator

Particle accelerators dissipate much of their power in the form of heat. In linear accelerators most of the loss occurs because of electrical resistance in the waveguides that generate the radio-frequency waves that accelerate the particles. Most of this power loss could be avoided if the waveguides could be made to be superconducting, or resistanceless.

Physicists and engineers in several parts of the world have been trying to build superconducting accelerators, but they have run into severe difficulties because of instability in the metal of choice, niobium. Experimental waveguide sections built of niobium perform well at first but over time the Q, the ratio of power delivered to the accelerated particles to power lost, deteriorates to unacceptable levels.

This week Argonne National Laboratory announced that a group working there and also some workers at the nuclear physics institute in Karlsruhe, Germany, have discovered a fairly simple way to prevent the deterioration of niobium waveguides. It consists of anodizing them so that their surfaces are covered with a layer of niobium pentoxide.



Argonne
An anodized niobium waveguide coil.

According to Lowell M. Bollinger of Argonne, no one yet knows why the anodizing works, any more than they know why the bare niobium breaks down. "We don't know what the physics is," he says.

Nevertheless the Argonne management is so confident of the technique that even while the physical and chemical reasons for its success are being looked into, the laboratory is making a proposal to the Atomic Energy Commission to use it to build a superconducting heavy-ion accelerator. According to Bollinger the proposed machine would combine a tandem electrostatic accelerator of conventional design and a superconducting linear accelerator. The maximum energy for ions would be 10 million electron-volts per nucleon.

Bollinger says the tandem alone could do a good deal of high-resolution studies of nuclear structure. For such things as attempting to manufacture superheavy elements or studies of damage induced in materials by radiation consisting of heavy ions, the combination would be used. The laboratory does not yet have a firm cost estimate, but something around $12 million or $13 million seems likely. Three years ago, Argonne made a proposal to build a similar machine with nonsuperconducting elements. The cost estimate for that was $25 million. With the intervening inflation, that design would cost substantially more today. Argonne hopes the economies of superconductivity will make it easier for both the AEC and the taxpayers to approve such projects.

Bollinger stresses that so far tests of the anodizing method have been done only in the frequency range of interest to the heavy-ion people, about 50 megahertz. The high-energy physicists interested in building proton accelerators with billions of electron-volts energy require correspondingly higher frequencies, and nobody yet knows whether the niobium pentoxide coating will prevent breakdown in that range. □

Crowding in Chicago: Links with pathology

Laboratory studies showing that research animals subjected to overcrowded conditions are affected in detrimental ways always pose a problem for sociologists. Are the results at all applicable to human beings or not?

Three sociologists now report on a painstaking statistical analysis they have done of crowding in Chicago. The study provides an indication that high population density does have pathological effects on humans. But the researchers caution that more research must be done before there is conclusive evidence.

The three sociologists are Omer R. Galle, Walter R. Gove and J. Miller McPherson of Vanderbilt University. They took as a starting point a 1962 study of rats which showed that popu-

How the European robin navigates

The journeys of migratory birds cover thousands of miles. Some species go virtually from pole to pole, yet their navigation is often very precise. How they do it has been the subject of much speculation and some experimentation.

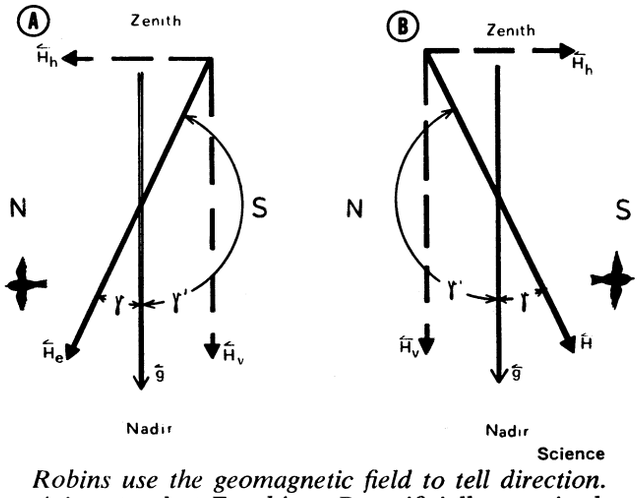
Most of the suggested means of avian navigation parallel those used by humans—the sun, the stars, landmarks, etc. In the April 7 SCIENCE two German researchers, Wolfgang Wiltschko and Roswitha Wiltschko of the Zoological Institute of the University of Frankfurt am Main, present evidence that for at least one species of bird, the European robin (*Erithacus rubecula*), the mechanism is a magnetic compass.

The Wiltschkos note that a number of recent experiments have shown that birds are affected by magnetic fields of an intensity similar to that of the earth (0.46 gauss). They determined to do some experiments to see whether the birds found direction by magnetic means. It turns out that the birds do use the magnetic field, but in a way that is radically different from the mariner's compass.

The compass uses the horizontal component of the earth's field—the north-south polarity—to establish a baseline from which the direction of a ship's motion may be measured. The birds use the vertical component of the field, or dip. The earth's field loops out away from the surface of the earth so that the actual direction of the field lines, except at the magnetic equator, is not horizontal but at some angle to the ground. As one goes south or north, the angle becomes steeper.

In the experiments, the Wiltschkos subjected caged birds ready for the spring migration of 1971 to magnetic fields of the same intensity as the earth's, but with different combinations of vertical and horizontal components. They then determined in what direction the birds preferred to orient their bodies. This would be, presumably, the direction they would fly if they could.

In the natural field at Frankfurt, the birds preferred a somewhat northeasterly direction as they should. Then a Helmholtz coil was used to impose artificial changes of field. Reversing the north-south polarity did not seem to give the birds any significant clue, but changing the



Robins use the geomagnetic field to tell direction. A is natural at Frankfurt; B, artificially contrived.

relation between the field lines and the vertical did.

From the results the Wiltschkos conclude that the robins use the angle between the vertical (the direction of the gravitational forces they feel) and the magnetic field lines to determine direction. They point themselves in the direction in which the angle between the gravitational force and the magnetic force is less than its supplement. The angle gets narrower the farther north they go so they may use it to tell how far north they are.

By itself, however, this system is not universal. European robins spend all their time in the northern geomagnetic hemisphere. At the geomagnetic equator the mechanism would fail, and in the southern hemisphere it would lead the birds south when they should be going north. Thus birds that cross the equator must use a different means or supplement this one with other information.

Nevertheless this mechanism represents a highly flexible direction finding system, the Wiltschkos say. It can adjust to changes in the magnetic field strength over a certain range, and is thus independent of secular changes in the strength of the earth's field. It does not make use of the polarity of the field, and thus it has enabled the robins to maintain their migration pattern in spite of the reversals of the earth's polarity that have occurred since the species appeared.