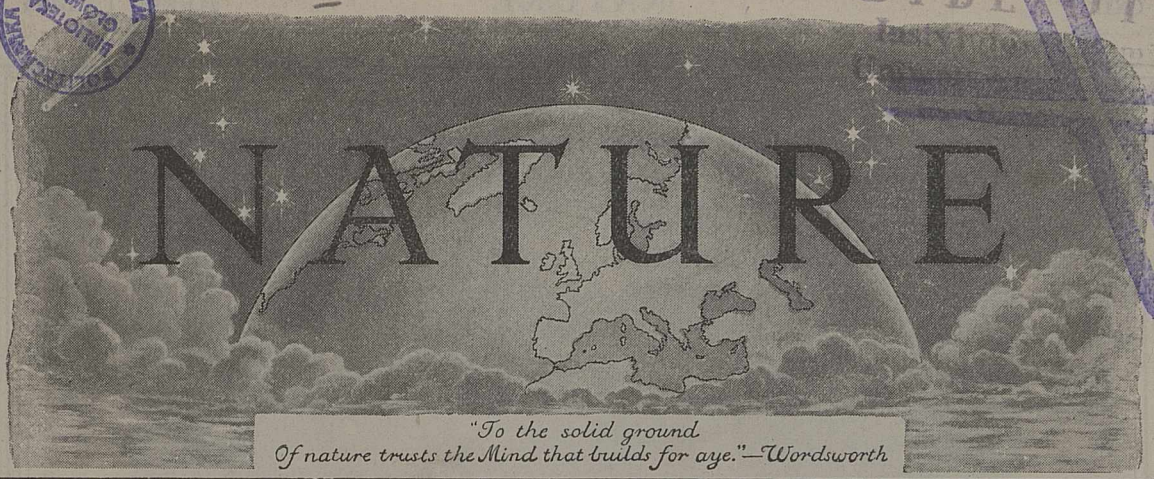

"To the solid ground
Of nature trusts the Mind that builds for aye."—Wordsworth

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ROYAL COMMISSION ON POPULATION

IN 1937 many members of the present Government voted against the Population (Statistics) Bill. Now, after the lapse of only seven years, the Government has appointed a Royal Commission to inquire into the problem of Britain's population (see NATURE, March 11, p. 310). Before the War this vital issue did not receive the attention it undoubtedly deserved ; in general, the country was indifferent, an attitude which was reflected in Parliament when a considerable section of the House of Commons resisted a measure designed to ascertain certain facts essential to any scientific study of the demographic position of Great Britain. It was alleged that the Bill would lead to some infringement of the personal liberties of the subject. Nevertheless, the operation of the Act during the past six years has not, so far as is known, been attended by consequences of this kind, nor has it resulted in any opposition from the general public. Unfortunately, however, the scope of the Act was restricted on account of the reception given it by the House of Commons and by certain sections of the Press, with the result that the facts at our disposal to-day are less comprehensive than they might have been.

It is indeed satisfactory that, despite the debates of 1937 and the subsequent issue in 1942 of a reassuring White Paper on the future trend of population, the Government has changed its mind and has appointed a strong Royal Commission. It will be the task of future historians to identify and assess the influences which led, in the fourth year of war, to this decision. It cannot be due to the trend in the birth-rate since 1937, for it has risen from 14·9 to more than 16·0 per 1,000 population.

The Commission, under the chairmanship of Lord Simon, with its three attendant technical Committees (Statistical, Economic, and Biological and Medical) numbers among its personnel many authorities on demography. The Government is to be congratulated upon the selection that has been made. It may be found in practice, however, not altogether satisfactory that most of these experts have been placed in the technical committees and not on the Royal Commission itself. This may have been thought necessary on political grounds, but, nevertheless, the relegation of the scientific personnel to positions where they may not take part in the study and discussion of the broad issues is not perhaps a very wise arrangement.

The problem of human fertility, though it may appear simple to the casual observer, involves a great many extraordinarily complicated aspects—statistical, medical, social and economic. The Commission, although widely representative as it is, does not include among its membership many recognized students of demography. The Swedes, when they organized their population inquiry, foresaw this particular difficulty and arranged their committees accordingly. Perhaps in the case of Lord Simon's Commission, the problem may be overcome by a

close co-ordination of the work of the main body and its technical committees. This will be necessary unless time is to be wastefully expended on uninstructed debate.

The Commission's terms of reference are exceptionally comprehensive. It is to concern itself with the facts relating to the present population trends in Great Britain, the causes of these trends and their probable consequences, and finally to consider what measures, if any, should be taken "in the national interest" to influence the future trend and to make recommendations.

It is clear that the first task of the Commission will be to establish, and agree upon, the facts. Thus, in the first instance, much will turn upon the work of the Statistical Committee under the chairmanship of Prof. A. M. Carr-Saunders. Before any attempt can be made to extrapolate existing trends—even into the near future—the Committee will doubtless wish to ascertain what has been happening since the first (and only) fertility census for England and Wales in 1911. It has been pointed out that a 60-year decline in the birth-rate was arrested in 1933 and that, as the Minister of Health stated in the House of Commons in July 1943, the rate has since increased. But this does not necessarily mean that there has been a rise in fertility since 1933. The crude birth-rate is a very imprecise measure; it does not take account, for example, of changes in the number of women in the reproductive age groups and the proportion of such women married at each year of life. Due, of course, to the absence of data of this kind, there has been, not unnaturally, some divergence of opinion between different authorities as to the trend of fertility during the past thirty years.

From the statistical information so far made public, it may broadly be said that, before the War, the net reproduction-rate for England and Wales was approximately 0·80; in other words, the number of female births fell short by 20 per cent of the number which, other conditions being equal, would be required to replace in the next generation the women of reproductive age in the present generation. What of course is of paramount importance is the contribution made by women of different ages to this total replacement-rate. What changes have occurred, and are occurring, in the fertility-rates of women aged (say) 20–25, 25–30, 30–35 and so on, according to the proportions married, length of marriage and other factors? Is the present birth-rate being buttressed by an undue proportion of first births to young married women? Or does the rise in the crude birth-rate presage a shift in fertility in favour of larger families to older women? These are the type of problems which it will be essential to investigate if the Commission's work is to rest on any scientific basis.

But these are not by any means the only statistical questions which must come before the Commission. They are, after all, only national averages; and such averages may mask widely different social patterns. Next in order of importance then, as a preliminary to any study of causes and consequences, is the problem of what is known as 'differential fertility'. The reproductive behaviour of various social groups has for long been known to exhibit considerable differences. The inverse association of fertility with social and economic status has for many years been a characteristic of Western civilization. The census for England and Wales taken in 1911 showed, roughly, that the fertility of unskilled workers was about 80 per cent in excess of that for the highest social group. What has happened since 1911? Has the considerable fall in the national crude birth-rate during the past thirty years meant an equalization of the class-rates, or has the decline been disproportionately distributed over the various social and occupational groups? Furthermore, have the regional differences in fertility developed in a similar manner?

If and when the Commission reaches the stage of considering recommendations to reverse the present deficiency in births, the answers to these questions must, it seems, influence their deliberations. Quite clearly different instruments will be needed if some groups in the community are more than replacing themselves while others are far below replacement level, instead of a situation where uniformity in fertility behaviour is generally widespread. Questions of incentives to parenthood, such as a system of flat-rate or graded family allowances, are bound up with the nature of present-day class fertility patterns.

The initial labours of the Commission must, therefore, rest mainly with the Statistical Committee. Some of the information that is needed can be made available, no doubt, by the Registrar-General's Office from the results of the Population (Statistics) Act. But other essential data which are lacking (such as knowledge of class fertility) can only be obtained by fresh inquiries and additional research. It is not clear from the Government's statement whether it is intended to survey and report on what facts are already available, or whether some of the gaps in our knowledge about human fertility are to be closed. It is to be hoped that the Government will not, for the sake of speed, reject proposals for gathering fresh information vital to any adequate survey of such a fundamental problem. It will be better to have a good report in five years time than to appoint another Royal Commission in 1954.

It is stated that the Commission will, at a later date, take evidence on the more general aspects of the inquiry. To enable such evidence to be soundly based, it seems essential that any new statistical material should be made generally available for outside study. It is at this later stage, when the statistical ground has been covered, that presumably the Economic and the Biological and Medical Committees will be actively engaged in studying the problems of causes and consequences. The latter Committee may perhaps at an earlier date be occupied with the much-debated problem of fecundity, that is, the physiological capacity to reproduce.

Some time must elapse, therefore, before the Commission can come to grips with the problem of raising the average size of the family. This issue covers an immense field, and includes practically every aspect of social life from child welfare to education, maternity

provision to family budgets, employment policy to migration, housing to marriage barriers and much else besides. The Royal Commission, in surveying all these factors, will have the advantage of the great amount of research, reflexion and preparation that has gone on in Government Departments in relation to reconstruction. It will be unfortunate if post-war decisions on reconstruction do not take account of the work of the Royal Commission. But as reconstruction must be a process of growth, depending upon the characteristics of the transitional period from war to peace, it may not be too late to shape our post-war plans to influence Britain's demographic future.

THE FOUNDATIONS OF THE DEEP

The Floor of the Ocean

New Light on Old Mysteries. By Prof. Reginald Aldworth Daly. (The Page-Barbour Lectures at the University of Virginia, 1941.) Pp. x+177+12 plates. (Chapel Hill, N.C.: University of North Carolina Press; London: Oxford University Press, 1942.) 15*s*. 6*d*. net.

UNTIL the interruption enforced by the outbreak of the War, investigations of the ocean floor and its foundations were proceeding apace with steadily increasing success. In three lectures delivered at the University of Virginia in 1941, and now made available to all in this attractively written and beautifully illustrated volume, Prof. Daly presents a progress report of the detective methods used in probing the secrets of ocean geology and of the spectacular results so far achieved. The three chapters of the book deal in turn with (*a*) the composition and thickness of the sub-oceanic crust and the nature of the underlying substratum; (*b*) the islands, mountain structures and oceanic deeps which diversify the relief of the deep-sea floor; and (*c*) the submerged continental terraces and the mysterious 'canyons' or gullies of the continental slope. The book summarizes clearly and comprehensively a multitude of data not otherwise easily accessible; and it does much more than this, for the author has himself made notable contributions to his subject.

It is pointed out that the detailed investigation of the sub-oceanic crust from records of 'near' earthquakes must await the establishment of an adequate network of seismographic stations located on oceanic islands. Meanwhile, however, the study of long waves (recorded at continental stations after passing through the sub-oceanic crust) suggests in a general way that the rock underlying the central Pacific down to a depth of fifty miles or so is crystalline and has the composition of basalt, and that similar material underlies the other oceanic regions with here and there a thin and patchy covering of sial. The basaltic layer continues beneath the sialic layers of the continents, but, it is thought, with a considerably reduced thickness. From other geophysical evidence, as well as from the geological evidence provided by recently glaciated areas, it is inferred that underlying the basaltic layer there is a very thick substratum of exceedingly weak material. Two working hypotheses are then introduced: that the substratum has the composition of periodotite, and that it is weak because it is too hot to have crystallized. Such a glassy layer would react to earthquake waves as if it were solid, while behaving like a highly viscous liquid towards stress differences of longer duration.

The earth model now favoured by Daly is consistent with a wide variety of phenomena, including the support of great volcanic cones by the strength of the crystalline crust; but it still fails to account satisfactorily for the volcanic activity which built up those cones. Daly's earlier view was that volcanic islands, like the basaltic volcanoes and plateaux of the continents, were fed from a world-circling basaltic layer of which the deeper levels were glassy and therefore eruptible when tapped by fissures. But the idea that the present temperature at the base of the basaltic layer is everywhere high enough to maintain it in a glassy state has had to be abandoned, in face of recent accurate measurements of the heat flow from certain non-volcanic regions. Daly thinks it probable that there may have been a continuous glassy basaltic layer in former geological times, but if such a layer no longer exists it cannot be claimed as directly responsible for present-day vulcanism. The impasse is a very real one, and it should be clearly stated that the whole problem of volcanic activity seems now to be further than ever from an acceptable solution.

Other topics that are capable of more satisfactory treatment include coral reefs and atolls, and the interpretation of the belts of negative anomalies of gravity flanking the East and West Indies as long submarine mountain chains of probably Alpine complexity. Interesting reference is made to the cores of deep-sea oozes brought up from the Atlantic floor by the Piggott boring apparatus; but one misses a discussion of the possible total thickness of the deep-sea deposits. For a solution of this tantalizing problem we shall probably have to wait until sub-oceanic earthquakes can be recorded at nearby island stations. Pioneer studies of the thickness of the continental shelf sediments have already been successfully carried out by seismic methods.

More than a quarter of the book is a masterly description and discussion of the submarine 'canyons' and ridges which have been found to furrow the continental slope wherever its surface has been explored in detail by echo-sounding. These valley-like trenches and gullies have been excavated in the sea-floor to depths of as much as 4,000 ft. below the intervening ridges, and some have been traced to depths of more than 10,000 ft. below sea-level. Many hypotheses have been proposed to account for their erosion; but only one, first suggested by Daly himself in 1936 and now more fully developed, appears to be reasonably satisfactory. During the glacial epochs the continental shelf was everywhere exposed. Waves and currents then churned up the muds of the outer part of the shelf and so gave rise to heavy undertow currents of mud-laden water which flowed down the continental slope and eroded chance depressions into deep channels. There is ample evidence, natural and experimental, that the process envisaged by Daly is a real and efficacious one and that its operation in glacial times is correctly dated.

Daly's latest book will be welcomed by a wide circle of readers. As always, he has much to say that is fresh and stimulating. Like Aristotle in an earlier age, he "adds boldness to genius" in synthesizing his facts into a world picture "with due regard to the steadily revised principles of a dozen other sciences".

ARTHUR HOLMES.

PIONEERING FARMING ON A WESTERN SCOTTISH ISLAND

Island Farm

By Dr. F. Fraser Darling. Pp. 224+26 plates. (London: G. Bell and Sons, Ltd., 1943.) 15*s*. net.

THIS book is a record of pioneer farming on the island of Tanera, one of the Summer Islands, lying a little way out from the mainland in western Ross-shire. Here the author and his devoted wife became the owners of an abandoned and ruinous house, and by sheer hard work, without, as the author says, any considerable bank balance to which to turn for comfort, have renovated the land with lime and basic slag, have repaired the ruined quay, have brought the garden again to life, and although their work is not yet completed, have changed the face of the land.

