receptors and one may surmise that the sweet proteins associate with them much more strongly, in the manner of an antigen with its antibody for example. The search for gastronomically interesting proteins has now presumably been joined in earnest and no doubt the minds of workers in the field are busy with the possibilities of measuring the interactions of the sweet proteins with receptors, and of anchoring them to matrices, so as to capture receptor proteins by affinity chromatography. Cagan (*Science*, **181**, 32; 1973) has just reviewed the properties of miraculin and the two sweet proteins.

It might be noted that the isolation of a sugar-binding receptor protein was reported last week by Hiji and Sato (*Nature new Biol.*, **244**, 91; 1973).

PEST CONTROL

More Protein for Africa

from a Correspondent

UNDER the auspices of the Department of Agriculture of the Rockefeller Foundation, twenty of the chief workers on tsetse flies and trypanosomes from many countries recently gathered at the magnificent Villa Serbelloni on the shores of Lake Como. The purpose of the gathering was to scrutinize the relationships between tsetse flies and the pathogenic trypanosomes which they transmit to man and domestic animals in Africa and in particular to make some progress in deciding the most promising approach to the control of cattle trypanosomiasis—a disease which denies large areas of Africa to cattle, seriously reducing the amount of animal protein produced in that vast continent.

The new research data were related during the numerous stimulating discussions to the control of trypanosomes by chemotherapy or by immunization of cattle and to the control of tsetse flies by insecticides or by biological methods. The main difficulty with chemotherapy on a large scale is that of cost and practicality, because of the repeated dosing that is necessary with available drugs. Pharmaceutical companies are reluctant to invest in developing more effective and more easily applied trypanocides. Immunization of calves against trypanosomes would be an ideal alternative to chemotherapy, if only long lasting immunity could be guaranteed. Unfortunately the antigenic properties of trypanosomes are extremely plastic for reasons that are imperfectly understood. Much work is needed on the whole subject of variable antigenicity, though this will only be possible once large quantities of fly-adapted trypanosomes are available, and in this connexion, development of tsetse fly tissue culture techniques for growing the infective invertebrate forms of trypanosomes could become of great significance in the future.

Traditional control methods of clearing natural vegetation and shooting game animals, together with the application of insecticides, were only briefly discussed. These three still remain the only effective methods of eliminating tsetse flies and controlling trypanosomiasis. They are expensive techniques which often need to be repeated and they are all ecologically unsound in some respects. Great hope was held out for the wide range of potential biological control methods discussed, some of which are urgently in need of further detailed study. For example, flies of the genus *Thyridanthrax* are commonly occurring parasites of tsetse in the wild; if only these parasites could be bred in captivity, then large numbers might be released in the field. Again, the midgut symbionts of the tsetse fly supply vitamins and when these symbionts are killed the flies soon follow suit, clearly suggesting a novel control method based on the destruction of tsetse symbionts with antibiotics introduced in the fly's diet. Another possible biological control method lies in blocking the anticoagulant of tsetse fly saliva, which would cause blood to coagulate in the fly's food canal and so prevent further feeding. These together with many other aspects of tsetse fly sensory, neural and energy metabolism would be fertile ground for pharmacologists with an interest in developing effective blocking compounds. This is a field which is virtually untouched at present.

The most advanced biological control method is based on the release of sterilized male tsetse flies, which mate with the wild female flies resulting in a marked decrease in numbers. This technique has been used with varying amounts of success on several other types of flies. The tsetse is particularly susceptible to the sterile male technique because of its very slow rate of population increase, and if this technique was applied to a population of flies already much reduced in numbers by some other method, then success would seem certain. A prevalent opinion among the conferees was that different combinations of various control techniques would be needed to eliminate tsetse from different environments. It is clear that in each new control situation competent ecological advice should be sought prior to the implementation of the control programme. It is also of some importance that adequate economic, political and sociological information be obtained in advance so that the land freed for ranching is used to best advantage. The convivial atmosphere at the Villa Serbelloni encouraged a most open and relaxed exchange of ideas, to the mutual benefit of all of the participants and, ultimately, to the detriment of the tsetse flies and trypanosomes that plague the African continent.

ENZYMES

Evolution in the Test-tube

from our Molecular Genetics Correspondent

WHAT recourse has a bacterium when it irretrievably loses the function of one of its genes? One path open to the cell is the alteration of some other gene so as to code for a protein which can substitute for the lost function. Forced evolution of this nature has been followed in a series of experiments of remarkable elegance by Campbell, Lengyel and Langridge (*Proc. natn. Acad Sci., U.S.A.*, **70**, 1841; 1973).

The strain of bacteria used to provide the raw material for evolution carried a deletion in the *z* gene of the lactose

New Light on Myofilaments

ANTIBODIES to myosin have been used to study the disposition of myosin molecules in the thick filaments of muscle. It has recently been found that the presence of antibodies to another thick-filament protein, the C-protein, in the anti-myosin introduced some ambiguity into these results. With the isolation of C-protein, it became possible to prepare antibodies against it alone, and use them to identify its location in glycerinated muscle fibres. The results of these experiments are reported by Rome *et al.* in next week's *Nature New Biology*. Using X-ray diffraction, they found that labelling with antibodies to C-protein resulted in a large enhancement of a reflexion at 442 Å. The diffraction data, together with electron microscopy, are tentatively interpreted in terms of a periodicity from the C-protein equal to that of the myosin. In an accompanying paper Rome *et al.* use the same approach to examine the distribution of the calcium-binding component of troponin, which is known to reside in the thin filaments. An X-ray reflexion from whole muscle on the meridian at 385 Å has been assigned to the I-band repeat, but its identification with troponin has been speculative. The calcium-binding component of troponin (troponin-C) was used to make antibodies and these were diffused into glycerinated muscle. The result was a large enhancement of the 385 Å reflexion, which as measured appears actually to be closer to 383 Å. This value is in better accord with the suggestions that the troponin repeat is seven times that of the actin subunits in the thin-filament helix.