spermatozoa ; but the oocytes remain relatively minute, seemingly until the seasonal advent of environmental factors that permit successful reproduction. For example, the males of a breeding rookery feed the incubating females and later the nestlings as well. It is certain, then, that the food supply within each restricted area must have become sufficiently abundant to be gathered by one bird of each pair before reproduction can take place. It is significant that rooks—and other species—do not breed at precisely the same time each year. Records[6] kept by the Marsham family in Norfolk for about two hundred years indicate that the first rooks appear at any time between March 23 and May 2, with a mean during mid-April. It seems clear that whatever *initiates* the sexual cycle, the ovulation date is governed and the breeding season ultimately timed, not by unvarying photoperiodicity but by local stimuli that vary in time of onset from year to year and which probably operate through the exteroceptors of the female. Any theory of avian breeding seasons based primarily on internal rhythm and secondarily on various environmental changes has the advantage of possible application to all seasonal species whether they breed in the spring, in the depth of winter (as does the Antarctic emperor penguin) or on the equator, where light fluctuations are too small to command consideration.

We wish to thank Mr. Charles Boswell for help in the field.

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SCIENTIFIC RESEARCH AND THE ART GALLERY

NUFFIELD FOUNDATION RESEARCH SCHOLARSHIPS AT THE NATIONAL GALLERY

AN article published in *Nature* of October 8, 1949, p. 601, described the activities of the Scientific Department at the National Gallery, London, and emphasized the dual character of its functions. Thus, there is the day-to-day work in conjunction with the restorers, and, in parallel, the need for long-term investigations into relevant problems at present little understood, or at best only imperfectly formulated. The pattern is a familiar one, long recognized in industry and in medical science. If the outstanding questions regarding the care of paintings of national—indeed of international—importance are ever to be tackled in a fundamental sense, then some system of research scholarships tenable at an institution which is itself a collection of supreme pictures has for some years seemed the only way of grappling with these problems upon a truly scientific basis. In this context, it is perhaps too readily assumed that industrial processes and data of roughly analogous kinds can be taken over bodily and applied to the cases in point ; experience has shown that this is by no means so. Many substances of interest in the arts have no real counterpart in industry, and furthermore, for a great public gallery, very long views need to be taken of all technical developments. What may be done to a masterpiece is not done for a year or two, but for decades, and perhaps for centuries ; and again, the unique character of the material itself, and its irreplaceability, need no stressing.

It was a deliberate assessment of all these factors which led the Nuffield Foundation to offer to provide two graduate scholars, and an assistant, to work in the National Gallery laboratory under Mr. F. I. G. Rawlins for a period of three years. This is believed to be the first instance, anywhere in the world, in which a grant has been made to enable the sciences to come to the help of the humanities in a field such as this, demanding the prosecution of studies far removed from an *ad hoc* character, but yet orientated specifically towards the task of conservation. The research team has recently been completed, and now consists of Mr. J. S. Mills, of the Imperial College of Science and Technology, London (chemistry), Mr. I. Graham, of Trinity College, Dublin (physics) and Miss J. Wilson (technical assistant). Although the scholars are at liberty to pay brief visits to other laboratories in order to become familiar with specific techniques, their work is essentially concentrated at the National Gallery itself.

The main theme is the chemistry and physics of diffusion and swelling—together with solvent action—in films. In short, this is but one aspect of the vast subject of colloid science, and is clearly fundamental for any exact understanding of the properties and behaviour of surface coatings, linoxyn films, whether pigmented or not, and the mechanical aspects of such films when swollen. An interpretation in terms of surface energy and thermodynamic potentials would be a natural extension, more especially in view of the somewhat confused state of knowledge relating to moisture permeability and the influence of relative humidity, both when equilibrium may be assumed to be established and when stratified systems such as classical paintings are involved in cyclic changes and consequent hysteresis. The whole outlook might perhaps be envisaged as one of 'micro-cleaning', and thus it is essential to bring about the interlocking of the chemical and physical approaches by reference to the general concepts of the colloidal state.

Separating the whole programme into the appropriate chemical and physical sectors, it is proposed to use the principles of chromatography extensively in the former, and an optical (interference) system for the latter. Progress can already be reported in the separation of a number of components from the natural resins, using solid absorbents and paper chromatographic techniques. This stage is a necessary prelude to further examination. Meanwhile, a modified form of the method of observation initiated at the Research Laboratory, Courtaulds, Ltd., Maidenhead, is proposed to deal with the diffusion problem. In this, the advancing boundary of attack is followed by means of the fringes produced in a suitable optical path. In the past, some weight has been given to the idea of a 'solvent differential', as a discriminant for the use, or non-use, of any given solvent in respect of its action upon a surface film (varnish), and its essentially inocuous effect upon the paint-layer below, considered as an aggregate of pigment particles in dried linseed oil (linoxyn), and including the case of vanishingly small pigment concentration. It seems more than likely that in many instances the phenomenon of preferential diffusion is much more significant: in fact, two superposed chemically similar phases can be imagined in which the passage of the penetrant

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could be so controlled as to act upon the upper stratum alone, ignoring the lower, a condition of affairs in which the solvent differential would obviously be zero. Academically, a complete examination of the anisotropic character of diffusion is of much interest, as recent theoretical investigations have revealed.