But this book is not concerned entirely with their days on what might be termed their home island, Tanera. There is a most interesting record of a journey to North Rona and a visit to Sula Sgeir. Readers of the author's previous book "Island Years" will remember that Dr. and Mrs. Fraser Darling remained on Rona throughout one autumn in order to study the home-life of the Atlantic seal. The second visit to that remote island fifty miles out into the Atlantic from Cape Wrath was made in the early summer of 1939, when (p. 81) the author found a colony of a thousand pairs of greater black-backed gulls nesting there. This must be the greatest colony of these large predatory gulls anywhere in the British Isles. Here he found the intestines of a bull Atlantic seal, which had died on that island the previous autumn, torn out by the gulls. The sun had dried these intestines—the author measured fourteen yards of them. The gulls had twisted them, time and again, in a fruitless effort to pull them to pieces, and in their twisted state the sun had dried the guts into a rope of great strength.

On Rona the author secured by flashlight what is probably the first photograph ever taken of Leach's petrel (p. 87) in flight.

From Rona a landing on Sula Sgeir was attempted, (p. 91) but was defeated by bad weather. But the author sailed round that rock in a motor launch, and estimated the number of gannets nesting there as four thousand pairs. It is likely that during the last four years the numbers have considerably increased, from Suleskerry Stack.

The main theme of the book is Tanera, an island homely as compared to Rona and no more than 1¾ miles from Baden Tarbat pier on the mainland. But even that island can be stormy enough upon occasion. There is a fine description (p. 173) of the great blizzard of January 18, 1941—a storm which I well remember in Skye, for the whole island was isolated by a greater depth of snow than had been experienced there for nearly thirty years. When they were half-way across to Baden Tarbat, the blizzard without warning swept in upon them:

"On Ben More Coigach there were huge plumes of driven snow flying from the several summits and ridges and shining in the sunlight in amazing beauty. Sea, sky and air—all reached a pinnacle of beauty in that moment, but contemplation of it was not my job. I knew that I gazed upon the coming of savagery of the elements, and did then what I have rarely done before: I turned back and berthed the launch before the harbour dried. . . ." When night came and the shutters were put up, "they could do nothing to prevent the terrible noise of the sea and the shaking and creaking of the little house. The byre was filling with snow when I went out to milk".

But even that blizzard was less severe than the one which followed on the night of March 26–27. The following morning, when Dr. Fraser Darling went out, what he saw (p. 176) was most remarkable. In his own words:

"When I went out in the morning I felt dazed, but things of interest revived me in a very short time. I was seeing things I might not see again—at least I hope I shan't. There were wrinkled crabs in the walled garden, not one but a dozen or so, and some were six inches across the carapace. Then I went into the park and found more crabs and many star-fish, and my collie found a ballan wrasse, weighing a pound and a half. The fish, and the crabs, are denizens of the sea just below low tide mark, and here they lay about the grass two hundred yards above the high tide mark. . . . Sometimes I wish I could have seen the great disturbance of the waters of the Anchorage which caused this to happen, and at others I feel that it was just as well to have been in bed."

That tremendous gale actually rubbed the bark from the apple trees, so that "it hung like the velvet from a stag's antlers in August".

Dr. Fraser Darling found (p. 195) that the rats which infest the island eat the pupæ of the green-bottle and bluebottle flies, and also the eggs of the Arctic tern, but are apparently afraid to enter a herring gull colony. The rats also make caches of potatoes up to 20 lb. in weight thirty or forty yards from the nearest row. When the author was trapping the rats he placed the carcases on a rock. The first three mornings the local ravens ate the carcases but never touched them after that: the author deplores the scarcity on his island of buzzards, which would have kept the rats in check.

The tree-planting experiments are interesting. Dr. Fraser Darling planted two hundred Corsican pines (*P. laricio*). Not one survives. We in the treeless north-west coast of Skye planted, as being hardy and salt-resisting, five hundred of these trees. Less than a dozen remain, twelve years after the experiment, and these survivors are barely existing and are no more than six feet high. Dr. Fraser Darling has found that Sitka spruce is the best tree, and this has been our experience also. But I believe that the best tree of all to plant would be Araucaria, the monkey puzzle, for, although not an attractive tree, it seems to be impervious to the salt-laden gales and grows absolutely erect and symmetrical in the most exposed island sites.

There is much interesting farming information in this book. To naturalists the author's account of how basic slag induced a strong growth of leguminous plants, and how those plants attracted the barnacle geese, is noteworthy. He describes in fine poetic prose (p. 210) how the geese have lost their fear of him and now feed actually in the garden, allowing him to approach to twenty yards of them without fear. A remarkable photograph of the geese grazing illustrates this. A deficiency of lime is found in most soils of the Hebrides. Dr. Fraser Darling advocates the liming of the ground from the coral beaches. He is fortunate in having a coral beach within reach. Where I write, in northern Skye, the nearest beach of this kind (and this has already been almost worked out) is forty miles distant.

Dr. Fraser Darling notes that, in addition to the barnacle geese, many butterflies have been attracted to the land and the cliff's edge through the application of basic slag.

This book is indeed one of unusual interest, written by one who knows his subject as no one else at the present day. It is written simply, and in attractive prose, and is illustrated by some fine photographs, which have resisted the austerity production of war-time. This war production may account for the absence of an index. SETON GORDON.

DISK-HARROWING VERSUS PLOUGHING

Plowman's Folly

By Edward H. Faulkner. Pp. v+162. (Norman, Okla.: University of Oklahoma Press, 1943.) 2 dollars.

WHERE is the folly? Mr. Faulkner declares it to be with ploughmen who bury green manures, weeds and stubbles many inches below the surface. He is of the opinion that ploughing places such material out of reach of crop roots and creates a sub-surface "blotter" which interferes with capillary movement of moisture. He advocates the use of the disk-harrow as a means of incorporating such materials into the soil surface. If land is prepared in this way, and not ploughed, Mr. Faulkner is persuaded that crop yield may increase five- or ten-fold. By disking plenty of green manure into the surface he believes crop yields can be secured against the vagaries of the weather. According to his predictions, such crops will not be seriously affected by drought, nor, on the other hand, will they suffer in wet seasons. Land drainage would be not merely unnecessary, it would be detrimental to such crops. They would also be practically immune from the ravages of insect pests. Furthermore, Mr. Faulkner is confident that by using the disk-harrow in place of the plough, weeds could be much more easily controlled, provided this practice is adopted over the whole of a considerable area.

All these high hopes have sprung from Mr. Faulkner's experiences in growing vegetables in a garden in 1938 and in growing market garden crops, mainly tomatoes, in 1939 and 1940. No measurements are quoted, presumably because none was made. Mr. Faulkner's folly in committing himself to print on so slender a pretext is infinitely greater than that of any ploughman.

The heavy disk-harrow must be drawn by a tractor. No horse-drawn implement could incorporate a green crop in the soil surface as a tractor-drawn disk-harrow can do it. Mr. Faulkner's thesis that it is better to incorporate a heavy green crop in the surface layer than bury it at plough depth is not unreasonable, and results of independent field trials are quoted in which a fifty per cent improvement in yield was obtained. There is a case for investigation.

Investigation by field trial is inevitably a slow business. The experimentation must be sufficiently extensive both in time and space to cover normal variations in climate and soil. The desire to short-circuit this process is understandable, but should be held in check. The factors influencing plant-growth are many and complex. Patient investigation has greatly extended our knowledge of them in recent years. In the long run, agriculture is best served by using this knowledge to design field experiments.

We do not commit the folly of declaring that no benefit can be derived from disking that could not equally be obtained by ploughing. Traditional methods should be constantly under critical review. It may be that the plough has gained and maintained its favour with farmers on account of the neat appearance of skilfully ploughed land. The awards in ploughing contests have undoubtedly been based on the tidiness of the work. No proof has been sought, and certainly none has been obtained, that land judged to be best ploughed is thereby put in the way of producing the best crops.

Hitherto the record of green manuring in Great Britain has been chequered. On the whole the benefits predicted by its advocates have not been matched by practical results. Admittedly most of these green crops have been ploughed under, not disked-in. Now that tractor-drawn disk-harrows are more widely available, some enterprising farmers in Great Britain will no doubt try their hand at disking-in a green crop without waiting for the results of carefully controlled experiments. Farmers are cautious men, and are not likely to take very seriously the extravagant claims made by Mr. Faulkner. R. K. SCHOFIELD.

STARCH

Starch and its Derivatives

By J. A. Radley. (Monographs on Applied Chemistry, Vol. 11.) Second edition, revised. Pp. xii+558+47. (London: Chapman and Hall, Ltd., 1943.) 36*s*. net.

THE second edition of this book is an improvement in many respects on that published three years ago. There has been a good deal of pruning of older work now obsolete, and many new chapters have been introduced which deal with a wider field of interest. Some of these have been contributed by recognized experts in the subject. An example of this is the section on the structure of starch which has been contributed by Prof. E. L. Hirst and Dr. G. T. Young. The reader is therefore introduced to some of the newer concepts of the constitution of starch derived from chemical evidence.

It is clear that the author has been at some pains to effect a considerable revision in this edition, and the result is that the monograph has gained in interest both for the general reader and for the expert. Even so, it cannot be said that the present volume provides much more than an introduction to a very complex subject, and, although the attempt has been made to give a critical review of the literature, the selection which has been made is not always well balanced or authentic in the conclusions which are presented. This is perhaps to be expected at this stage of the development of the chemistry of starch, where claims are often made which are conflicting, and where so much that has been written in the vast literature of the subject has to be discarded.

It can be said that the author has made a brave attempt to present in a concise form a very readable account of many of the reactions which starches undergo, and of the industrial and other uses to which they are put. Many readers will be grateful for the opportunity to use this monograph as a guide to the literature of the subject, including the original papers, and for a general survey which brings together much of the research which has been published and which is at present in progress.

GENETICAL CONTROL OF INCOMPATIBILITY IN ANGIOSPERMS AND FUNGI

By DR. K. MATHER

John Innes Horticultural Institution, Merton, London

ALTHOUGH the majority of organisms agree in showing some special control over their breeding systems, whether to encourage inbreeding or outbreeding, they display a great variety of devices by which control is achieved. In most animals the sexes are separate and so self-fertilization is impossible. In spite of this, however, a high degree of inbreeding can be achieved by controlled brother-sister mating, as in the grass-mite; or, on the other hand, inbreeding may be discouraged by various ancillary devices such as the production of unisexual broods or cyclical changes in sex. Discriminative behaviour in mating may also favour either outbreeding or inbreeding, or some combination of the two. In fact, it appears that the controlling devices are likely to depend for their working on any of the special characteristics and faculties of the organisms in question. This is strikingly illustrated in man, whose unique power of combining the transmission of rules of conduct, by means of what has been called tradition, with their enforcement by communal action, is used to govern mating in many different ways to give various degrees of outbreeding. Human matings may vary in advantage for non-genetic reasons in civilized and semi-civilized communities; but the occurrence of mating control even among the most primitive tribes shows that control must have arisen originally for genetical reasons[1].

In plants, as in animals, breeding control abounds, but it depends on a different set of devices. Plants are not mobile, and hence sex separation, or dicecy as it is here called, is not an efficient method of control, for it would involve an undue waste of gametes. Consequently, dicecy is relatively uncommon in plants, which rely on other means of governing the breeding system. Controlled inbreeding evidently may be achieved relatively simply, but outbreeding demands more complex devices[2].

First of all there must be some means of placing gametes from different individuals in appropriate juxtaposition. This may be done by growth of the parent individuals, as in fungi, but it often depends on the use of some intermediary, like water, wind or insects in higher plants. Thus we find adaptations to the use of such intermediaries, especially in the Angiosperms, where, for example, the means of attracting insects to the flowers are both complex and striking. But such adaptations, though clearly essential to outbreeding, will not of themselves suffice to secure its regular occurrence. The mere transport of gametes to another generative structure is not enough, because this structure may not be borne by an appropriate individual. Pollen may, for example, be carried by an insect merely from stamen to stigma of the same flower, or of a second flower borne by the same zygote in the Angiosperms. The plant must, in the last analysis, control the functioning of pollen for itself, if it is to exercise reasonable control of its own breeding. In the same way, though adjacent cells may not achieve fertilization in fungi, separate hyphæ of the same individual may grow together and mate unless some further restriction is imposed.

These further restrictions on inbreeding seem to be imposed in Angiosperms in two chief ways. There may be a time difference in the release of pollen and the receptivity of the stigma, such that certain types of mating are impossible. In protandry and protogyny this time difference will serve mainly to prevent effective pollination within a single flower, where, of course, it is most likely to be brought about; but it is unlikely seriously to hamper pollination between flowers of the same plant—a procedure which in the vast majority of cases has genetical consequences equivalent to those of self-pollination within a flower, as Darwin showed experimentally[3].

The second means of controlling effective pollination in Angiosperms is through the sorting out of the pollen, as delivered to the stigma, by the plant itself, with the prevention of functioning of inappropriate gametes. In fungi the same broad process is seen at work in the aversion, or at least ineffectiveness of contiguity, of inappropriate hyphæ. This general type of behaviour is described as incompatibility and appears to be widespread in the plant kingdom, though it is known by special names in some cases, for example, as heterothally in fungi. The underlying genetical and physiological mechanisms may vary too, but the main principle is always the same, namely, that there exist means whereby an individual, whether haploid or diploid, or even a single gamete, can discriminate for mating purposes among the functional gametes with which it might come into contact.

Incompatibility has been chiefly investigated in the fungi and in the Angiosperms. Discussion must therefore turn largely on the behaviour of these groups. In the former the haploid phase, generally speaking, dominates the life-cycle; though in the Basidiomycetes there is a compromise, a diplophase, with haploid nuclei and diploid cells. In the flowering plants, on the other hand, the haploid phase is so reduced as to be parasitic on the diploid. It is not therefore surprising, in view of the way in which special features of an organism appear to be used, where suitable, in the control of the breeding system, to find that while incompatibility is manifest between haploids in the fungi, the diploid phase plays its part in the Angiosperms.

In the fungi two levels of genetical elaboration may be recognized in the control of breeding[4]. The first involves control by a single gene of two allelomorphs, as in Mucor spp. and Ustilago spp. This prevents self-mating of the haploid, such as would lead to immediate homozygosis, but has no effect on the relative frequencies of homo- and hetero-zygosis following crossings of distinct haploids. In many of the higher fungi, however, greater elaboration is found, the genetical structure comprising one or more series of multiple allelomorphs, similarity for any one of which is sufficient to prevent effective mating. This is interpretable as an adaptation which, in addition to eliminating self-mating, decreases the relative frequency of mating between haploids originating from the same diploid or diplophasic zygote.

