obtainable by varying the water and salt content of the crystals, and the chemical nature and species of the hæmoglobin. The pattern of the molecule should be resolvable within about 7 A. when the signs of all terms have been determined. Dr. C. H. Carlisle and Prof. J. D. Bernal discussed the crystal structure of ribonuclease. Dr. Carlisle discussed Patterson projections, inferring that parallel polypeptide chains appear to be present in the structure, but that these do not have the right packing and cross-section for α-helices. Prof. Bernal attacked the problem by a very different approach, selecting constellations of 'significant reflexions' as the starting-point for Fourier computations; the method does not lend itself to brief exposition and can only be mentioned here [see *Nature*, June 14, p. 1007].

Dr. K. Bailey reported his work[4] on the size and shape of the very asymmetric molecule, tropomyosin, which appears to be about 385 A. long, with an axial ratio about 22 : 1, and a molecular weight of 53,000. It contains no free α-amino group, and one free α-carboxyl. It is composed probably of two more-or-less parallel polypeptide chains.

H. E. Huxley reported low-angle X-ray studies on living muscle, which reveal the presence of very long molecules, packed in hexagonal array, and 450 A. apart. The relative intensities of the first- and second-order transverse reflexions from this spacing are completely reversed by removing adenosine triphosphate from the muscle. Along the fibre axis there is a repeating unit 420 A. in length; this seems to be due to the actin component, rather than to the myosin. Surprisingly, this spacing does not change on stretching the muscle. The axial and transverse patterns are still clearly observed in glycerol-extracted fibres (Szent-Györgyi's technique). This opens the possibility of studying contracted fibres by X-ray methods.

Although many topics were discussed at the meeting, the prime emphasis was on the underlying structural pattern of the polypeptide chains in proteins. As Dr. Corey remarked near the end, structures such as those proposed by Pauling are precisely defined; they lead to definite predictions about physical properties, and critics can attack these structures where they fail to fit the facts. Revised and improved models can then be put forward, and progress in this supremely important field should proceed with increasing rapidity.

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[1] Cochran, W., and Crick, F. H. C., *Nature*, **169**, 234 (1952).
[2] Riley, D. P., and Arndt, U. W., *Nature*, **169**, 138 (1952).
[3] Low, B. W., *Nature* [**169**, 955 (1952)].
[4] Bailey, Tsao and Adair, *Biochem. J.*, **49**, 27 (1951).
[5] Yakel, Pauling and Corey, *Nature*, **169**, 920 (1952).
[6] Bamford, Brown, Elliott, Hanby and Trotter, *Nature*, **169**, 357 (1952).

KODAIKANAL OBSERVATORY

By DR. A. K. DAS
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THE Kodaikanal Observatory completed fifty years of astrophysical work in March 1951. The occasion was celebrated by a simple function held on September 18 over which His Highness Maharajah Sir Krishnakumarsinghji Bhavsinghji of Bhavnagar, Governor of Madras, presided, and a souvenir pamphlet describing the activities of the Observatory during the half-century was issued to commemorate the occasion.

Kodaikanal Observatory has its roots in the fairly distant past, for it is really the continuation of the Madras Observatory which was started in 1792 by the East India Company "for promoting the knowledge of astronomy, geography and navigation in India". Mr. N. R. Pogson, who was in charge of the Madras Observatory during 1861–91 and whose work in positional astronomy is well known, was the first astronomer to conceive the idea of establishing a branch of the Madras Observatory in the Palni or the Nilgiri Hills especially for photographic and spectroscopic observations of the sun and the stars. But it was in the time of Mr. Charles Michie Smith that the idea took practical shape, and a site at Kodaikanal (elevation 7,688 ft. above mean sea-level) in the Palni Hills was chosen for this branch. The foundation stone of the new Observatory at Kodaikanal was laid in 1895, and by 1901, when systematic solar observations were begun at Kodaikanal, the astronomical work of the Madras Observatory had almost completely ceased and practically all its equipment, except the historical meridian circle, had been transferred to Kodaikanal. However, the astronomical observatory at Madras still existed, though only in name; and Mr. Michie Smith's official designation was "Director of Kodaikanal and Madras Observatories", a designation which continued until 1932, when Kodaikanal Observatory's connexion with Madras came to an end.

Mr. John Evershed, who succeeded Mr. Michie Smith as director, joined the Kodaikanal Observatory in 1907 as assistant director. In 1909 he discovered the phenomenon of radial motion in sunspots which is commonly known as the Evershed effect. When Mr. Evershed became director in 1911, Dr. Thomas Royds joined as assistant director, and their fruitful collaboration continued until Mr. Evershed's retirement in 1922. A very considerable part of the accurate spectroscopic work for which this Observatory is noted was done during the period 1907–22. The tradition of high-dispersion spectroscopic work built up during this period has continued until the present day. But Dr. Royds, during his directorship, which lasted from 1922 until 1937, placed a good deal of emphasis also on the observational study of solar prominences and dark markings. Dr. A. L. Narayan, who was assistant director during 1928–37, succeeded Dr. Royds as director and remained in charge of the Observatory until about the middle of 1946. He was responsible for a considerable amount of work in atomic and molecular spectroscopy. Dr. A. K. Das, who as assistant director between 1937 and 1942 made theoretical studies of the motion of gases in the sun's atmosphere, returned to the Observatory after the Second World War and succeeded Dr. Narayan as director. Dr. R. Ananthakrishnan joined the Observatory as assistant director towards the end of 1946.

