The Origin of the South-west Monsoon.¹

By DR. G. C. SIMPSON, F.R.S.

IT has generally been held that the south-west monsoon owes its origin to the great difference of temperature which exists during the summer months between the heated land surface of India and the surrounding oceans, the general idea being that the warm air over the land rises, and damp air from the sea flows into India to take its place, thus resulting in the strong south-west winds, the rainfall itself being due to the cooling of the air as it rises over India.

This theory has to face the difficulties that the temperature over India is much higher in May, before the monsoon sets in, than it is during the monsoon itself; that the temperature is higher in years of bad monsoon than in years of good monsoon; and that the part of India which has the highest temperature and the lowest pressure, and where ascending currents should be the greatest, is a region of practically no rainfall throughout the monsoon.

The true explanation of the south-west monsoon can be obtained only by taking a wide view of the weather conditions over large parts of the earth's surface during the summer months in the northern hemisphere. It is then seen that the south-west winds are not due to the temperature in India, but are a relatively small part of a general circulation of

the atmosphere caused by a region of high pressure over the South Indian Ocean and a region of low pressure which extends over the whole of Central Asia. Air passes northwards from the region of high pressure as the south-west trade winds so far as the equator, where it gets caught up in the circulation around the low pressure over Asia. On account of the particular arrangement of sea and land, combined with deflection of wind currents due to the earth's rotation, this air travels for 4000 miles over the sea before it reaches India, where it arrives in a very warm and exceedingly humid condition. This air, however, would probably sweep right across India to its goal in Central Asia without producing much rainfall if it were not for the unique distribution of mountains around India. From the north of the Mokran coast, right round India, following the line of Afghanistan, the Himalayas, and the mountains of Burma, there extends an unbroken wall of mountains, nowhere lower than 5000 ft., standing directly athwart the air-currents. The mountains catch the air, which is being driven by a pressure distribution extending from the Southern Indian Ocean to the centre of Asia, in a kind of trap, out of which there is no escape except by ascension. The damp, humid air, which begins to rain as soon as it rises 500 ft., is forced to rise between 10,000 ft. and 20,000 ft., and, in consequence, large masses of water are precipitated over the greater part of the Indian area.

¹ Abstract of a paper entitled "The South-west Monsoon," read to the Royal Meteorological Society on Wednesday, March 16.

The Finsbury School of Chemistry.

By PROF. G. T. MORGAN, F.R.S.

THE widespread feeling among scientific workers that the threatened closing of the Finsbury Technical College would be a calamity of national importance has found expression in a petition recently presented to the council of the City and Guilds of London Institute. In this appeal, which is supported by a long list of eminent names representative of every branch of art, science, and technology, the members of the Finsbury Technical College Defence Committee, many of whom are former students of the college, testify to their grateful appreciation of the long-continued benefactions made by the institute to the college, and urge the council to take into consideration all possible sources of assistance in the responsible task of keeping the college open as an institution for higher technical education.

The saving of Finsbury cannot be regarded otherwise than as a prudent step in the conservation of our educational resources at a time when public expenditure on new institutes embodying untried schemes is scarcely likely to meet with popular approval. This anticipated continuance of the college involves, however, a retention in its entirety of the unique system of scientific education given at Finsbury, so that the future of this institution may be a logical and evolutionary development of its former activities. The policy consistently adopted in the past by the City and Guilds of London Institute was to place implicit trust in the judgment of the scientific men appointed to the professoriate of the college. These professors were not tied down by formal curricula, and were allowed complete liberty to teach their respective subjects in their own way.

It is largely this freedom from prescribed courses and examination restraints which has given to the

Finsbury School of Chemistry, founded by Prof. H. E. Armstrong in 1879, its outstanding and distinctive features. From the first its laboratories were a centre of unceasing chemical activity, for they were open to day and evening students, who found unfailing assistance in their preparatory studies and inspiration in research from the hard-working staff whom the professor gathered round him. Among the more salient investigations of the early Finsbury School of Chemistry, which inaugurated a new era in the teaching of this science, were the researches on the laws of substitution among aromatic compounds and on the relationship between colour and chemical constitution, and the important discovery by Armstrong and Miller of the purification of coal-tar hydrocarbons through their sulphonic acids.

With Prof. Meldola's arrival in 1885 the chemical department was brought into even closer association with the synthetic colour industry. The new professor had recently discovered the oxazine blue which still bears his name, and had also made in the works several notable discoveries which afterwards bore fruit either in this country or abroad. The investigations then initiated at Finsbury showed the influence of the earlier industrial experience of its director. The course of substitution in the naphthalene series was the subject of several memoirs, and the researches on azo-compounds originally commenced in the works laboratory were continued throughout the remainder of the professor's lifetime. In collaboration with Mr. F. W. Streatfeild, Meldola instituted an inquiry into the constitution of diazoamino-compounds and amino-amidines which brought to light unexpected instances of isomerism. In 1900 he discovered the first recorded instance of the replacement of a nitro-group

by hydroxyl during diazotisation. Numerous cases of this substitution have since been noticed and shown to be capable of industrial application in the production of useful mordant dyes.