In Angiosperms self-mating of the haploid is ruled out by the separation of sexes between pollen and embryo-sac consequent on the extreme reduction of the gametophyte. The incompatibility mechanism is then concerned with the control of mating between haploids from the same zygote, which it can eliminate altogether and not merely reduce as in fungi. This elimination is achieved by the interposition of diploid somatic tissue, mainly in the form of the style, between pollen and egg. The stylar tissue, and perhaps also other somatic tissues of the ovary and

ovule, acts as a sieve which stops the tubes of certain genetical types of pollen, while permitting others to grow to successful fertilization. It may be noted that although within species the incompatible pollen is that which bears too close a genetical relation to the stylar tissue, the same system may also serve to exclude pollen which is genetically too unlike the female soma, that is, act as an isolation mechanism between species, as in Petunia[5]. Thus we may regard the stylar tissue as primarily a means of regulating the mating system of the plant, able to exclude both the too like and the too unlike (though, of course, other functions in adapting the flower to pollination by particular intermediaries have also developed). The female gametes themselves are protected and conserved in the sense that pollen with which these eggs would, as a general rule, give zygotes of inferior genetical constitution is prevented from achieving fertilization and so wasting the eggs. It is said that in some plants, like Gasteria[6] and the cacao[7], incompatibility manifests itself as a breakdown of development after fertilization. Such a situation can, however, scarcely be described as due to incompatibility in the present sense, for it omits the essential selective advantage of conservation of female gametes, and hence must have arisen in some other way. In fact, it is difficult to see how such a system could arise at all by direct selection. It must be a by-product of some other development[5].

The female haploid of the Angiosperms plays a purely passive part in mating discrimination, except perhaps in situations of the kind supposed to occur in Gasteria and the cacao. If the pollen tube can penetrate the female somatic tissue, it appears not to be repelled by the haploid organs of the embryo sac, and so encounters no further barriers to success. The diploid phase has taken full control on the female side. This is, however, frequently not the case on the male side. In incompatibility of the type first described in Nicotiana and Veronica, and now known to be widespread[8], the reaction is one between haploid pollen and diploid female soma. In all clear cases the genetical control is by a series of multiple allelomorphs, which act in such a way that pollen carrying an allelomorph also present in the stylar and related tissues is discriminated against. Pollen carrying an allelomorph not present in the female soma is not handicapped. It is characteristic of these systems, as of the genetically more elaborate fungi, that there should be a long series of allelomorphs, concerned with normal operation.

There are, however, also cases of Angiosperms in which the pollen grain is not autonomous in incompatibility. These are mainly afforded by heterostyled plants, though *Capsella grandiflora*[9] shows the same property without any morphological variation. In Capsella and distylic plants, such as the many dimorphic Primulas, the reaction of the pollen is most simply regarded as determined by the genotype of the soma which bore it. In Primula species, for example, the thrum type is heterozygous, *Ss*, and the pin type homozygous, *ss*, for the controlling gene. The *s* pollen of a thrum fails on an *Ss* style, where the *s* pollen of a pin is successful, but is successful on an *ss* style, where the pin *s* pollen fails. In other words, the male and female somata must be genetically unlike for success, the genetical constitution of the pollen being immaterial (Fig. 1.)

This simple interpretation breaks down with tristylic species, such as *Lythrum salicaria*, for here the position of anthers and stigmata in the flowers comes

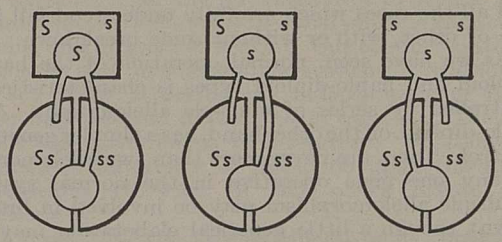

Fig. 1. Diplo-diploid control of incompatibility in Primula. Success or failure of the pollen (upper circle) in fertilizing the egg (lower circle) depends on the relations existing between the genotypes of the male soma (rectangle) and female soma (half circles). The genotype of the pollen itself plays no part in determining the reaction.

into play in a more striking way. A given flower produces pollen at two levels and each level has its own characteristic and distinct properties in incompatibility[10]. Thus the effect on pollen behaviour of the male somatic genotype is not so important as the immediate effect of the male soma where the pollen is borne. The behaviour of certain homostyled types of *Primula sinensis* suggests that the same mechanism may be operative in distylic species[11], but here, however, differentiation between the two possibilities is not final.

Whatever the mechanism of action of the male soma may be in such cases, it is at any rate clear that the behaviour of the pollen in incompatibility is determined by physiological differentiation of the zygote which bore it. Thus we can recognize three main incompatibility systems. The first, as found in fungi, is haplo-haploid in that it depends on a reaction between two haploids. The second is haplo-diploid, as in Nicotiana, where haploid pollen and diploid stylar tissue are involved. Lastly, we have the diplo-diploid type of Capsella and the heterostyled plants, in which the action of the haploid pollen is that impressed on it by the diploid soma from which it came (Fig. 2). There may perhaps exist intermediate or compound types of control, since the genetical basis of incompatibility as found in many Angiosperms has not yet been adequately analysed on account of its apparent complexity. In some cases the complications must be due to partial breakdown of the system through hybridization or other cause of disturbance of the polygenic balance on which the maintenance, as opposed to the operation, of incompatibility appears to depend[12]. It is, however, not yet clear that this accounts for all the complications. But whatever the situation may be, the three types under discussion must represent the basic categories,

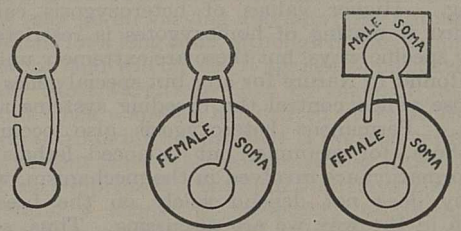

Fig. 2. The stages in control of incompatibility by the diploid phase. In the haplo-haploid, incompatibility depends on the genetical relations of two haploid cells; in the haplo-diploid, on the genetical relations of haploid pollen and diploid female soma (the egg being passive); and in diplo-diploid on the relations between male soma (the reaction type of which is impressed on the pollen it bears) and female soma.

and all the cases which are fully understood fall into one or other, with or without some breakdown.

As we have seen, normal operation of the haplo-haploid and haplo-diploid types is characteristically controlled by series of multiple allelomorphs. The diplo-diploid, on the other hand, has a simpler genetical control. There are never more than two allelomorphs of any one gene operative in the normal system (multiple allelomorphism may be involved in breakdown), though a little genetical elaboration may be introduced by the operation of two loci, as in Capsella and Lythrum[13]. My colleague, Dr. D. Lewis, has pointed out that this difference in genetic control is probably a reflexion of the two types of gene action involved. In the haplo-haploid and haplo-diploid each allelomorph may be regarded as essentially individualistic in action, for only a single allelomorph can be operative in any one reaction. Hence no question of combining and co-ordinating the action of two allelomorphs arises, in the way that it must with the diplo-diploid system, which may thus be physiologically restricted.

The three types of incompatibility systems form a series of increasing control by the diploid phase. Is there any corresponding increase of efficiency and advantage to the plant ? It is not difficult to see that the intervention of the diploid phase on the female side is advantageous. Haplo-haploid control can prevent inbreeding at the first and most extreme level, namely, self-mating of a haploid leading to immediate homozygosis ; but it can never wholly eliminate the occurrence of inbreeding, at the second or zygotic level, by mating of haploids from the same parent zygote. This may be of lesser importance in fungi, where the spores of a zygote are broadcast widely ; but in an Angiosperm it is a matter of considerable moment because self-pollination, leading to mating of male and female haploids from the same zygote, may be unduly common unless restricted. The interposition of the style in the incompatibility system allows of complete elimination of this contingency, if advantageous, with the result that inbreeding is controlled at the zygotic level.

The second difference in the degree of diploid control, that on the male side, seems to lead to no increase in efficiency. The suppression of inbreeding at the zygotic level is achieved by the action of the diploid style, and given free dispersion of pollen and seed the prevention of self-pollination ensures maximum outbreeding. Breeding systems must be regarded as essentially adjusted to controlling the degree of heterozygosis of the population[14], and the maximum heterozygosis obtainable for all the genes of an organism by this means alone is that given by random mating. Higher values of heterozygosis can be obtained if mating of homozygotes is restricted in highly specific ways, but these are extremely unlikely to be found in Nature for any but special genes such as those which control the breeding systems themselves. Permanent heterozygosis also occurs in Oenothera, for example, but balanced lethals and ring-formation are involved in the mechanism, which thereby does not depend solely on the breeding system in the way we are discussing. Thus, so far as mating control is concerned, inbreeding in flowering plants is largely a matter of self-pollination. Indeed, as measured by Wright's inbreeding coefficient[15], the rate of inbreeding may be calculated to a first approximation, the adequacy of which depends on the adequacy of seed and pollen dispersal, from measurements of the natural rate of self-pollination.

From this point of view the haplo-diploid system is no less efficient than the diplo-diploid, for both can give maximum outbreeding, namely, effectively random mating in all but the smallest populations. Indeed, where pollen and seed dispersal are not free, haplo-diploid systems may have an advantage over the diplo-diploid as we know it, since the multiple allelomorphs of the former permit somewhat freer mating between non-sister zygotes than between sisters. This superiority of control at the third, or sibling, level of inbreeding seems, however, likely to be an advantage too trivial to warrant consideration at the present stage of analysis ; but a second potential disadvantage of dependence on two allelomorphs is more serious. In distylic plants, with one gene of two allelomorphs, any individual can mate successfully on the average with only one half of its fellows. In tristylics this fraction is raised to something like two thirds, but in the haplo-diploid system, with many allelomorphs, the effective fraction must approximate closely to unity. Thus mating efficiency is higher and gametic loss lower with a haplo-diploid control, though the gametic loss is perhaps somewhat reduced in the diplo-diploid type by the heterostyly with which it is so regularly associated.

The diplo-diploid system has, however, one compensating advantage, in that the haplo-diploid requires a minimum of three allelomorphs for its operation whereas the diplo-diploid requires but two. For this reason it may well be that the genetical situation necessary for the origin of a diplo-diploid control is simpler and more likely to occur than that for the haplo-diploid. In view of this it seems that diploid and haploid controls of the incompatibility reaction on the male side cannot on balance differ markedly in the relative advantages which they carry. This is in sharp contrast to the corresponding situation on the female side, where the advantage of diploid control by the interposition of the style is always clear in affording the possibility of eliminating mating between both the too like and too unlike. It is thus not surprising that the structure through which diploid control on the female side is exercised should be a universal feature of the higher plants, whereas there is apparently no corresponding uniformity of control on the male side. Perhaps if a form of male control should arise, combining the ease of origin of the diplo-diploid type with the efficiency of operation of the haplo-diploid, it would supplant both the existing types. Such a system would presumably use both the multiple allelomorphs of the haplo-diploid and the co-ordination of gene action necessary to impress a somatically determined behaviour on the male gametes in the way shown by the diplo-diploid. It is, however, not yet clear how, or even whether, such a system is a developmental possibility.

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THE ILLUSION OF PERSONALITY*

By H. G. WELLS

THE integrality of the individual in the higher Metazoa is a 'biologically convenient delusion'. The expression 'psycho-analysis' implies a mental unity which can undergo analysis. This is the delusion. The reactions of the human machine are loosely linked behaviour systems, participating in a common delusion of being the self. Most lower animals react to stimuli without hesitation. As we ascend the scale *inhibition* appears. There is no longer a mere algebraic summation of stimuli. There is reference back to a storage organ, a 'brain'. According to the record of that storage organ, the organism, not as a whole but as much of it as is affected by the recorded stimuli, reacts. Circumstances may have changed and it may act disastrously, or it may 'profit by experience'.

The *conception of self* appears most evidently in gregarious animals, which have to conduct themselves with regard to the flock or pack. The sub-men seem to have been gregarious running animals, less like the solitary great apes than the baboons. Self-consciousness and a conception of other individuals as consistent persons are necessary to gregariousness. The self-conscious social individual, *whatever it does and however much of it does it*, will ascribe its behaviour to its self, the same self, in continuous operation.

A man awakening from sleep imagines, when he has rubbed his eyes and yawned, etc., he is 'all there'. He is not. The evanescent impressions of dreamland give way to a more vivid reaction-memory-and-event-system which has established a by no means perfect control over what are called the voluntary muscles of his body. Body holds mind together and not mind body. The body goes as the dominant system in the neuro-sensitive apparatus directs, but other reaction systems are either deflecting or ousting the dominant system.

There are endless variants of 'John Smith'. He will admit in ordinary speech that he 'has his moods' and sometimes 'forgets himself'. It is John Smith No. 214, John Smith who had a dispute with his employer yesterday, who wakes up, the indignant employee. He rehearses a spirited conversation with his 'gov'nor'. He sees his wife's portrait on the mantel and succumbs to resentment and jealousy. The recalcitrant employee is simply not present. John Smith, under control of No. 618, goes down to breakfast in a dark, unloving mood. All the Smiths, from No. 1 to No. 5,000 or No. 5,000,000, have a common belief that John Smith is really one person, because they are not only all aboard the same body, but also built round a similar conception of himself, his *persona* as Jung has it. *In fact, they are a collection of mutually replaceable individual systems held together in a common habitation.*

If the systems vary widely, John Smith is a moody man. If still more widely, you have at last a 'double personality'. Whatever system dominates at the time owns John Smith and believes itself to be wholly and solely John Smith.

Conduct systems of reaction require a fable to hold our *selves* together and put them over to others. The neuro-sensitive apparatus in social animals cannot do a thing and forget, cat-fashion. Our conduct systems, whenever they invade simpler systems of reaction in us, set about attacking the independence of these other impulses and drawing them together. They go about like governesses, drill-sergeants, imposing an impossible uniformity of discipline upon the mute unconscious elbowing of our other drives and reactions.

In order that the *persona* should be as consistent as possible in its autobiographical effort, these conduct systems, which concern themselves with the reputation of a human body, ignore aberrant impulses, push them away into what the analyst calls the unconscious, that is, a multitude of reaction systems out of contact with the main directive system. The psycho-analyst says they are below in a dungeon; the behaviourist says they are at large outside. The contradiction is flat.

Jung called this excluded stir the *anima*. It may contrast markedly with the material in the *persona*. It stirs, says the psycho-analyst, beneath the conscious life. It skulks, says the behaviourist, on the edge of the waking life.

That the integrality of the human individual is illusory does not sweep aside continuity from life. The individual belongs to his species, which existed before he appeared in the world, and will outlast him. Generally a man does not realize that. He may refer himself to a family, to a tribe, to a school, to a real or imaginary 'race', to a creed—indeed to a vast variety of larger aggregations. He may fluctuate in his terms of reference. So he thinks and feels. The biological reality is that while he can interbreed with every variety of human being, he goes on as a unit in the whole species, and, whatever frame of community he adopts, it can, from the ecological point of view, have no narrower boundary than the species. Every individual is in the nature of a unique experiment. There is no experimenter nor question behind it; it is an unpremeditated experiment.