Since 1946 the spectroscopic equipment of the Observatory has been greatly improved by the construction of a number of high-dispersion spectrographs, siderostats, cœlostats, etc., and work on various problems of solar physics is in progress. It is expected that a 100-ft. solar spectrograph, a polarizing monochromator and a Lyot coronagraph will shortly be added to the equipment of the solar physics section. The most notable post-war developments in the activities of the Observatory have been, however, the addition of a magnetic and ionospheric branch and of a section of stellar physics. The magnetic observatory, which was started towards the end of 1949, is now in full operation and is equipped with a set of Watson magnetographs, a set of La Cour magnetographs and the usual accessories; the equipment of the magnetic observatory will shortly be further strengthened by the addition of an Askania magnetic field balance, as well as a set of *QHM* and *BMZ* instruments. The principal instrument of the ionospheric observatory, which started functioning from the beginning of 1952, is an automatic multifrequency ionosphere recorder of the latest type designed by the U.S. Bureau of Standards. The magnetic and ionospheric section naturally has an electronics laboratory attached to it. Recently an equipment for the study of solar radio radiation in the 100 Mc./s. region has been built in the electronics laboratory and has been brought into regular use. Mr. B. N. Bhargava, who had his specialized training in radiophysics in the United States, is in charge of the magnetic and ionospheric section. The stellar physics section has made a modest beginning with a 20-in. Cassegrain reflector by Grubb as its principal instrument. Though old, it is an excellent and very versatile telescope which originally belonged to the now disused Observatory of Poona called after His Highness Maharajah Takhtasinghji of Bhavnagar. This telescope was presented to the Kodaikanal Observatory many years ago, but had remained unused and dismantled. Recently it has been installed for regular use after reconstructing several of its missing or damaged parts, and has been named the Bhavnagar telescope. Work on planetary spectra and some aspects of stellar spectroscopy is being begun with this instrument. Our plans for the development of the stellar physics section include the acquisition of a large Schmidt–Cassegrain telescope and a large reflector of about 100-in. aperture as soon as the necessary funds become available.

The developments that have already taken place have necessitated considerable improvements in our workshop facilities. The Observatory machine shop is now equipped for meeting most requirements of a modern astrophysical observatory; an optical workshop for the Observatory is also one of our projects.

PASTURE AND FODDER DEVELOPMENT IN MEDITERRANEAN COUNTRIES

THERE are a number of countries in the south of Europe and the north of Africa which have sufficient in common to be grouped as the Mediterranean area but in which there is also diversity of topography and, to some extent, of climate: the rainfall varies from 200 to 1,000 mm. a year. The prevalence of limestone rock with soils derived therefrom is a characteristic of this area; but there are considerable areas of igneous rocks, although here, too, practically all the overlying soils are directly related to these rocks. The olive and the evergreen oak are characteristics of the area; indeed, it may be said that a map of the olive and evergreen oak is a map of the typical Mediterranean area. The past history of these countries—invasions, wars and tribal movements—have necessarily affected the people's way of life and the agricultural traditions that have come to be established, but the influence of the past is not now easy to diagnose in its entirety.

There are some specialized crops, particularly the vine and the olive, that are long established and the management of which is generally good; but the cultivation of the more utilitarian crops is mostly unsatisfactory, and arable work on a rotational basis is very weak. Wheat is a dominant crop, and an alternation of wheat and fallow is the chief rotation.

Except in some parts of the south of France, there is a very great deal of pressure on the land to secure the livelihood of the people, and this arises to a considerable extent from the deterioration that has put some areas completely out of cultivation. There has in the past been a good deal of forest destruction, not only to make room for arable cultivation but also to provide wood for buildings and for ships; in consequence, there has been considerable denudation and erosion, and over-grazing has intensified this decline.

The keeping of small animals, particularly sheep and goats, is very common. The keeping of one or two animals by a family is quite normal, but there are also professional shepherds with their flocks. None of the stock, however, is developed for one primary purpose; almost every animal is a multiple-purpose animal to produce whatever labour, milk, meat, skin and so forth it can.

In addition to the defects in crop husbandry itself is the lack of integration between crop and animal husbandry. There is very little pasture specifically cultivated for grazing. Grazing is largely a random affair, and the stock graze in areas that are inaccessible for ploughing or on crop residues. The shepherds who keep flocks of sheep have little grazing ground which is their own, and these shepherds make financial arrangements wherever they can for their flocks to graze.

The Mediterranean farmer has for a long time followed tradition without receiving much inspiration for the development of new ideas, but it does seem that these people are amenable to help and guidance in raising the level of their farming. The pasture and forage problems are crucial to the progress that can be made, and in this connexion the Organization for European Economic Development has produced a report, entitled "Pasture and Fodder Development in Mediterranean Countries"*, which should be the means of big developments and considerable transformation. For some time now the Food and Agricultural Committee of the Organization has been concerned with the development of grassland in Europe, and, following a conference in Paris during May 1950, it published "Farm Advisory Methods for Grassland Improvement". It was during the Paris conference that the need for studying pasture and fodder production in the Mediterranean area was stressed and, in preparation for a conference on the matter, the countries concerned were surveyed by a number of experts from the United States, Australia, South Africa and Great Britain. Each of these experts worked with suitable colleagues in the country concerned, and reports on the various countries are published in Part 2 of the present publication of the Organization for European Economic Development. The reports were discussed first with representatives of the various countries and

* Pasture and Fodder Development in Mediterranean Countries. (Technical Assistance Mission No. 56.) Pp. 176. (Paris: Organization for European Economic Co-operation; London: H.M. Stationery Office, 1951.) n.p.