During the greater part of their joint career at Finsbury, Meldola and Streatfeild had as research assistants at any given time only one or two senior students chosen to work for one session in the professor's laboratory. Streatfeild, however, had a wonderful faculty for dovetailing together instruction and research, and Meldola had the happy knack of furnishing his youthful collaborators with an "Arbeit" which generally blossomed into a contribution to the Chemical Society's Transactions within this annual period of apprenticeship. From 1908 onwards the council of the college provided the professor with a whole-time research assistant, who generally held this coveted post for about three years. The senior students who were fortunate in receiving this more prolonged experience in research have justified their training by gaining responsible industrial appointments within a short time of leaving college.

When the writer succeeded his former teacher in 1916 the work of the Finsbury laboratories was dominated by the exigencies of the war, then entering on its critical stages. The Trench Warfare Department employed in the Finsbury laboratory of applied chemistry a small works plant for smoke-bombs and other munitions, which was not at that critical time to be found in any other London college. In 1917 the institute sanctioned an extension of the

chemical department, and the additional facilities thus provided were promptly made use of by the Chemical Warfare Department, which maintained a staff of research workers at the college until after the armistice. At the same time the chemical school remained in touch with the synthetic colour industry, inasmuch as the new research laboratories afforded accommodation to a group of chemists sent by the British Dyestuffs Corporation to extend their experience of organic synthesis. Other firms also took advantage of the research equipment for applied chemistry which was now being made in the chemical workshop, and several experienced chemists were allotted laboratory facilities for their researches in various branches of chemical technology. The materials required by these research workers were in certain instances prepared by senior students of the chemical department, who thus benefited by being brought at an early stage into contact with the actualities of industrial practice.

With a high tradition of practical laboratory instruction extending over a period of forty years it is not surprising to find that the senior *alumni* of the Finsbury chemistry department now occupy responsible positions in every centre of chemical activity in the British Empire. It is, moreover, a noteworthy consequence of the close association of the college with the industrial life of the country that several important chemical firms are taking an active interest in the Finsbury defence movement, thus showing in a practical manner their appreciation of the training afforded in this historic school of chemistry.

Bacterial Diseases of Farm Crops.

IN certain seasons some of the bacterial diseases which attack farm crops do sufficient damage to become serious economic factors. An instance of this was provided in 1918 by the "halo-blight" of oats which caused much trouble throughout Wisconsin and other parts of the United States (C. Elliott, *Journ. Agric. Research*, 1920, vol. xix., No. 4). The blight appears to be present in oat-fields every season, but attracts attention only when it develops strongly and does serious damage under particularly favourable weather conditions. The epidemics disappear if the weather changes to a type more favourable to the development of the plant.

The halo-blight usually appears as lesions on the leaves, but may occur on the leaf-sheaths and glumes; infected areas show a centre of dead tissue surrounded by a halo-like margin of chlorotic tissue, and they gradually spread and often coalesce until large areas are involved and the whole leaf becomes dry and brown. A typical white organism has been isolated from these lesions, for which the name *Bacterium coronafaciens*, n.sp., is proposed. The organism is a motile rod with rounded ends, sometimes occurring singly or in pairs, but usually in short to long chains. One to several polar flagella have been made out, but no spores have been observed. The bacteria live through winter on the seed, produce primary lesions on the first leaves of seedlings, and are carried to other leaves by wind and rain. Natural infections of halo-blight have been observed only on oats and rye, though artificial inoculations indicate that the organism may be slightly pathogenic on wheat and barley also. Infection takes place more readily on injured than on uninjured parts of the plants. In normal circumstances different varieties of oats show differences in susceptibility to the disease.

NO. 2683, VOL. 107]

Though halo-blight is known to be seed-borne, no practical method of seed treatment has yet been found which will entirely control the disease. Treatment with 1 in 320 formalin, as is used for smut, keeps the blight in check, but is not entirely effective. Heating the seed in a hot-air oven for thirty hours at 100° C. completely checks the disease, but the commercial application of the treatment has not yet been worked out.

An unrecorded bacterial disease, basal glume-rot of wheat, was discovered in 1917 by L. McCulloch (*Journ. Agric. Research*, 1920, vol. xviii., No. 10) on plants obtained from various localities in Canada and the United States. The leaf, head, and grain of wheat are all affected, the diseased portions being discoloured and blackish, and the basal ends of the grains often appear charred. The development of the grain is hindered when the disease appears early in life, but it is possible for the plants to be attacked when the ears are well filled out. Bacteria are abundant in all the discoloured tissues, and are fairly resistant to desiccation, as the organism has been isolated from dry wheat-kernels kept at room-temperature for seventeen months. The organism, for which the name *Bacterium atrofaciens* is proposed, is a white, polar-flagellated rod, producing a green fluorescence in the ordinary culture media. It attacks starch, and will tolerate sodium chloride up to a strength of 5 per cent., above which no growth occurs. Many tests of the reaction of the bacteria have been made, and the optimum growth-temperature appears to be between 25° and 28° C., the thermal death-point being about 48° or 49° C. Ten minutes' exposure to sunlight or forty-four hours' freezing was also found to kill most of the bacteria. No method of controlling the disease is suggested.

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