It may be rejected at once; or it may have survival value in itself. By surviving it changes the totality of the species by its individual difference. In the generality of cases the difference is slight, and such individual cycles are called *normal*. Their collective effect is that of confirmatory experiments.

A marked and sudden difference is called a variation. The causes of a variation will almost certainly be acting not merely in one case but also upon groupings of similarly situated genes. So long as the individual variation has the qualities that enable it to survive and reproduce itself it will do so.

There is no benevolent bias in that survival. A species may go on varying and surviving through its individuals for a long time, although it is accumulating a variation that will disarm it against some conclusive danger. Most variations have no survival value at all; but when a species has drifted into disharmony with its surroundings—and that is the case with ours at the present time—then abnormalities which would have been suppressed in the humdrum days of security may stand a chance of temporary establishment. Palæontology shows repeated evidence of a sort of flurry of abnormalities before the collapse and obliteration of some dominant group which has outstayed its welcome. This seems to be the case with man to-day.

From its first appearance, the human animal was too widespread and too thinly spread to produce a

* An abridgment of a thesis on "The Quality of Illusion in the Continuity of the Individual Life in the Higher Metazoa, with particular reference to *Homo sapiens*", accepted for the doctorate of science of the University of London. Copies of the complete thesis are available to scientific institutions free of charge; otherwise it is two guineas unsigned, which will be devoted to the propaganda of the Natural Rights of Man, of which Mr. Wells is acting secretary.

homogeneous *Homo sapiens* throughout the earth. There has been more homoplasy and less of diffusion in Homo than is commonly believed.

Migrations began only in the past ten thousand years or so, when the social structure had developed means of conquest and exploitation. At a far remoter period exiguous human races ranged seasonally over wide territories, incapable, for lack of transport or organization, of sustained aggression or enslavement. The seasonal movement of gregarious food animals, horses, cattle and the like in response to pasture may have led to seasonal gatherings of these far-flung tribes from considerable distances, with little or no spirit of feud or aggression.

The leavings of Solutrean men suggest a gregariousness in which the individuals were more self-reliant and socially tolerant than their descendants. These early nomads exchanged goods at these primordial fairs, as the distances of many early artefacts far from their sources testify. With the dispersal of the food beasts this human gathering dispersed again, with quite possibly a woman or so and an artificer going off with a new party. He or she would not need to learn a new language, when grunts and gestures remained the language of mankind.

Time estimates of these periods defeat even geologically trained imaginations. Our grip on big quantities is a feeble one. We have got beyond any other animals by checking with our digits, but our sense of a hundred is foggy, and few will agree whether a crowd was a thousand or three thousand strong. Beyond these limits we *concertina*. We have a 'gibus' sense of time. A thousand years is a huge succession of yesterdays beyond our clear apprehension. If we reflect on the changes in social life since the Christian era, we may achieve an intellectual if not a realistic comprehension of the remoteness of these wanderers from whom we spring. Many people believe that our ancestors were like the Australian aborigines. These 'primitive peoples' are imagined as having been marking time for a hundred thousand years. But in that interval they have been subjected to climatic changes, changes of food, new environments. They have experienced dark ages and phases of recovery. Anthropologists underestimate the intervals in which these systems have decayed and revived and changed and become something quite different. The 'primitive' Australian *talks*, and he has a complex grammar. He betrays traces of admixture, and, if we bring geographical shifting into consideration, we are forced to conclude that in the past there must have been trading, a 'pigeon' language, and ideas and imitative stimuli from other drifting peoples. One may doubt if one can exaggerate the mental remoteness of these creatures whose lives are the basis of our thought and feeling. The makers of eoliths and of Chellean implements gave place to Acheuleans, to Mousterians, to Aurignacians, Solutreans and Magdalenians. Meanwhile every species of large animal contemporary with the Acheulean had become extinct. Can we imagine, then, that the ascent of man has been simple and straightforward from Neanderthal to Beckenham, Paris and the Riviera ?

We make our way painstakingly to the fact that the mind of ancestral man was essentially unlike ours, and that the species was living under conditions still mostly unimaginable. He was not only different from anything human we can talk to, but, from the very beginning, he was also different *inter se*.

A species is a species so long as it can interbreed and its kindred varieties, however divergent, can be recognized. There never was an original dog. Dogs are anything but select in their emotional phases. If an end came to dog fanciers, Canis would go back to a variety of mongrels, reflecting the regional opportunities in which they found themselves.

Gregariousness is a subordination of the individual to the herd. The individual merges into a wider synthesis, a vast sentient web overspreading many acres ; becomes shareholder in faculties always awake, eyes that see in all directions, ears and nostrils that explore a broad belt of air ; a super-individual occupying every bit of ground whence the approach of an enemy can be detected. Each individual receives a maximum of security at the cost of a minimum of individual animation. When an animal which has been accustomed to a gregarious life is isolated, it feels itself exposed to danger from every part of the circle around him, except the one point on which his attention is momentarily fixed. His glance is restless and anxious, and is turned in succession to different quarters ; his movements are hurried and agitated, and he becomes a prey to the extremest terror. The blind instincts evolved under those conditions have been deeply ingrained into our breed, and they are a bar to that freedom the forms of modern civilization could assure. A modern community must be held together by stronger forces than are derived from the purely gregarious instincts. It cannot be a mob of slaves, clinging together, incapable of self-government and begging to be led ; because it will always be led to disaster. It must consist of vigorous, self-reliant men, knit to one another by a strong, tense and elastic community of will and understanding.

The personal life of the individual will still continue, held together by the individual body. Within its conditions that may be a very intense and passionate existence. Many of the bodily phases that constitute John Smith may be preoccupied with sex. The sexual stir of the contemporary Homo is renewed monthly, unlike so many of the larger Eutheria, which have their annual rut. These phases are dependent upon the secretion of gonads, which again seems to be determined by the fluctuations of innate rhythms under climatic and correlated physical influences.

There has been an enormous and biologically unserviceable over-development of those aspects of life in the handy and intelligent Primates. The release of hand and brain by the adoption of the erect attitude during the human dawn, and the revival or continuation of some primitive monthly breeding cycle among the sub-human and human series, stimulated a recurrent or almost continuous interest in the orgasm that is only too manifest in a cageful of monkeys or any over-fed and idle social group—both confined and unemployed groups. But while the monkey's interest is unabashed, contemporary man is in a state either of defiant indulgence or passionate suppression that disorders all his social life. Christianity, Islam and Judaism are all phallic religions, and 'morality' over a large part of Christendom means nothing more than values attached to sexual behaviour.

But we do not know how long this stress on sex as 'morality' has lasted. Dawning man, except under deprivation, may have been as shameless and casual as a monkey. Those primordial fairs were amiable corroborees, free of competitive or possessive ideas. We may describe man, in those sparse days, as under-

sexed. The male and the female of the species excited one another and achieved a mutual or substitutional relief; it was all over in no time, and that was all about it. The manner in which the sexual urge lies in wait, so to speak, and seizes upon and makes use of any unemployed mental energy in *Homo sapiens* has still to be worked out in detail.

There have been and still are wide and rapid variations in the relationship-phases of men and women, and nowadays a woman will be either a subjugated meretrix or a hard-minded and responsible equal, just in the measure that her sexual impulses and status dominate or are secondary in her *persona*. The decision rests upon womankind and the atmosphere they will create.

Every living thing, in obedience to its hormic urge, seeks to assert itself over other things that move about—over other life or over inanimate things that are imagined as having life. "This," in effect says life, emerging to a consciousness of others, "is not going to beat me." This primitive uneasiness to reassure oneself that one has the upper hand of the not-me is still far more persistent than any other urge. We assert these selves through a huge miscellany of claims. The claims we make depend upon our upbringing and the ideas imposed on us. We pride ourselves on 'race', country, class, family, 'set' or dollars, intuitions, exceptional muscles or remarkable characters. We gravitate to the groupings in which these are key values.

Man in his dawn was certainly not so collectively maladjusted as the man of our own time. Contemporary man *en masse* is definitely a degenerate creature, in the sense that he presents no collective resistance in the face of change. He experiments only feebly in adaptation; he persists in his follies.

But since we have some two thousand millions of him varying about the average cases *of any particular quality*, whatever it may be, the exceptional instances are likely to have a wider range than in any previous period. These exceptional types will include, among others less biologically favourable, types of self-forgetfulness in some impersonal interest.

The factor in the individuals of this emergent *élite* is a development of the natural curiosity, the picking and searching hands and eyes of our ancestors. The dominant phases of the unrestrained man, as distinguished from the suppressed individual in our now disintegrating modern communities, are those of an inquirer and maker. His unrestrained phases discover an innate desire for mastery; in invention (artistic or 'practical') and construction, according to his aptitude. The profounder disposition of mankind is to make, and to sublimate self in the discovery, each man, of his own idiosyncratic creative possibility.

In the case of an intellectual *élite* there will be recurrent phases in their lives when an ecstasy of discovery will possess them. They will stand "silent upon a peak in Darien". They will be looking upon something, hitherto hidden, which will now be the property of all mankind. They must descend again from that great moment into the shadow of their personal selves, but the achievement will remain as an enduring contribution to the human synthesis.

The spreading realization that personality is illusory will not abolish the practical reality of individual living. This warp and woof of hallucination provides the fabric on which lives are lived, just as the cinema screen supplies the fabric on which personal dramas are played out. To realize that the drama is hallucinatory will be to escape from ultimate 'explanations' of life, from priestcrafts and mental muddles that have embittered human relationships hitherto, but it will not release human beings from 'conduct'. It will, however, lift them into a new atmosphere, and mitigate profoundly the confused motivation of that long "Martyrdom of Man" which is now drawing to an end.

OBITUARIES

Sir John Farmer, F.R.S.

By the death of Sir John Farmer on January 26 biology has lost an outstanding figure, one who did much for the development of botany and for the extension of its applications.

John Bretland Farmer was born on April 5, 1865, at Atherstone and was for a time at the Atherstone Grammar School, but was later educated privately. A country upbringing and a knowledge of the farmer's outlook was of great value to him in his later efforts to use botany for the advancement of agriculture. He went to Magdalen College, Oxford, in 1883, and took a first-class in the Honours School of Natural Science in 1887. In that year he was appointed demonstrator in the University, for Bayley Balfour, who was then Sherardian professor of botany, early recognized Farmer's intellectual gifts and fostered his botanical development in every way. Farmer would often speak in warm tones of the inspiring influence of his old teacher, who was both botanist and gardener. In 1889 he was elected to a fellowship at Magdalen.

When Huxley retired from the headship of the Biology Department of the Royal College of Science at South Kensington the chair was replaced by two assistant professorships, the botanical one being filled by the late D. H. Scott. When Scott retired in 1892 he was succeeded by Farmer, the position being raised to a full professorship in 1895. Farmer remained at South Kensington for thirty-seven years, retiring only in 1929.

Farmer's long period at the Royal College of Science (later to become an integral part of the Imperial College of Science and Technology) was one of remarkable development and expansion of the department. In Farmer's early years at South Kensington the department was housed in two rooms at the top of the building in Exhibition Road and the staff was a professor and one demonstrator. When he retired in 1929 the department occupied two large buildings in Prince Consort Road and consisted of five sub-departments, each with a professor at its head.

Farmer was not only a scientific investigator but also a man of vision who had his own distinctive idea as to the direction in which the department should develop. Fifty years ago academic departments of botany held aloof from the practical application of their subject. Farmer, however, early realized how much trained biologists (plant pathologists, geneticists and plant physiologists) could do not only for agriculture in Great Britain but also for the plantation industries overseas and for tropical agriculture generally. He therefore set himself to provide such a training in pure botany as would equip men for work in applied botany abroad. This aim he fully achieved and his students were soon occupying important positions in Colonial agriculture. Some measure of his success may be gathered from the

testimonial given to him on his retirement. Of the old students subscribing, fifteen were in India, ten in Africa, seven in the British West Indies, seven in the Federated Malay States and Borneo, six in Egypt, five in Ceylon and a number in Australia, New Zealand, Burma, Iraq and Japan.

In the pursuit of these aims Farmer did not, however, allow the torch of pure learning to be dimmed. He had wide interests in botany and published work in various fields, and he did distinguished work as a cytologist before the boundary between cytology and genetics had broken down. In 1907 he gave the Croonian Lecture of the Royal Society—of which he had become a fellow in 1900—his subject being the "Structural Constituents of the Nucleus and their Relation to the Organization of the Individual". He received a Royal Medal in 1919 and was a vice-president during 1919–21. Farmer was a writer of clarity and directness, qualities which he himself ascribed to a youthful drilling in Latin. He wrote several smaller books on elementary botany and with A. D. Darbishire edited the translation of "Die Mutations Theorie" by de Vries. He organized and during its early years was editor of *Science Progress*. He edited also the *Gardeners' Chronicle* during 1904–7 and for a number of years the *Annals of Botany*.

Farmer, with his broad scientific knowledge, his grasp of affairs and his powers of decision, was naturally in great demand where the organization of what might be called plant technology was concerned. He was a member of the small Inter-Departmental Forestry Committee, on the report of which the Imperial Forestry Institute was founded. He served on the Milner Committee, and played a large part in the establishment of the Imperial College of Tropical Agriculture in Trinidad. He was a member of the Advisory Council of the Department of Scientific and Industrial Research from 1920 until 1926, and it was during that period that the Forest Products Research Board was organized, and he was its first chairman. To the Empire Cotton Growing Corporation, especially in its early years, Farmer gave notable service. On behalf of the Corporation he and Mr. L. G. Killby visited Trinidad in 1925, and as a result of their report the Cotton Research Station was set up in 1926. He also gave invaluable advice and help when the Corporation established a postgraduate studentship scheme for the recruitment of its staff. Later he was to serve on a committee set up by the Secretary of State for the Colonies to inquire into the training of agricultural officers for the Colonies. Farmer, from his experience of the Corporation's scheme of postgraduate studentships, advocated a similar one for the Colonial Office. As a result of the Committee's report an entirely new scheme of recruitment for the Colonial Agricultural Service was established. Farmer's advocacy was of the greatest value, for the scheme brought about an almost revolutionary improvement in the qualifications of the Colonial agricultural officer. Farmer was active in many other ways—as a member of the Research Committee of the Rubber Growers' Association, of the Royal Commission for the Exhibition of 1851, and of the governing body of the Imperial College, on which he served from its establishment in 1907 until his retirement. He was knighted in 1926.

