

friends for the IBP, especially among those organizations, international and otherwise, which have been created specifically to deal with the more immediate problems.

Even within its chosen terms of reference, however, the IBP is not entirely consistent. Sometimes it has been interpreted as a licence for conservationists, or as a charter for whole organism biology. But if, for example, one of the objects is to lay foundations for the more efficient conversion of sunlight into carbohydrates, do not the biochemists and molecular biologists working with chlorophyll have at least as much to contribute as the ecologists and plant physiologists? And what about the chemists who are forever dreaming of edible protein from petroleum? As the programme gathers momentum, they may have a place in the section called UM (which is short for "Use and Management of Biological Resources"), although this seems to have been one of the least promising to reach the starting gate at Paris. In general, however, the gulf between the IBP and the laboratory biologists is too sharp for comfort.

What, then, is the prospect for the next five years? In the long run it will be best for the IBP if its friends as well as its critics do not expect too much. The IBP is not and cannot be an executive agency, with a budget to use for sponsoring research and thus the power directly to influence events. It is not, therefore, a surprise that many of the research projects listed in the national programmes would probably have been undertaken in the ordinary course of events. What the organization must hope for is that by drawing attention to the ways in which research can help with the solution of wider problems, it will in the long run influence the pattern of research—and increase its usefulness. This is an intricate task—a kind of public relations within biology. Five years is by no means too long a time. In the long run, everything will depend on the people involved and on the quality of what they have to contribute. This explains the diverse attainments of the various sections so far. One section seems, for example, to have made an impression at Paris by the soundness and the originality of its proposals for studying human populations in different natural environments. Another seems well off the mark with suggestions as to how the careful study of large artificial lakes may turn out to be economically important.

In these and other connexions, there are useful jobs to be done. The IBP may be able to help by seeing that projects like these are carried out on a sufficiently big scale, and in such a way that the findings are readily usable elsewhere. If anything, there are too many opportunities to be seized on, so that the organizers will have to live like opportunists, backing obvious winners, gaining friends and influence where they can. Now that the enterprise is about to start in earnest, there are dangerous tendencies to bumbledom and immodesty if the organization is not to do more harm than good. The biggest danger is that the IBP may outrageously overplay its hand.

JUPITER AND IO

PEOPLE have been wondering why Jupiter should emit radio waves in the decametre region ever since the first discovery in 1955, but the problem has taken on a somewhat bizarre flavour in the past two years, with the recognition that the strength of the signals is closely correlated in time with the periodic motion about Jupiter of the satellite Io, the innermost of the five satellites. Why should a satellite as far from the centre of Jupiter as the Moon is from the Earth exert such a continuing influence on the upper atmosphere of the planet? And what, in any case, is the mechanism by which the radiation is produced? Observations at centimetre wavelengths have supported the supposition that Jupiter is surrounded by a region in which protons and electrons are trapped in the magnetic field in much the way in which the van Allen belt is trapped around the Earth, and it has even been possible to infer that the magnetic axis of Jupiter is inclined by 10 degrees or so from the axis of rotation. It is only natural that the origin of the radiation synchronous with Io should be sought in the same place. The sheer size of Jupiter is enough to raise the possibility that Io may interact directly with the belt of radiation.

Two theories starting from this point of view have now appeared. Dr. L. Marshall and Professor W. Libby (*Nature*, this issue, page 126) argue that the stream of particles moving outwards from the Sun should leave a long wake behind the satellite Io in exactly the way that the Solar Wind leaves a wake 300,000 km long behind the Moon. Even though the velocity and density of the outward stream of particles will be much diminished at the orbit of Jupiter, Io is bound to cast a shadow of some kind on the trapped radiation belt beneath. One important feature of this theory is that it suggests why the pattern of radiation from Jupiter should not be centred precisely on the position of Io, but rather displaced from it by 15 degrees—the wake surrounding Io acts as if it were a huge proboscis pointing towards Jupiter. Dr. J. A. Gledhill (*Nature*, this issue, page 155) takes a different line. He points out that the comparatively rapid rotation of Jupiter as a whole, and the existence of a magnetic field, will push out the trapped plasma centrifugally, so that the radiation belt will be more like a disk than a doughnut, and sufficiently extended for Io to pass through it twice on every revolution. This theory also accounts for the displacement of the pattern of radio waves from the position of Io in its orbit, perhaps more directly than that of Marshall and Libby. Uncertainties about the magnetic field of Jupiter and the density of particles in the radiation belt imply that it is much too soon to know which of them carries the greater conviction. Events may even show that both are wrong, but for the time being what matters is that there are at least some tangible ideas to test—and that the decametre radiation promises to yield a surprisingly rich haul of information about Jupiter.