in question seem as marked now as thirty years ago. Richmond station, moreover, is $\frac{3}{4}$ mile from the Observatory, and is not in the direction from which the prevailing wind blows. It is not a station where much shunting is done. A minimum in the morning and a maximum in the evening have been observed at most places, town and country alike.

Dr. Reynolds is, however, I think, quite correct in believing that electrical phenomena in and near large towns are much influenced by the works of man. Steam no doubt may play an important part in some localities, but atmospheric pollution by smoke is, I think, a much more important factor. Reasons for this belief will be found in the Royal Society Handbook to which Dr. Reynolds refers.

Undoubtedly a continuous record of potential gradient and other electrical phenomena at some really country place, situated desirably to the south-west of London, is a somewhat urgent desideratum.

C. CHREE.

Experimental Study of the "Soaring" of Albatrosses.

A SERIES of experiments was made by me in Africa in 1920 in order to study the flight of the vulture. Kites were brought into the immediate vicinity of the soaring birds, and carried with them sensitive apparatus, making it possible to find, by means of electrical connexions with registering apparatus on the ground, the variations of internal energy of the air (temperature within 0.02° C., pressure within 0.1 millimetre; speed, direction, and horizontality of wind variations).

The registrations so obtained showed that in all of the observed cases of flight, the birds used ascending air currents, the origin of which was almost always due to temperature variations; the ascending air columns often shifting according to the temperature variations. The experiments enabled me to measure (by the relation of the horizontal and vertical speeds of the bird relative to the air) the lift/drag ratio of these birds, which is about eighteen.¹

The soaring of albatrosses and other sea-birds seemed to be quite different. The French Government accordingly sent me on a mission to the South Seas, in the neighbourhood of South Georgia, to study the flight of these birds. Registering apparatus was made use of, either on board of the ship or at sea, by means of floaters left from the board (to avoid the possible perturbations due to the boat). The variations of the internal energy of the air were so studied, as in Africa, amongst birds. Films taken by an automatic cinematographic apparatus, moved by clockwork, enabled me to find out, by photographic reconstruction, the trajectory of albatrosses and their velocity. (The average speed, relatively to the air, was 22 metres.)

The experiments showed that the soaring of albatrosses always takes place when there is no ascending current over the waves and the wind is even; but then it is always observed in the air strata where albatrosses fly, that the wind is *increasing according to the altitude*; doubtless it is the friction of the sea on the wind in the low strata that decreases its velocity.² Albatrosses, then, are continually manœuvring up and down, turning from time to time, going up against the wind and going down with the wind, so

that they alternately put themselves in strata of air of different speeds.

I took numerous measurements in the open sea in order to find out experimentally this variation in altitude of the wind speed that albatrosses use. These measures enabled me to calculate the energy gained by albatrosses.

The results are as follows:

(1) This sort of soaring is possible only for very swift birds. It needs a minimum wind of five metres, close to the water.

(2) The stronger the wind is, the higher (10-15 metres) the birds must do their upper turn.

(3) These trajectories of albatrosses are the most advantageous as regards gain of energy.

These theoretical conclusions are in agreement with the observations. Albatrosses consequently use the slackening of the wind speed due to friction on the surface of the sea.

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Bio-Chemistry of Muscle Contraction.

THE films of long-chain organic compounds (*e.g.* the aliphatic mono- and dibasic acids) crystallised on glass surfaces possess a structure in which the molecules are orientated so that their terminal groups lie in a series of planes parallel to the surface on which they are deposited. This structure is similar to that postulated by Friedel for liquid crystals (*e.g.* soap curds) in the smectic state. In the lamellæ between the planes, the long chains are arranged with respect to the surface at an angle which depends on the nature of the terminal group. For the mono-basic fatty acids the inclination is about 55° and for the esters of these acids approximately 90° .

Films of aliphatic organic acids when crystallised on glass or on the surface of aqueous alcoholic solutions have been examined by convergent polarised light and found to show the biaxial interference fringes typical of crystal sections in which the acute bisectrix is not normal to the surface. The two optic axes may be accounted for by assuming that successive molecules of acid lie in different directions in space giving rise to a chain of molecules running in a "zig-zag" manner from the surface of the glass. The angle between the chain directions of two adjacent molecules will depend on the configuration of the terminal groups, being different for an acid and its ester and salt.

This type of crystal structure has a possible significance in physiology, for if it be present on the surface of a muscle fibre it would provide a mechanism by which contraction on stimulation could occur.

A striated muscle fibre shows alternate isotropic and anisotropic striæ along its length. On contraction, the width of the striæ decreases, the diameter of the fibre increases, and a tension is produced along the axis. According to Engelmann, the active constituent in producing the contractibility is the anisotropic part of the muscle. The anisotropy is conceivably due to the presence of orientated molecules, presumably of long-chain amino-acids, which are either present in the membrane of the muscle fibre or are distributed in fibrillæ throughout. Assuming for the moment that the membrane is anisotropic due to the presence of long chains of salts or esters of amino acids, and that these are orientated so as to give a zig-zag arrangement of the molecules in a direction parallel to the axis of the fibre, and further consider the effect of converting these salts into amino-acids. In the first place, the

¹ C.R. Académie des Sciences, February 27, July 5, 1920, May 9, 1921; "Études expérimentales sur le vol à voile," par P. Idrac. Thèse de la Faculté des Sciences de Paris 1921. Vivien éditeur, 48 rue des Écoles; publiée aussi dans *L'Aérophile* (January, February and March 1922).

² C.R. Académie des Sciences, November 24, 1924, "Le Vol des albatrosses." Vivien, 48 rue des Écoles. *Bulletin de Recherches et Inventions*, March 1, 1925; *Technique Aéronautique*, February 15, 1925.