

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 super-heavy 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.

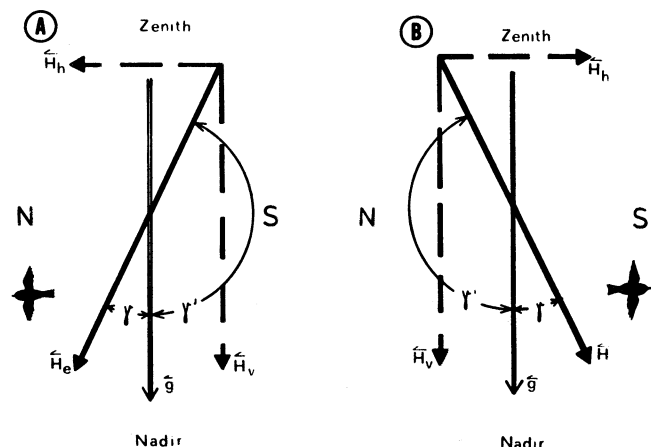
Most of the suggested means of avian navigation parallel those used by humans—the sun, the stars, landmarks, etc. In the April 7 *SCIENCE* two German researchers, Wolfgang Wiltschko and Roswitha Wiltschko of the Zoological Institute of the University of Frankfurt am Main, present evidence that for at 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.

lation density higher than in the mammals' natural habitats resulted in increased mortality, lowered fertility rates, maternal neglect of young, excessive aggression, withdrawal, sexual aberrations, and other "psychotic" behavior. Later overcrowding studies showed some of the same pathologies for monkeys, hares, shrews, fish and other animals.

For analogues to the pathologies observed in the animals, the Vanderbilt researchers chose public assistance rates (judged to give a rough indication of "ineffectual parental care of the young," according to statistical correlations based on previous work), juvenile delinquency rates and rates of admissions to mental hospitals. Also included were mortality and fertility rates. Correlations between crowding and the various pathologies using a gross measure of population density per acre were ambiguous when the researchers attempted to segregate the effects of crowding from the effects of social class and ethnicity. So they refined their measure of crowding into "structural" factors: the number of persons per room, the number of rooms per housing unit, the number of housing units per structure and the number of structures per acre.

This time they got clearer results, although there was still some muddying by the class and ethnicity variables. They report their findings in the April 7 SCIENCE.

Four of the pathologies—higher death and fertility rates and more public assistance and juvenile delinquency—were correlated most prominently with high numbers of persons per room. The number of housing units per structure were second in importance. Number of rooms per housing unit had the highest correlation with the fifth pathology, higher admissions to mental hospitals—a reflection, the researchers believe, of the isolation and loneliness of persons who live alone. A finding that did not jibe with animal studies was higher rather than lower fertility in crowded rooms. But the researchers explain this anomaly by the fact female animals have periods of estrus, of being "in heat," whereas human males and females can be interested in sex at any time. Hypersexuality, say the researchers, may be a pathological symptom related, when it results in fertility, to inability to step back from one's environment, judge it objectively and plan for the future.

"Our studies suggest," conclude the researchers, "that overcrowding may have a serious impact on human behavior." But they warn that social structure and crowding variables are so highly intercorrelated "that it is difficult to accurately identify their independent effects." □

Psychology: Catching on big in the Southeast

Psychology is a relatively young and still-growing science. That is one of the reasons the rate of unemployment among psychologists is lower than it is in most other areas. Even so, money is tight and psychologists must compete for it. These facts were evident last week in Atlanta at the annual meeting of the Southeastern Psychological Association (SEPA).

Attendance (more than 1,500) was higher than at any previous meetings. Some even said the turnout was double that expected. Actually it was probably 20 to 25 percent higher than anticipated. The psychologists came from all the southeastern states—probably because Atlanta is centrally located. But they also came from many other areas of the country—probably looking for jobs. The placement center did a brisk business throughout the meeting.

Psychologists are job-hunting in the Southeast because psychology is catching on there. Universities are expanding their psychology programs and enrollment is up. The traditional Southern lag in education is being overcome and better teachers and programs are being attracted. This has been aided by a lessening of loyalty to Northern universities but more so by the fact that local, state and Federal money may be more available in the Southeast.

The Southeast has been able to get this money through community-oriented programs. The National Institute of Mental Health emphasizes community psychology, and state and local agencies are more willing to fund programs that will funnel the money back into their community. Raymond D. Fowler of the University of Alabama is president of SEPA. He considers community psychology a growing national trend but long the mainstay of Southeastern psychology. It grew in the Southeast out of financial necessity and was easier to implement there because it did not have to compete with entrenched psychological systems. Fowler mentioned Midwestern empiricism in particular. Edward H. Loveland of the Georgia Institute of Technology agrees. He says, "Psychology grew from scratch down here."

Charles D. Spielberger of Florida State University is president-elect of SEPA. In his view community psychology grew in the Southeast because there were fewer professionals to compete for the money. Most psychologists in the Southeast are university-affiliated and, he says, there is less sibling rivalry with the psychiatrist.

Community psychology is also opening up professional avenues for minori-

ties. Spielberger says blacks are still reluctant to enter many Southern universities but substantial gains are being made in black psychology. Women psychologists have their complaints and Spielberger has appointed a committee to investigate. He is also in favor of opening membership in the American Psychological Association to accredited master's degree psychologists. The proposal could increase APA membership as much as 20,000 and completely change the whole organizational structure of the APA. □

Automakers and the emission standards

The Environmental Protection Agency is constrained by the 1970 clean air amendments to go through the motions of making auto companies meet 1975 and 1976 emission standards, or show why they cannot, while largely pretending to ignoring the larger question of whether autos should be eliminated or reduced in cities.

Another act in the drama began this week as EPA started a month-long series of hearings on an application by the Swedish automaker Volvo for a one-year extension of the 1975 carbon monoxide and hydrocarbon standards. The other automakers—including Detroit's Big Three—have been ordered to come, too. Although Volvo's application technically is the only one at issue, actually the hearings will result in an all-or-none decision. Volvo just happened to apply first.

The rationale as explained by EPA's George Allen at a press conference: The basic problem is not one of new technological discovery, but of coordinating "the complex lead-time dynamics." But just in case one company comes up with a workable new emission-control device the others don't have, the first company is required by the law to let the other companies have it at a fair royalty as determined by a court. And if one company spends the money and effort needed to meet the standards on time, then it would be penalized if another company got an extension. Volvo's application came early in March, so EPA has to reach a decision by early May in order to meet the statutory 60-day limit. But the decision can be reconsidered.

In the meantime, the larger questions will surely come to the fore. Asked about recommendations that the use of autos in cities be restricted, Allen said: "This is the real issue." Environmentalists and others say the time has come to deal with the issue. But officialdom is still hesitant to begin the touchy task, especially in an election year, of taking on Detroit. □

See related article on p. 252.