From the methodological angle, it is necessary to recollect that a long series of tests upon (necessarily) over-simplified examples will be needed before it is possible to go over to the extremely complicated, and largely empirical, circumstances of application in the restorers' studio. In this lies the intrinsic value of the present opportunity. *En route*, some recourse will probably be had to various micro-dissection techniques, and apparatus is available with that in mind. If and when a tolerably complete grasp of the whole matter in its basic form has been achieved, the incidental, but practially important, question of the optimum conditions for the easy and rapid removal of over-paint from pictures will almost certainly be answered automatically.

In all these ways, it is intended to attempt fundamental advances in our knowledge both of the materials and phenomena which are of direct significance in the care of a great collection of paintings. Without the generous support of the Nuffield Foundation, it is difficult to believe that such an enterprise could ever have been contemplated. Moreover, the National Gallery is now in the unique position of being the locus of research which should not only benefit the priceless patrimony in the care of the Trustees, but also, through publication of the results in due course, render a service to the responsible tasks of curatorship throughout the world.

NEWS and VIEWS

Institution of Electrical Engineers : Honorary Members

THE Council of the Institution of Electrical Engineers has elected the following to honorary membership of the Institution : Sir Arthur Fleming, for his distinguished work in electrical engineering, in particular in the field of technical education, his contributions to scientific research, and his services to the Institution ; and Sir Edward Appleton, for his distinguished work in the field of pure and applied physics and his researches into the characteristics of the ionosphere and the part they play in determining the mode of propagation of radio waves.

Faraday Medal

THE Council of the Institution has made the thirtieth award of the Faraday Medal to Prof. E. O. Lawrence, for his distinguished work in the field of nuclear physics. Prof. Lawrence, who was born in Canton, South Dakota, on August 8, 1901, was educated at the South Dakota, Minnesota, Chicago and Yale Universities and became professor of physics at the University of California in 1928. Lawrence's early researches were concerned with photoelectric effects, and in 1930 he became interested in the possibilities of using the method of resonance acceleration in order to obtain positive ions of very high energies by means of a number of consecutive accelerations through relatively low differences of potential. His recognition, however, of the limitations of this method of linear resonance acceleration led him to conceive and build the first cyclotron, which he used to study the transmutation of elements and artificial radioactivity. For this work he was awarded the Nobel Prize for Physics in 1939. During the Second World War Prof. Lawrence was a member of the team of American and British scientific men concerned with the development of fissile materials. The need for larger samples of uranium-235 than could be obtained by the mass-spectrograph method led him to investigate the large-scale separation of uranium isotopes by electromagnetic methods. He achieved success by employing the 'Calutron' mass separator, and this method of effecting the large-scale separation of uranium isotopes was adopted in preference to the two other methods (the centrifuge and diffusion systems) which were under investigation at the same time. Among Prof. Lawrence's honours are the Hughes Medal of the Royal Society and the Duddell Medal of the Physical Society.

Veterinary Science in the Ministry of Agriculture : Sir Thomas Dalling

SIR THOMAS DALLING, chief veterinary officer of the Animal Health Division, Ministry of Agriculture, is to retire at the end of March. Born in Edinburgh in 1892, a son of the forge, and educated at George Heriot's School, he entered the Royal (Dick) Veterinary College in 1910 and qualified M.R.C.V.S. with honours in 1914. As a student in Edinburgh he was outstanding in his year, and also gained the FitzWygram and Williams Prizes open to all students qualifying in the veterinary colleges of Great Britain and Ireland. After a short period in general practice he joined the Army Veterinary Corps and served in France during the First World War, where he was employed in various veterinary laboratories. On demobilization in 1919 he returned to general practice for a very short time ; but opportunity to join Prof. Gaiger at the Glasgow Veterinary College as research worker in bacteriology led to his becoming chief investigator of the Animal Diseases Research Association, founded and maintained by subscriptions from the farming community and interested agricultural bodies in Scotland. In 1923 he became veterinary superintendent of the Wellcome Physiological Research Laboratories at Beckenham, where he carried out research on disease problems, including blackleg in cattle, leptospirosis in dogs, canine distemper and bovine tuberculosis. During 1937–42 he held the chair of animal pathology at the University of Cambridge.

Government service opened a wide field for Sir Thomas's organizing and research ability when he became director of the Veterinary Research Laboratory of the Ministry of Agriculture at Weybridge in 1942 ; and on the retirement in 1948 of Sir Daniel Cabot, chief veterinary officer of the Ministry of Agriculture, he succeeded him. For many years he has been a member of council of the ruling body of his profession, the Royal College of Veterinary Surgeons, and on the reconstitution of the Council following the passing of the Veterinary Surgeons Act of 1948 he was appointed president of that body, and was re-elected the following year. Since the end of the War, his advice on the control of animal disease has been sought by practically every country in

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