Farmer was a man built on generous lines both in mind and body. He stood well over six feet, and the big muscular hands of his large-boned frame were equally good at cutting a botanical section, tying a fly, or giving confidence on the rope to the tyro whom he was instructing in the craft of rock climbing; for he was botanist, fisherman, mountaineer and, not least, gardener. In all these pursuits Farmer was the born teacher, always ready to pass on his knowledge, and delighted if he could inoculate others with his enthusiasm. Farmer was a steadfast friend, and since to a knowledge of men and affairs he added the quality of 'allroundaboutness' of outlook, one could go to him in a difficulty with the certainty of receiving counsel of rare balance and wisdom.

V. H. BLACKMAN.

Prof. J. W. H. Eyre

BRITISH bacteriology and Guy's Hospital both lost an outstanding personality when Prof. J. W. H. Eyre, emeritus professor of bacteriology in the University of London, recently died at the age of seventy-five. Entering Guy's as a medical student in 1889, he qualified in the minimum time, graduated M.D., M.S., in the University of Durham and received his first hospital appointment. This initial experience as registrar in the Ophthalmic Department was an appropriate introduction to the delicate, small-scale experimental laboratory work to which he was later to devote his life. In fact, his first research, though ophthalmic, was essentially bacteriological, culminating in his description of tuberculosis of the conjunctiva which stands a classic to this day. At that time (1895) all hospitals, realizing the great future of medical bacteriology, were developing laboratories accordingly, and inevitably Eyre was attracted by this new trend. In 1899 he gave up eye work entirely for the post of bacteriologist to Charing Cross Hospital, where he became the first Ernest Hart Memorial Research Scholar and at once began to devise new technical methods, and showed such genius for the work that three years later he was invited to occupy the corresponding post at his own hospital. He never again left Guy's and there centred the whole of his remarkably industrious and productive career.

In 1905 he was invited by the Royal Society to join the Advisory Board of the Commission on Mediterranean Fever. Working overseas as chairman of the team experimenting in Malta he was associated with a number of results which did much to advance our early knowledge on Brucella infections and paved the way to their ultimate control. Returning home he resumed his former work of bringing law and order into the still somewhat chaotic state of routine bacteriological investigation, and shortly after published his standard work, "The Elements of Bacteriological Technique", which, when consulted to-day, shows us his pioneer conception of a remarkable number of modern methods. About this time he was elected a fellow of the Royal Society of Edinburgh. Soon, bacteriological diagnosis becoming more accurate, he found it possible to give his research a more direct medical bearing, and over this period he published with his clinical colleagues many case notes on infective disease.

Most notable, perhaps, was his work on the varieties of pneumococci associated with different respiratory infections, a true forerunner of later developments, and also his proof that much institutional dysentery was really of the Flexner type. Meanwhile the amount of work entering the laboratories at Guy's was increasing so rapidly that the Governors of the Hospital wisely decided to develop a new and completely up-to-date department. This they entrusted to Eyre,

giving him an entirely free hand, and the result was possibly one of his major contributions to his subject. For many years his laboratory stood as a model for others, both as to its design and its system of records, references and accounts. It was, in fact, still meeting every demand made upon it even at the time of his retirement twenty-five years later, a remarkable example of his exceptional skill as organizer as well as scientific worker. Its opening coincided with the outbreak of the War of 1914–18, and as might be expected, although the Department was never under direct Government control, a very large amount of work directly aiding the Services passed through it. Eyre's peace-time activities had brought recognition in the form of appointments as Erasmus Wilson Lecturer and Hunterian Professor at the Royal College of Surgeons and Milroy Lecturer before the Royal College of Physicians.

The moment war broke out he placed the facilities of the laboratory at the Government's disposal, and the first big work undertaken concerned the urgent task of systematically detecting the many typhoid and paratyphoid carriers returning from the British Expeditionary Force. Methods were standardized and compared and a complete system instituted which must have prevented many home outbreaks. In 1915 Eyre was appointed as a civilian pathologist in the London District Command, and co-operated in improving and selecting the various anti-enteric vaccines which later proved so successful in France. Then the second great war-time infection threatened, namely, cerebro-spinal fever, and his laboratory again was active in investigating both meningococcal carriers and acute infections. It is interesting to note in his reports of those days how he insisted, and was ultimately proved correct, that cerebro-spinal meningitis is primarily a septicæmia. A little later, these urgent investigations being over, Eyre turned his attention to the then somewhat inadequate bacteriological facilities available to the many semi-private military hospitals which were springing up all around London, and we find him displaying really astonishing energy as honorary bacteriologist to a very large number of them. Military, Royal Flying Corps, and American units were included, and the volume of personal work he must have got through at that period was enormous.

When the influenza epidemic attacked Great Britain, Eyre at once found himself involved in the investigation of the prevailing secondary respiratory tract infections and the possibility of preventing them by prophylactic vaccine. In this case he was particularly concerned with the New Zealand Forces, and at one period his Department placed half a million doses of vaccine at the disposal of the Army Medical Department of the War Office inside seven days. Records show how greatly this work must have reduced the incidence of complications. In April 1918 he was invited to join the Trench Fever Committee of the War Office and co-operated in proving this disease to be louse-borne, although the War ended before the exact nature of the organism could be determined. His final war-time contribution was as a member of the Chemical Warfare Committee of the Medical Research Council, the work of which guaranteed our preparedness in that sphere at least.

The return to peace conditions called for considerable departmental reorganization, and Eyre's was one of the first to get into its stride again. A rapidly expanding venereal disease clinic at his hospital brought new volumes of serological work, and he was concerned with many serial observations on the comparative value of the Wassermann reaction and the various flocculation tests for syphilis. Also Sonne dysentery was coming to be recognized as a real threat to institutional life, and one of the earliest fully recorded outbreaks was observed in his laboratory.

Having held a readership for many years, Eyre was in 1920 appointed professor of bacteriology in the University of London, and from then onwards his activities in medical societies and committees became even greater. He had been president of the Section of Bacteriology and Pathology at the British Medical Association meetings of 1933 and became president of the Royal Microscopical Society in 1920. Later he held the same office in the Hunterian Society and the Royal Institute of Public Health and Hygiene. He attended many overseas meetings and was well known on the Continent. His editorship of the English translation of Kolle and Hetch's "Experimental Bacteriology" was admirable.

Although the scientific world will remember Eyre chiefly as an inventor of technique, his colleagues at hospital always realized that he had considerable clinical gifts. He was always about the wards and his advice freely taken. He produced with Dr. Bosanquet a most useful little manual, "Serums, Vaccines and Toxins in Treatment and Diagnosis". The passing years never seemed to affect his remarkable energy, and his strong personality carried him along, always in harness, to the very end. An interesting appointment which he held for a good many years was that of bacteriologist to the Worshipful Company of Fishmongers, and he may be said to have thereby controlled the bacteriological purity of the nation's fish supplies, doubtless preventing innumerable epidemics. But this work had its essentially scientific side also, and he produced several beautifully illustrated monographs on the bacteriology of the edible molluscs.

His colleagues at Guy's will always remember the minute, neat, intensely active figure of "Johnny" Eyre. Everyone knew, honoured and loved him and, when he retired from the active staff of the Hospital in 1934, gave him a memorable farewell dinner. But he never entirely deserted his Medical School, and was seen about the laboratories less than a week before his tragically sudden death. Those who actually worked with him will greatly miss the inspiration which he always gave to them and his unfailing interest in the welfare of everyone ever connected with his old Department. There are many working in the medical laboratories of to-day who, for the excellence of their earlier training, owe him a very great debt of gratitude. F. A. KNOTT.

WE regret to announce the following deaths :

Dr. J. McKeen Cattell, editor of *Science* since 1894, and also of other American scientific journals, on January 20, aged eighty-three.

Mr. A. W. Clayden, principal during 1894–1920 of University College, Exeter, known for his reports to the British Association on the measurement of cloud altitudes, aged eighty-eight.

Mr. A. Eidinow, of the National Institute for Medical Research, London, known for his work on the principles of ultra-violet ray therapy, on March 22.

Dr. James H. Kimball, since 1936 principal meteorologist of the U.S. Weather Bureau, on December 21, aged sixty-nine.

NEWS and VIEWS

Prof. W. H. Pearsall, F.R.S.

PROF. W. H. PEARSALL, who has held the chair of botany at the University of Sheffield since 1938, has accepted an invitation from the University of London to become Quain professor of botany at University College, London, from October next. Prof. Pearsall is a graduate of the University of Manchester. After serving in France in the War of 1914–18, he became lecturer and afterwards reader in botany at the University of Leeds, where he founded his reputation in research and teaching. His researches cover a wide range in the fields of ecology and plant physiology, but it is for his contributions to plant ecology that he is best known. He was the first in Great Britain to make a comprehensive study of the vegetation of lakes and to work out the essential relationship which exists between the type of aquatic community and the nature of the substratum. This led to the recognition and the elucidation of the relationship which also exists between the distribution and periodicity of the plankton algæ and the character of the dissolved substances present in lake waters. His work on these problems and others connected with the plant communities of woodland, moorland and bog considered in relation to soil chemistry has given inspiration to many plant ecologists. His contributions to plant physiology include numerous papers on growth and nitrogen metabolism.

Prof. Pearsall acted as joint secretary of the Society for Experimental Biology for many years, he became editor of the *Journal of Ecology* in 1938 and was elected a fellow of the Royal Society in 1940. He played a leading part in the establishment and progress of the Freshwater Biological Association of the British Empire, and for many years conducted postgraduate vacation courses at the Association's laboratories at Wray Castle, Windermere.

New British Agricultural Attaché at Washington and Agricultural Adviser at Ottawa

PROF. JAMES A. SCOTT WATSON, Sibthorpian professor of rural economy in the University of London, who for the past two years has been agricultural attaché on the staff of His Majesty's Ambassador to the United States of America and agricultural adviser to the High Commissioner for the United Kingdom in Canada, will shortly be returning to Great Britain and he will be succeeded by Prof. Robert Rae, professor of agriculture in the University of Reading. Prof. Rae was trained at the University of Edinburgh and the Edinburgh and East of Scotland College of Agriculture. After a short period as lecturer in agriculture at the East Anglian Institute of Agriculture at Chelmsford, in 1921 he became vice-principal of the Hertfordshire Institute of Agriculture, St. Albans. In 1925, he left St. Albans for Northern Ireland, where he was appointed professor of crop and animal husbandry at the Queen's University, Belfast, director of the Agricultural Research Institute of Northern Ireland and head of the Crop and Animal Husbandry Research Division of the Ministry of Agriculture for Northern Ireland. In 1933 he became professor of agriculture at the University of Reading.

Prof. Rae has had wide experience of agriculture under both peace and war conditions. He is a member of various committees of the Berkshire War Agricultural Executive Committee, and serves on the board of the National Institute for Research in Dairying and on the Committee of the Reading Artificial Insemination Centre. He is also a member of the executive committee of the Land Settlement Association. Prof. Rae will be no stranger to the United States, for in 1943 he visited America at the invitation of the United States Department of Agriculture. He travelled widely, visiting agricultural colleges and farming conferences and speaking on British agriculture in war-time, and giving particular attention to the American system of agricultural education.

Dr. G. O. Curme: Willard Gibbs Medallist

DR. GEORGE O. CURME, JUN., vice-president and director of research of the Carbide and Carbon Chemicals Corporation, New York, has been awarded the Willard Gibbs Medal of the Chicago Section of the American Chemical Society for 1944. The award, one of the highest distinctions in American chemistry, is bestowed annually in recognition of eminent work in, and original contributions to, pure or applied chemistry. Dr. Curme has been responsible for the development of the Carbide and Carbon Chemicals Corporation and for its outstanding advances in the field of aliphatic chemistry. Dr. Curme was born in Mount Vernon, Iowa, on September 24, 1888. He received the B.S. degree from Northwestern University in 1909 and the Ph.D. from the University of Chicago in 1913. He continued his graduate studies in Berlin, and during 1914–20 he was a fellow at the Mellon Institute for Industrial Research, Pittsburgh. He became chief chemist of the Carbide and Carbon Chemicals Corporation in 1920, and since 1927 has been vice-president and director of research. He received the Chandler Medal in 1933, the Perkin Medal in 1935, and the Elliott Cresson Medal in 1936.

Prof. E. Pavlovsky

PROF. EVGENI PAVLOVSKY, of the Academy of Sciences of the U.S.S.R. and lieutenant-general of the Soviet Medical Service, has been awarded the Order of Lenin on the occasion of his sixtieth birthday, and in recognition of his scientific work in the field of parasitology. Since 1929 Prof. Pavlovsky has occupied the chair of zoology and comparative anatomy at the Military Medical Academy of the U.S.S.R., and has taken part in expeditions to Central Asia, the Caucasus, Crimea, Trans-Baikal, Iran and Iraq. Several years ago, settlers in the virgin forest districts of the Siberian Taiga caught an unknown disease affecting the tissues of the cerebrum and nervous system; mortality was 25 per cent, and survivors were incapacitated. After persistent work in the Taiga, Pavlovsky discovered the causative agent and elaborated methods of combating it. For this work he was awarded a Stalin Prize in 1939. Pavlovsky has also carried out extensive work in combating typhoid and malaria. He has led a number of expeditions charged with the task of improving health conditions in newly developed agricultural territory and on industrial construction sites in new areas. For many years he has headed the Department of Parasitology of the All-Union Institute of Experimental Medicine. During the War Pavlovsky has done a great deal of work on infectious diseases of the Central Asiatic Soviet Republics and neighbouring countries.

The vacancies advertised in these columns are available only to applicants to whom the Employment of Women (Control of Engagement) Orders, 1942-8, do not apply.

BEIT MEMORIAL FELLOWSHIPS FOR MEDICAL RESEARCH

NOTICE is hereby given that an ELECTION of JUNIOR FELLOWS to begin work on October 1 will take place in July, 1944. Junior Fellowships are normally of the annual value of £400 for three years; but candidates, younger than those usually elected or whose promise for medical research must be judged mainly on work outside that field, may be awarded a lower rate of £300 for the first two years. Candidates are asked to state whether they would be unable to accept this lower initial rate.

Candidates must have taken a Degree in a Faculty of a University in the British Empire or a Medical Diploma registrable in the United Kingdom. Elections to Junior Fellowships are rarely made above the age of thirty-five years.

The Trustees are desirous of furthering research in Mental Diseases and in the general allotment of Fellowships will give some preference to a candidate proposing research on approved lines in that subject.

Applications from candidates should be received by May 14, though late entries will be accepted up to June 1.

Owing to the disturbance caused by the War, it is necessary for candidates to submit evidence that they could be given accommodation in the departments where they propose to work.

Forms of application and all information may be obtained by letter only addressed to: Dr. A. N. Dury, F.R.S., Acting Secretary, Beit Memorial Fellowships for Medical Research, The Lister Institute, Chelsea Bridge Road, London, S.W.1.

