annual report—which does not cover the period earlier this year when plankton surveys based on one of the association's research stations found the first traces of the bloom of dinoflagellates which eventually caused mussel poisoning in north-east England (*Nature*, **220**, 21; 1968). According to the report, plankton surveys have now made it possible to work out the ways in which shifting plankton populations help to determine the size of herring populations in the North Sea. A continuous survey is maintained off the Scottish coast, while plankton recorders have been towed behind merchant vessels and weather ships in the Atlantic, sampling once a month wherever possible. The seasonal and annual variations in the plankton population are being analysed by computer in the hope of identifying long-term trends.

One result of the survey has been to demonstrate that the date of spawning of the herring stocks in different areas coincides with the peak phytoplankton production. For all fish, the seasonal peaks in the numbers of larvae occur at or just before the maximum production of young copepods. Two geographical groups of species are found for the plankton; the first, containing *Calanus*, *Spiratella* and *Clione*, were more abundant in the northern part of the fishing ground and around Shetland. The second group contains *Temora*, *Centropages hamatus* and *Cladocera* which were more numerous in the Buchan area. Since 1958 there has been a decrease in copepods generally and in *Calanus* in particular in the sea around Buchan. This, the marine biologists suggest, explains why the Shetland fishery has prospered while the Buchan fishery has declined.

ATOMIC ENERGY

Generating Neutrons in Canada

In spite of the cancellation of a major project, the Intense Neutron Generator (ING), university physicists in British Columbia seem not to be too cast down. For one thing, ING was never a university machine, being intended for the laboratories of Atomic Energy of Canada Ltd. For another, the Canadian Government has agreed to support the building of another important machine which, although not so large, will ensure that nuclear physics survives in Canadian universities. This is the unhappily named Tri-University Meson Facility (TRIUMF) which is to be built on the campus of the University of British Columbia at Vancouver. The name of the new machine is inaccurate as well as ungainly, for the machine now claims the support of four western universities, three in British Columbia (the University of British Columbia, Simon Fraser University and the University of Victoria) and one in Alberta (the University of Alberta at Edmonton).

The machine is to be an intermediate energy cyclotron, capable of accelerating H^- ions in a continuous stream before converting them into 500 MeV protons by stripping two electrons from each ion. Although the energy of the beam is low by modern standards, the intensity is very high, 1,000 times higher than any similar machine. This has been made possible by two innovations, both of which have already been proved in smaller machines. The first is the unusual shape of the magnet, which consists of six spiral sectors, each coming to a point at the centre of the machine. The H^- ions are brought into the centre of the machine at low energy and then spiral outwards with increasing energy until they emerge from the machine. The shape of the magnets is such that the particles remain in step with the accelerating mechanism, allowing an almost unbroken stream of particles to be obtained. The use of H^- ions makes it possible to get almost all the accelerated particles out of the machine. At the periphery of the machine a stripping foil is used to remove the two electrons, converting the H^- ions into

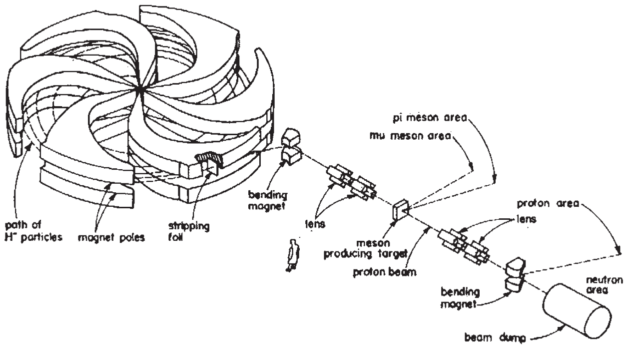

Fig. 1. Diagram showing the relationship of the experimental neutron beam to the core of the neutron generator. Various types of neutrons are produced along the length of the beam.

protons. The proton beam can in turn be used to produce streams of mesons by passing it through a suitable target, and when the beam is finally "dumped" it produces a flux of thermal neutrons similar to that from a nuclear reactor.

At the University of British Columbia, the research staff responsible for TRIUMF see it as a powerful and flexible tool for the investigation of the atomic nucleus. They hope that it will provide a clearer picture of the structure of the nucleus itself, as well as being used to produce new nuclear systems consisting of atomic nuclei with added mesons. The machine is also expected to be used to examine the collision of high energy proton beams with heavy nuclei and to study the structure of the mesons themselves under much better conditions than are available with machines already in existence.

So far, TRIUMF is no more than a vacant plot cut from the woods in the UBC campus, and a 1/20 scale model in the Department of Physics which has been used to determine the shape of the magnets. But by 1972 it should be in full scale operation, and keeping busy a team of perhaps 90 staff members and 180 graduate students. The present estimate for the construction cost is $19 million, which provides some $4 million for contingencies. After completion, the machine would cost about $3 million a year to run.

PHYTOTRONS

Million Dollar Greenhouse

A grant of $400,000 has been awarded to the University of Alberta by the National Research Council of Canada for the construction of a "controlled environment greenhouse" in which plants and animals native