COUNTY BOROUGH OF DONCASTER EDUCATION COMMITTEE

GRAMMAR SCHOOL

Headmaster: F. C. Lay, M.A., B.Sc.

Applications are invited for the post of LABORATORY STEWARD in the Science Department of the School.

Candidates should be skilled in laboratory arts and have had experience in the service work of laboratories.

Salary £208 per annum by annual increments of £13 to £234 per annum plus war bonus.

The post is subject to the provision of the Local Government Superannuation Act, 1937.

Applications (by letter) should reach the undersigned at the Education Offices, Doncaster, not later than April 15, 1944.

V. CLARK,
Chief Education Officer.

UNIVERSITY OF BIRMINGHAM

A research worker, who should be a physicist with some research experience, is required in the Coal Treatment Laboratory of the Mining Department of the University for investigations connected with the cleaning of coal (with particular reference to fundamental work connected with suspensions of fine solids in aqueous media).

The salary offered is up to £450 per annum according to qualifications and experience.

Further particulars may be obtained from the undersigned, to whom applications must be submitted not later than April 15.

The University, Edmund Street, Birmingham, 3.
March, 1944.

C. G. BURTON,
Secretary.

CITY OF CARDIFF EDUCATION COMMITTEE

THE TECHNICAL COLLEGE

Principal: Dr. J. Stephenson, M.A., M.Com.

Required on September 1, 1944, a full-time lecturer in CHEMISTRY. Candidates should have a good honours degree, and experience both in research and in teaching. The person appointed will be required to teach Physical and Inorganic Chemistry up to Honours B.Sc. standard, and to direct the research work of postgraduate students. Salary in accordance with the Burnham Technical Scale (with due allowance for research, teaching or industrial experience); a man of suitable qualifications will receive in addition a special responsibility allowance of £25.

Forms of application, together with further particulars, are obtainable from the undersigned, to whom they must be returned not later than May 1, 1944.

W. J. WILLIAMS,
Director of Education.

UNIVERSITY OF LONDON

The Senate invite applications for the Chairs of Mathematics, Philosophy and Physics, tenable at Bedford College for Women. Salary not less than £1,000 a year in each case. Applications (10 copies) must be received not later than first post on April 24, 1944, by the Academic Registrar, University of London, Richmond College, Richmond, Surrey, from whom further particulars should be obtained.

Export: Managing Director established New Zealand distributors, visiting England shortly, desires contact Manufacturers binoculars and Cameras and Associated lines. Buying Agencies required now. Substantial orders can be placed immediately manufacturing facilities available.—Write Sawell, 4 Ludgate Circus, London, E.C.4. Central 4353.

Assistant Biochemist required by Midland firm of manufacturing chemists to work mainly on Pharmacological problems. Applicants should preferably be graduates with some experience in industrial laboratories, but this is not essential. Thorough experience of Biochemical technique will be a definite advantage. Salary £450–550 plus war bonus according to experience. Superannuation scheme in operation.—Replies to Box 168, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Experienced Metallurgist-chemist required for research on corrosion, protection, and allied problems on magnesium-base light alloys in scheduled Industrial Laboratories in the Manchester district. Will have small staff of assistants and must be able to initiate and carry through research programmes without detailed direction. Sound knowledge of modern theory essential, together with ability to utilize this knowledge in practical applications.—Apply stating age, experience and salary required to Box 175, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Metallurgist required for light alloy research in Industrial Laboratories in Manchester area scheduled under E.W.O. Must be able to carry out research programmes with minimum supervision; sound basic knowledge of Physical Metallurgy necessary. Knowledge of German advantageous.—Apply stating age, experience and salary required to Box 176, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Metallurgist-chemist required for research on melting and fluxing problems on magnesium base light alloys in scheduled Industrial Laboratories in the Manchester district. Must have sound basic knowledge of Inorganic Chemistry; some experience in metallurgical work preferred. Apply stating age, experience and salary required to Box 177, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Industrialists seek to make contact with Scientist having process for conversion of Methane (98 per cent purity) into commercial product.—Box 174, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Reflecting Telescopes: 6½" Mirrors of excellent quality £10 8s. 6d. Flat 7s. 6d.—Roland Lee, "Infield," Babell, Holywell, Flintshire.

Wanted: Laboratory vacuum pump, to give at least 10–4 mm. Hg.—Box 173, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Refractometer, Pulfrich or similar, wanted for war work. Write particulars and price. Gowllands, Ltd., Morland Road, Croydon.

Microscopes, of all descriptions, only a few available second-hand, perfect condition. Send details of your requirements enclosing 3d. stamp.—Chards, Microscope Specialists, Forest Hill, S.E. 23.

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Penicillin Committee

Sir Andrew Duncan, Minister of Supply, has announced that Sir Henry Dale, president of the Royal Society, has been appointed chairman of the Penicillin Committee. The Committee is constituted as follows: Mr. Arthur Mortimer, deputy director of medical supplies, Ministry of Supply (vice-chairman); Dr. V. D. Allison, Ministry of Health; Lieut.-Colonel H. J. Bensted, Army Medical Department, War Office; Prof. R. V. Christie, Medical Research Council, director of the Medical Professorial Unit at St. Bartholomew's Hospital, London; Dr. A. N. Drury, Medical Research Council, director of the Lister Institute; Prof. A. Fleming, professor of bacteriology in the University of London (St. Mary's Hospital Medical School); Prof. H. W. Florey, professor of pathology in the University of Oxford; Dr. C. R. Harington, secretary of the Medical Research Council; Prof. I. M. Heilbron, professor of organic chemistry in the Imperial College of Science and Technology and scientific adviser to the Minister of Production; Prof. R. P. Linstead, deputy director of scientific research, Ministry of Supply, professor of organic chemistry, Harvard University; Prof. H. Raistrick, professor of biochemistry in the University of London; Sir Robert Robinson, Waynflete professor of chemistry in the University of Oxford; Sir Russell Wilkinson, military medical adviser, Ministry of Supply; and representatives of firms engaged in the production of penicillin.

Intelligence and Season of Conception

It is beyond reasonable doubt, according to Dr. J. Fraser Roberts (*Brit. Med. J.*, March 4, 1944, p. 320), that children conceived in winter are, on the average, somewhat more intelligent than those conceived in the summer; but this fact has been almost universally misinterpreted. Practically every hypothesis brought forward to explain it has depended on the assumption that it is the season of conception that influences the intelligence of the child. Some have even urged the benefits of planned winter conception (for example, Mills, C. A., *Human Biology*, 13, 378; 1941). Dr. Fraser Roberts has tackled the problem by comparing winter and summer children born to the same parents, arguing that, if the season of conception influences the intelligence of the child, the usual difference will be found in such groups; if, however, the real explanation of the observed difference is the fact that the intelligence of the parents influences the season of conception, the two groups will show no difference. A second line of inquiry was the determination of the number of sibs of comparable groups of winter and summer children. Admitting that the evidence that he has gained is not based on very large numbers, Dr. Fraser Roberts concludes that the rather greater intelligence of the child conceived in winter is not due to seasonal influences on the mother or on the developing child; but to the tendency for the more intelligent parents to conceive children rather more often in the winter, while the less intelligent people tend to conceive children rather more often in the summer.

Sunflowers as an Oil Seed Crop

In the February issue of *Agriculture* there is an account of the progress made during the last four years on the development under English conditions of the sunflower as an oil seed crop, which was also referred to by Mr. E. F. Hurt in a lecture to the Royal Horticultural Society (Nature, February 26, p. 248). This work, started in 1940 at the Imperial College of Science and Technology by Mr. G. E. Blackman, has since been continued by him and a research team under grants from the Ministry of Agriculture and the Agricultural Research Council. To date it has been found that only semi-dwarf varieties, capable of ripening seed in August or early September, are suitable to Great Britain, for the giant varieties, which mature in the autumn, are very prone to attack from Botrytis. Besides the selection of three varieties—'Pole Star', 'Southern Cross' and 'Mars'—the course of the investigations has demonstrated the primary importance of spacing in controlling maximal yield and the relative small part played by soil type or manuring. By close spacing, yields much in excess of the average in other sunflower producing countries have been obtained, while the seeds are not inferior in the quantity and quality of the oil and protein. In addition, methods of harvesting and threshing suitable for English conditions have been devised. In 1943, the crop was first grown on a field scale on some twenty farms and this year the developmental work is to be expanded. The outlook for sunflowers as a new crop in England appears of distinct promise.

Vacation Work Scheme of the Imperial College

The Imperial College Union in its ninth annual report of its vacation work scheme shows an interesting record of development for the past year. Under this scheme, students of the Imperial College of Science and Technology are placed, during their vacations, in works and laboratories of industrial firms and of research institutions. During 1943, nearly 500 students registered for this purpose as compared with 180 in 1941, and 226 firms co-operated in this enterprise as against 124, so rapid has been the growth in popularity of the scheme. One of the most significant and welcome features is the extent to which firms have willingly co-operated in securing to the students entrusted to their care, the best possible and the most varied training and experience during their time at these institutions. In many cases a survey of the organization and administration is provided by lectures and tours conducted by members of the staff, in addition to the opportunity to take part in the productive processes in factory, workshop or laboratory. In this way the vacation work scheme at the Imperial College would appear to add to the theoretical studies of the students, whatever their branch of science or engineering, a valuable insight into the structure of industry, and enables them to see at first hand how wealth in the true sense is created from the organized skill and experience of all grades of workers, and how the various branches of science contribute in practice to this end.

In December 1943, the vacation work committee convened a highly successful conference of representatives from a number of the co-operating firms, at which a searching analysis was made by many speakers of various aspects of this scheme. From this it was evident how conscious were these institutions and firms of the part they have to play, jointly with the universities and technical colleges, in the creation of a highly trained body of scientific and technical workers. The scheme is under the chairmanship of Prof. H. Levy, who represents the governing body of the Imperial College; the secretary of the vacation work committee is Mr. J. Newby.

Evolution and Entropy

FOR an essay on "Evolution and Entropy" Mr. E. H. Betts has been awarded the Langhorne Orchard Prize of the Victoria Institute. The main thesis propounded is, that since in the author's opinion 'evolution' is contradicted by the law of entropy and the latter is beyond all question true, then 'evolution' is false or presumably has not taken place. The argument is put forward in a plausible manner and the essay makes interesting reading. What the author understands or means by 'evolution' is not at all clear, and sometimes he uses the word in the sense of change from simple to complex, sometimes it appears to have a moral, ethical or even religious meaning, and sometimes it is a striving towards perfection, whatever that may be. It is a relatively simple matter to endorse any of these points of view by quotations from some author or other, and then reduce to an absurdity or contradiction deductions that can be made from such quotations. Stress is laid on the difficulty of giving a logical statement of the derivation of living from non-living matter, but it seems equally clear that the law of entropy postulates the existence of matter capable of physical measurement but throws no light upon the origin of the matter itself. The ordinary mind has difficulty in imagining, let alone comprehending, that originally there was nothing, and then suddenly there was something; or the other alternative, that matter has always existed.

Mr. Betts suggests that in Nature and history the direction of progress is from complex to simple; presumably the organization of our society to-day is more simple than that of the ancient Britons. No biologist familiar with fossil faunas and floras would agree that this is true of the geological records of animals and plants. But perhaps all is well, for the author himself uses the sentence "Evolution itself thus rapidly evolved", and so employs a word which is extremely convenient to express the general idea that, in non-living as in living things, with the passage of time, a change or progression, so long as this is not intended to mean a movement limited to one direction, is, in fact, observable.

Differential Fertility in Canada

CANADA with its many wide spaces and farm lands has tended in the last few years to become more industrialized. It contains a large population of emigrants or the immediate descendants of emigrants from parts of Europe where tradition has influenced the reproductive tendencies of the people. For the future of Canada, which is under-populated, it is of some concern to understand the fertility of different groups of the population in order to supply information for policy-framing. Enid Charles (*Canad. J. Econ. and Pol. Sci.*, **9**, 175; 1943) presents an analysis of the differential fertility as seen in the 1931 census. The highest fertility is seen in Quebec and New Brunswick, the lowest in Ontario and British Columbia. There is high fertility among farmers, fishermen and food operatives, and low fertility among textile operatives, loggers, personal service workers, salesmen, owners and managers of manufacturing concerns. The late marriage of office workers and loggers could account for their low replacement birth-rate, while the small size of families of owners and managers accounts for the low fertility of these classes. Provincial differences contribute equally with occupational differences to fertility differences, while origin and religion of the individual are contributing causes. It is important to note that British Columbia, with a comparatively small population, is in reality urban in type—it has a high plane of living, a large majority of Protestants. The fertility is low. In a developing country like Canada, it should be possible to frame the policy and development of the country to encourage higher birth-rates in those sections of the community which are reduced, but it would seem that the Canadian population may tend to repeat the faults of several European countries unless a check is made by constructional legislation.

Nature of the Viruses

PROF. B. F. OSORIO TAFALL, National School of Biological Sciences, I. P. N., Mexico, has an article with the title "Naturaleza De Los Virus", in *Ciencia* of August 1943, which gives a very useful survey of the work done on viruses. While there is nothing added to our knowledge of the subject by this contribution, it provides an excellent historical review, and as it is written in a popular form, it will prove acceptable to many readers. Among the methods of studying viruses are ultra filters, colour tests (used to investigate psittacosis), photomicrography by ultra-violet light, the electron microscope, etc. New laboratory methods for diagnosing certain diseases caused by a virus which attacks both man and animals have been developed recently. Thus, Hertz described in 1942 how the allantois of the embryo of a chicken, when inoculated with the virus *A* and *B* of influenza, possesses the power of agglutinating the hæmatin, and this provides a simple test for detecting the virus of influenza in the throat and for determining the antibodies existing in the serum of the patient. The subject will be continued in a later issue of *Ciencia*.

The Colombian Hypericum

AN article under the title "Algunos Chites Nuevos Colombianos" appearing in *Ciencia* of August 1943 (published in Mexico) deals with the Colombian *chite*, a plant belonging to the genus Hypericum. This genus comprises about three hundred known species which are distributed in the subtropical regions, being scarce in the temperate zones. Colombia has many forms of the plant and up to the present twenty-five species have been found in the country. The author of the article, Jose Cuatrecasas, Escuela Superior de Agricultura Tropical, Cali, Colombia, acknowledges his indebtedness to Dr. Prittier, through whose kindness he has been enabled to study *H. caracasanum*. As a result of his investigations a number of previous identifications have been altered, and changes made regarding certain species and new varieties. Short descriptions are given of *H. ruscoides*, *H. magniflorum*, *H. stenoclados*, *H. tamanum* and *H. lancioides*.

Earthquakes Registered in New Zealand and Spain

DURING November 1943, seven strong earthquakes were registered by the seismographs at the New Zealand observatories. These were on November 2, 4, 6 (two), 13, 26 and 28. The shock of November 26, with an epicentral distance from Wellington of about 83°, had a focal depth estimated between 130 km. and 140 km. In addition, nineteen earthquakes were felt in some part of New Zealand. The strongest three of these had intensity VI and were felt (1) on November 5 from Greymouth to Arthur's Pass, (2) on

November 5 later in the day in the southern parts of North Island, and (3) on November 24 in the south-west parts of South Island.

In Spain during the same month, twenty-five earthquakes were registered by the seismographs at the Geophysical Observatory at Toledo. The earthquake of November 11, registered at 22h. 57m. 51s. G.M.T., had an estimated epicentral distance from Toledo of 370 km. and a focal depth of 25 km. Its epicentre is likely to have been in the neighbourhood of lat. 37·4° N., long. 1·7° W., which is just west of the town of Aquilas on the Mediterranean coast of Spain. The earthquake was felt at Granada with intensity V.

Study of Physical Medicine

According to the *Journal of the American Medical Association* of December 25, the first centre for the scientific study and development of physical medicine as a branch of medical practice has been established by the National Foundation for Infantile Paralysis in the Graduate School of Medicine of the University of Pennsylvania. The centre will include a department for development of physical medicine as a scientific part of the practice of medicine, a training centre for medical leaders and teachers in this branch of medicine, and a school for training technical workers. The departments of anatomy, physiology pathology and other basic sciences of the University of Pennsylvania will co-operate in this proposed programme.

The Chronica Botanica Co.

The Chronica Botanica Co., of Waltham, Mass., has issued a special edition of Dr. C. A. Browne's "Thomas Jefferson and the Scientific Trends of his Time" (an advance reprint from *Chronica Botanica*, 8) on the occasion of the tenth anniversary of its establishment. The Chronica Botanica Co. was founded in Leyden, the Netherlands, in September 1933, and was transferred to the United States early in 1940. An old, interesting, symbolic engraving, reproduced on an insert with the commemorative booklet, recalls the successful transfer of the firm's entire stock and its unique collection of source material in the history of botany and horticulture, just a few months before the invasion of the Low Countries. The firm, which is directed by Dr. Frans Verdoorn, publishes *Chronica Botanica*, "A New Series of Plant Science Books" and *Annales Cryptogamici et Phytopathologici* (formerly *Annales Bryologici*). Special projects in the course of preparation include: "Plants and Plant Science in Latin America" and the "Index Botanicorum".

American Academy of Arts and Sciences Grants

Income from the Permanent Science Fund of the American Academy of Arts and Sciences is used to support scientific research in the fields of mathematics, physics, chemistry, astronomy, geology, geography, zoology, botany, anthropology, psychology, sociology and economics, history and philology, engineering, medicine, surgery, agriculture, manufacture and commerce, education, or any other science of any nature or description. Equipment purchased outright through a grant from the Fund is subject to reassignment by the committee of award, upon termination of research in the particular field of endeavour in support of which a grant is made. Grants are not made for the financial support of work the results of which comprise partial fulfilment of requirements for an academic degree. It is a policy of the committee of award not to approve requests for general permanent equipment for institutions. Applications for grants-in-aid should be made on forms to be obtained from the chairman of the committee, and will be considered on June 1 and October 1. Communications should be addressed to John W. M. Bunker (chairman), Permanent Science Fund Committee, Massachusetts Institute of Technology, Cambridge 39, Massachusetts.

Announcements

The Executive Council of the Imperial Agricultural Bureaux has elected Mr. G. H. Creasy (Colonial Empire) as chairman in succession to Mr. Shamaldhari Lall (India). Lieut.-Colonel J. G. Robertson, representative on the Council of the Dominion of Canada, was elected vice-chairman.

The Colonial Office announces that Dr. E. E. Williams, of Trinidad, has been appointed secretary of the Agricultural Committee of the Caribbean Research Council. Dr. Williams, who has been assistant professor of social and political science at Howard University, Washington, has made a special study of economic problems in the British West Indies. He was born in 1911, and graduated at the University of Oxford.

The Secretary of State for the Colonies has decided, after consultation with the Governors of Northern Rhodesia and Nyasaland, to appoint a joint development adviser for the two territories, and Mr. G. F. Clay, director of agriculture in Uganda, has been appointed to the post. Mr. Clay has recently served as director of supplies for Uganda and director of native production for East Africa.

Many have been wondering how the gypsies have fared during the European War. After all, less than most folk are they concerned with the social and economic causes which have given rise to the present conflagration. The present issue of the *Journal of the Gypsy Lore Society* (**23**, pts. 1–2) contains the life and travels of Peter Lazarovič the Rudar, a vivid account of the story of an old gypsy who has had a chequered existence. There is also an interesting study of Esther Young, an English gypsy witch.

The annual report of the Board of Regents of the Smithsonian Institution for the year ended June 30, 1941, which has already been noted in Nature (**149**, 326; 1942), has now been issued as a bound volume (Washington, D.C.: Gov. Printing Office. 2 dollars) containing in a general appendix the customary miscellaneous selection of papers, some of them original, covering a wide range of scientific investigation and discussion. This appendix runs to some 450 pages. Among the papers not previously published elsewhere are those by E. P. Walker on "Care of Captive Animals"; F. C. Craighead on "The Influence of Insects on the Development of Forest Production and Forest Management", and F. C. Chase on "Useful Algæ". A number of others, such as those of H. C. Hottel on "Artificial Converters of Solar Energy"; J. W. Lasley, jun., on "Mathematics and the Sciences"; H. E. Munsell on "Vitamins and their Occurrence in Foods"; and W. N. Fenton on "Contacts between Iroquois Herbalism and Colonial Medicine", are now made more accessible to scientific workers.

LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications.

Ascorbic Acid and Hip Fertility in Rosa Species

FOR the past few years we have been studying the genetical and other problems presented by a rose population growing on a pit heap in Co. Durham. Only two species, *Rosa mollis* var. *typica* and *R. dumetorum* var. *ramealis*, are involved; but, in addition, there is a unique hybrid between the two which, as it possesses a chromosome complement of thirty-five, has the parentage *dumetorum* ♀ × *mollis* ♂.

Among the points investigated were the ascorbic acid contents of the three forms. These worked out at 1,420 mgm. of ascorbic acid per 100 gm. of flesh in the case of *R. mollis*, 724 mgm. for *R. dumetorum* and 941 mgm. for *R. dumetorum* × *R. mollis*. Such results instantly raise doubts respecting the correlation which Gustafsson and Schröderheim[1] seek to establish between low hip fertility and amount of ascorbic acid.

Although the average height of the individuals composing the *R. mollis* colony is just below 1 m., and that of the *R. dumetorum* forms a little more than 1·5 m., owing to the influence of heterosis, our hybrid attains a height of 4 m. and sprawls over a very considerable area. Nevertheless, its fertility is extremely low; of the four thousand flowers it was estimated to carry in June 1942, the bulk fell at once when the fruit began to develop in July. In the end, only twenty-eight ripe hips were displayed in September and October. Of these, nine contained no mature achenes, eight had one each, eight had two, two had three and one had six—an average of 1·28 per hip. If these results are compared with an average of thirty-one achenes per hip observed in the *R. mollis* colony, and twenty-nine per fruit in the *R. dumetorum* group, a full appreciation of the general sterility of the hybrid and of its low hip fertility will be gained. Further, when the ascorbic acid contents of the three forms are set alongside these figures, it will be obvious that our findings afford no confirmation of Gustafsson and Schröderheim's attempted negative correlation between hip fertility and ascorbic acid content.

In our opinion the results are simply a matter of heredity. Nor do we consider that Table 1, as put forward by Gustafsson and Schröderheim, supplies weighty evidence opposed to that view. In the first place, it should be emphasized that, owing to the marked difference in chromosome complements in the male and female gametes in the Canine roses, reciprocal hybrids in which they are concerned are not only quite dissimilar, but also are capable of manifesting certain characters in an exaggerated fashion. Moreover, it should be noted that Gustafsson and Schröderheim state definitely that their hybrid between "*R. canina*" and *R. rubiginosa* showing the less ascorbic acid value ripens later—a fact known to be correlated, independently of any hip sterility or fertility, with a lower content of vitamin C.

Again, we should like to urge that "Cases 1 and 2", considered by Gustafsson and Schröderheim and summarized in Table 2, are vitiated as evidence by facts not immediately apparent to British workers. Their "*Rosa canina*" includes four series regarded as species by British rhodologists: these are *R. canina*, *R. dumetorum*, *R. dumalis* (*Afzeliana*) and *R. coriifolia*, the former pair characterized by biotypes with low ascorbic acid values, and the latter pair by biotypes containing relatively high amounts. We cannot conceive how material so genetically heterogeneous, and so diverse in its ascorbic acid heredity, can be assembled promiscuously for mathematical treatment in such a way as to yield figures of real significance.

Lastly, it is asserted that, for a full ripening of a rose receptacle, only one or two fruits are required, which seems to imply that at least one must be present. In our experience, such development will occur in the absence of seeds. At present, we have under observation an example of the hybrid *R. Sherardi* ♀ × *R. spinosissima* ♂, which flowers freely but fruits sparingly; on the average, no fewer than 55 per cent of its hips, usually well developed, contain no mature achenes, and such cases could be extended materially.

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Feb. 21.

[1] NATURE, 153, 196 (1944).

IN the course of an investigation of rose hips as a source of vitamin C, undertaken with Dr. Magnus Pyke[1], no marked correlation was observed between the ascorbic acid content of the hip flesh and the percentage weight of achenes (nutlets or pips) in the hips. The publication by Gustafsson and Schröderheim[2] of their hypothesis that vitamin C content is negatively correlated with hip fertility has induced me to re-examine the earlier data together with some obtained later.

The range and the mean of both vitamin content and pip content differ from species to species. Thus, in *Rosa canina* a mean vitamin C content of 493 mgm. per 100 gm. of hip flesh and a mean pip content of 39 per cent was found, while in *R. Afzeliana* the figures were 1,121 mgm. and 36 per cent respectively. The effect of mixing data from two such species, as do Gustafsson and Schröderheim in their Case 1, would be to produce a false negative correlation between vitamin content and pip content. It is therefore important to consider the data for each species separately.

Our most extensive series of observations concerned *R. canina* and are summarized in the accompanying table. Contrary to the suggested correlation, low vitamin contents are found associated with both the highest and the lowest ranges of pip content, although the highest vitamin value, 1055, is for a sample with a relatively low pip content, 31. The mean vitamin contents are not significantly different from one another, or from the species mean, over the central ranges of pip content which include the bulk of the observations. A very low negative correlation ($r = -0{\cdot}10$) was calculated from these data, and this was not significant ($P = 0{\cdot}4$–$0{\cdot}3$). Data for other species are equally unfavourable to the hypothesis.

If the suggested negative correlation exists, one might expect differences in the vitamin content of hips from individual bushes from year to year, according to the number of achenes matured. The figures for *R. canina* and *R. rubiginosa* given by Gustafsson and Schröderheim are contrary to this theory. Our own observations of this kind are

RANGE OF ASCORBIC ACID AND PIP CONTENTS IN HIPS OF *Rosa canina*.

Weight of pips (per cent)	No. of observations	Mean vitamin C (mgm./100 gm.)	Range of vitamin C (mgm./100 gm.)
20–24	1	187	187
25–29	2	275	100–450
30–34	13	546	205–1055
35–39	28	501	115–850
40–44	23	508	164–1010
45–49	8	509	370–735
50–54	2	498	385–610
55–59	2	172	120–224
Total	79		

Species means: Vitamin C content, 493. Percentage of pips, 39.

limited but generally unfavourable. Thus hips of a bush of *R. canina* var. *dumalis* assayed in 1941 had 44 per cent pips and 164 mgm./100 gm. vitamin C; but in 1942, 29 per cent pips and only 100 mgm./100 gm. Corresponding figures for a bush of *R. mollis* were 1941: 24, 1,490; 1942: 15, 1,653; 1943: 23, 1,650; and for a bush of *R. dumetorum*, 1941: 51, 920; 1942: 32, 935; 1943: 33, 960. More numerous data published earlier by Schröderheim[3] on *R. pendulina* (Tables 9–12) and *R. rugosa* (Tables 33–34) appear to be no more conclusive.

It is noteworthy that of the three 'cases' cited by Gustafsson and Schröderheim, the correlation is lowest and least significant for the single species *R. rubiginosa*. The correlation is a little higher and significant for the mixture (Case 1) consisting mainly of *R. canina* and *R. Afzeliana*, and the only high correlation is for a heterogeneous mixture (Case 2). Probably this progression is due to an increased mingling of species having high vitamin and low pip content with others possessing low vitamin and high pip content. Among British roses the specific differences tend in these directions and appear to be due to hereditary differences in vitamin production coupled with differences in the proportions of the receptacle, and are independent of fertility. The diversity of vitamin content and fertility between the reciprocal hybrids of *R. canina* and *R. rubiginosa*, observed by Gustafsson and Schröderheim, can be regarded as another example of a kind of variation not uncommon among hybrids and genetical in origin.

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[1] Pyke, M., and Melville, R., *Biochem. J.*, **36**, 336 (1942).
[2] Gustafsson, A., and Schröderheim, J., NATURE, **153**, 196 (1944).
[3] Schröderheim, J., *Kungl. Fys. Sällsk. Handl.*, **52**, No. 9 (Lund, 1941).

Preparation of Retinene *in Vitro*

RETINENE, obtained by Wald from dark-adapted retinas, is defined as the chromogen responsible for a maximum at 664 mμ in the absorption spectrum of the blue solution obtained by mixing retinal extracts with antimony trichloride in chloroform. Such extracts show (in chloroform) an ultra-violet absorption band with $\lambda_{max.}$385 mμ. It has recently been suggested[1] that the chromogen is vitamin A aldehyde, and that it can be obtained by direct oxidation of vitamin A alcohol.

The following procedure yields small quantities of retinene in a state approaching purity. 2 gm. of distilled vitamin A alcohol ($E^{1\%}_{1cm.}$ 325 mμ 800, *c.* 46 per cent vitamin A) is dissolved in 40°–60° petrol ether (50 c.c.) and the solution poured into 5 per cent sulphuric acid (400 c.c.) at 25° C. *N*/10 potassium permanganate (600 c.c.) at 25° C. is then run in rapidly with vigorous shaking for a few minutes. The mixture is allowed to settle in a separating funnel and the aqueous layer discarded. The petrol ether layer is washed twice with water and dried over sodium sulphate. It is then poured on to a column of alumina (Brockmann) and the chromatogram developed with petrol ether. The solute is gradually washed through the column and the fractions are tested separately (1 or 2 drops with 4 c.c. antimony trichloride reagent). If each successive 10 c.c. portion of eluate is regarded as a 'fraction', the results can be summarized as in the accompanying table.

Fractions containing the 664 mμ chromogen only show

	664 mμ	>3200
$E^{1\%}_{1cm.}$	361 mμ	1420 (petrol)
	385 mμ	1570 (chloroform)

while the best fractions for the 560 mμ chromogen show

$E^{1\%}_{1cm.}$ 560 mμ/355 mμ = 2 : 1.

For both substances, the molecular extinction coefficient for the ultra-violet maximum approaches that of vitamin A. The 664 mμ chromogen is undoubtedly retinene. It is by no means an unstable substance. In cyclohexane, the ultra-violet maximum falls near 368 mμ and in petrol nearer 361 mμ. The 560 mμ chromogen (the nature of which cannot yet be discussed) is also a stable substance exhibiting a similar displacement of the ultra-violet maximum from 355 mμ in chloroform to 342 mμ in petrol. Hunter and Hawkins[2], in recording the preparation of vitamin A aldehyde by the Oppenauer method, give $\lambda_{max.}$657 mμ in the colour test and two maxima (368 and 350 mμ) for the ultra-violet absorption in cyclohexane. Wald at first gave 655 mμ for the colour test maximum, but later corrected it to 664 mμ. His ultra-violet maximum at 385 mμ refers only to chloroform solutions. The large solvent displacement, 368–385 mμ, which we have observed reconciles the data and makes it clear that retinene and vitamin A aldehyde are spectroscopically indistinguishable. We have not so far found the 664 mμ and 560 mμ chromogens to be

Fractions	Approx. conc. (per cent)	$\lambda_{max.}$ in $SbCl_3$ colour test: 620, 610, 664, 583, 560, 490 mμ	$\lambda_{max.}$ ultra-violet absorp. in chloroform: 325, 355, 385, 332, 300 mμ; in petrol: 325, 342, 361, 321, 287 mμ
1–10		+	+
11–13		+ ++	+ ++
24–26		++	++
27–41	0·06	+ +++	+++ +
42–50	0·02	++ +	+ ++
51–57	0·018	+++	+++
58–66	0·025	+	+
67–70	0·045	+	+ +

interconvertible, and the best fractions of the former show one ultra-violet maximum only.

The elegance and accuracy of Wald's work on retinal extracts makes us hesitate to suggest that the term *retinene* is inappropriate. Unfortunately, it suggests a retinal carotenoid. *Axerophthal*, following Karrer's terminology, is not very happy in this context. Perhaps *retinaldehyde* is more appropriate than retin*al*.

A fuller account of this work will be published elsewhere. We express our thanks to the Medical Research Council for financial assistance.

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T. W. GOODWIN.

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Feb. 25.

[1] Morton, NATURE, 153, 69 (1944).
[2] Hunter and Hawkins, NATURE, 153, 194 (1944).

Molecular Weight of Egg Albumin

THE molecular weight of egg albumin quoted in all but the most recent literature is 35,000–36,000, a value based on the early osmotic pressure measurements of Sørensen[1], the ultracentrifuge measurements of Svedberg and Nicols[2], Nicols[3], and Sjögren and Svedberg[4], as well as the diffusion data of McBain[5]. More recently, however, there has been general agreement that this value is too low; the sedimentation constant and diffusion data quoted by Svedberg and Pedersen[6], for example, as well as the osmotic pressure data summarized in Table 1, indicating a value of 43,000–46,000.

TABLE 1.

Author	Solvent used	Result
Sørensen	Water	34,000[1]
Adair (recalculated Sørensen's data)	Ammonium sulphate	43,000[7]
Marrack and Hewitt	Sodium acetate and sodium chloride	43,000[8]
Taylor, Adair and Adair	Sodium acetate	46,000[9]
Bull	Sodium acetate	45,160[10]

I have had occasion, while rehearsing the procedure to be applied to certain other proteins, to make osmotic pressure measurements with solutions of egg albumin. This protein was prepared by Prof. R. K. Cannan using the method of Kekwick and Cannan[11], and the amount in solution was estimated by the micro-Kjeldahl procedure and nitrogen figures of Chibnall *et al.*[12]. McIlwain's phosphate-citric acid buffer at *p*H 4·65 was used as solvent.

The osmometer used was of the type described by Adair[13], but the collodion membranes contained about 3 c.c. instead of 20 c.c. of protein solution. Pressures were calculated from the height of the column of solution of known density, corrected for the rise due to capillarity.

TABLE 2.

C_v	Pressure	Molecular weight
1·00	3·92	43,400
1·86	6·71	47,200
4·00	14·4	47,300
4·23	16·7	43,100
5·84	21·1	47,200
5·95	22·0	46,000
6·26	22·2	48,100
6·88	26·1	44,900
8·30	30·6	46,200
8·84	32·5	46,300
	Average	45,970

The computed values for the molecular weight are given in Table 2, where the pressures are recorded in millimetres of mercury at 0° C. It was found that over the range investigated the osmotic pressure was directly proportional to the protein concentration C_v, expressed in gm. per 100 c.c. solvent. The calculated results for the molecular weight, which are in agreement with those recorded in Table 1, though obtained under different conditions, show that the value is almost certainly 45,000 ± 2,000.

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[1] Sørensen, *C. R. Trav. Lab. Carlsberg*, **12**, 122 (1917).
[2] Svedberg and Nicols, *J. Amer. Chem. Soc.*, **48**, 3081 (1926).
[3] Nicols, *J. Amer. Chem. Soc.*, **52**, 5176 (1930).
[4] Sjögren and Svedberg, *J. Amer. Chem. Soc.*, **52**, 5187 (1930).
[5] McBain, Dawson and Barker, *J. Amer. Chem. Soc.*, **51**, 1021 (1934).
[6] Svedberg and Pedersen, "The Ultracentrifuge" (Oxford University Press, 1940), 382.
[7] Adair, *J. Amer. Chem. Soc.*, **49**, 2524 (1927).
[8] Marrack and Hewitt, *Biochem. J.*, **23**, 1079 (1929).
[9] Taylor, Adair and Adair, *J. Hygiene*, **32**, 340 (1932).
[10] Bull, *J. Biol. Chem.*, **137**, 143 (1941).
[11] Kekwick and Cannan, *Biochem. J.*, **30**, 232 (1936).
[12] Chibnall, Rees and Williams, *Biochem. J.*, **37**, 354 (1943).
[13] Adair, *Proc. Roy. Soc.*, A, **108**, 627 (1925).

Number of Configurations of Molecules occupying Several Sites

IN a recent communication[1], I gave a formula for $g(N_i)$ the total number of configurations of a mixture of molecules of several types, N_i denoting the number of type i. I have meanwhile obtained the more general formula for $g(N_i,X_{ij})$, the number of configurations of the molecules in which the number of pairs of sites occupied in alternate ways is specified.

Let the number of sites which are neighbours of one site be z; let each molecule of type i occupy r_i sites; let the number of sites which are neighbours of a molecule of type i be q_iz. The r_i's and q_i's are related by $z(r_i - q_i) = 2(r_i - 1)$. Let the number of alternative configurations of a molecule of type i be ρ_i when a site has been chosen for one of its elements. Let the number of pairs of neighbouring sites, one occupied by a molecule of type i the other by a molecule of different type j, be denoted by zX_{ij}.

The number $g(N_i, X_{ij})$ of distinguishable configurations of given N_i and X_{ij} is given by

$$\log g(N_i,X_{ij}) = \Sigma_i N_i \log \rho_i - \Sigma_i \log N_i ! + z\Sigma_i \log (q_iN_i) ! - (\tfrac{1}{2}z - 1) \log (\Sigma_i r_iN_i) ! - \tfrac{1}{2}z \Sigma_i \log (q_iN_i - \Sigma'_k X_{ik}) ! - z\Sigma'_{ij} \log X_{ij} !,$$

where Σ' denotes summation over all types except i. This includes as special case a formula due to Chang[2] for a mixture of two types of molecule, of which one type occupies two sites, the other a single site.

The above formula can be used to derive the thermodynamic properties of mixtures with non-zero energies of mixing, whereas my previous formula was sufficient for mixtures with zero energies of mixing. In particular, I find that T_c, the temperature of critical mixing of a binary mixture of molecules A and B, is related to w, the intermolecular energy per pair of sites one occupied by part of an A the other by part of a B molecule, by the formula

$$e^{2w/kT_c} = \tfrac{1}{2}\{1 + ab + \sqrt{(a^2 - 1)(b^2 - 1)}\},$$

where $a = zq_A/(zq_A - 2)$ and $b = zq_B/(zq_B - 2)$.

Full details are being published elsewhere. Some of the formulæ for the case of a binary mixture in which the molecules of one type occupy single sites have already been given by Orr[3].

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London, S.W.7. March 7.

[1] Guggenheim, NATURE, **153**, 255 (1944).
[2] Chang, *Proc. Camb. Phil. Soc.*, **35**, 265 (1939).
[3] Orr, *Trans. Farad. Soc.* (in the Press).

A Modification to the Cryoscopic Equation

IT is known that the molecular weights of pure solutes as calculated by the cryoscopic method are not found to be constant for varying dilutions, and it has been reported[1] that K_f also varies, the tendency being for the cryoscopic constant to decrease in value as the concentration increases. Meldrum, Saxer and Jones[2] studied this anomaly in the case of camphor and found that for various solutes of known molecular weights, the constant for one gram-molecule per 1,000 grams of solvent fell from 50 at low concentrations to 39·7 in solutions of molality greater than 0·2.

These observations were confirmed by us not only for camphor but also for benzene, where K_f decreased from 7·20 to 5·35 between molalities 0·075 and 1·0.

The difficulty which arises from variations in both K_f and molecular weights at different concentrations has been overcome by using a modified equation of the form :

$$\Delta t = K_f.m^b \quad . \quad . \quad . \quad . \quad (1)$$

$$\text{or } \log \Delta t = \log K_f + b \log m \quad . \quad . \quad (2)$$

The validity of this equation was checked by plotting $\log \Delta t$ versus $\log m$ for different solutes of known molecular weights in the cryoscopic solvents benzene and camphor respectively. For all cases studied, straight lines were obtained similar to the accompanying diagram showing the plot for naphthalene and camphor in benzene.

Applying a summation method to equation 2 :

$$\Sigma \log K_f + b \Sigma \log m - \Sigma \log \Delta t = 0$$

$\log K_f \Sigma \log m + b \Sigma \log^2 m - \Sigma \log \Delta t . \log m = 0$, we obtained $K_f = 5{\cdot}14$ and $b = 0{\cdot}8961$.

Hence the modified equation for pure solutes in this sample of benzene was : $\Delta t = 5{\cdot}14\ m^{0{\cdot}8961}$. For the results quoted by Meldrum *et al.* on camphor : $\Delta t = 38{\cdot}73\ m^{0{\cdot}9580}$.

K_f is found by this method to vary for different samples of the cryoscopic solvent. Thus for a different stock of benzene, $K_f = 5{\cdot}229$, whereas b, although constant for all pure solutes in a given sample of solvent, is extremely sensitive to impurities. It should be pointed out that cases may be found in which the value of b is unity and the modified equation consequently becomes identical with the classical.

The accompanying table gives the molecular weights of tetralin in benzene (*a*) using the classical equation, $\Delta t = K_f m$; (*b*) using the modified equation $\Delta t = K_f m^b$.

Concentration (per cent by weight)	Depression (Δt ° C.)	Molecular weight calculated on $\Delta t = 5{\cdot}229\ m$ (classical)	Molecular weight calculated on $\Delta t = 5{\cdot}229\ m^{0{\cdot}9394}$ (modified)
0·68	0·321	111·6	133·2
1·98	0·876	118·0	132·4
3·98	1·636	127·1	137·0
7·94	3·165	131·2	135·5
11·13	4·316	134·9	136·6

It is seen that by applying the classical equation the calculated molecular weight increases and approaches a value in the region of 132–136. Application of the modified equation, however, produces a set of reasonably consistent values, the mean of which is 136·1.

No attempt is made here to explain the anomaly of K_f at different concentrations, but it is suspected that a more rigid application of thermodynamic theory, on which the classical equation is based, is necessary. For the present, the above equation is proposed as one which gives consistent results at all concentrations below 1·0 molality.

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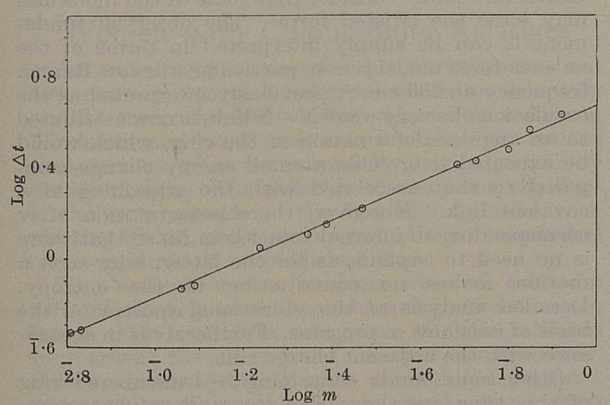

NAPHTHALENE AND CAMPHOR IN BENZENE.

Dissociation Energy of Nitrogen

VAN DER ZIEL[1] has observed weak predissociation in the First Positive system of N_2 for bands with v' greater than 11. The predissociation was reported to be of the type which increases in strength with the rotational quantum number J, and both Λ doubling components of the $B^3\Pi_g$ state are affected. Van der Ziel therefore concluded, apparently with good reason, that the state causing the predissociation was of type Δ. This led to the conclusion that a dissociation limit, the products of which were capable of producing a Δ state, must lie below the energy of the predissociation. Combining this information with the known predissociation limit for the $C^3\Pi_u$ state at 12·145 e.v., this gave a value of 7·383 e.v. for the dissociation energy of nitrogen, a value which has been generally accepted.

Gaydon and Penney[2] have pointed out that if this value is correct, then the rule that potential energy curves of molecular states of the same species may not cross must be violated. They suggested that the dissociation energy was probably about 9 e.v. This is now supported by the discovery that Van der Ziel's interpretation of his predissociation is not a unique solution.

The selection rules for predissociations or perturbations are usually quoted as: (1) Λ, the quantum number of the resultant electronic (orbital) angular momentum about the internuclear axis, may change by ± 1 or 0. In the former case the strength of the predissociation increases with J; in the latter case it is independent of J. (2) The $+ -$ symmetry is unchanged, that is, $+ \rightarrow +$, $- \rightarrow -$, $+ \not\rightarrow -$. For homonuclear molecules the g u symmetry is unchanged, that is, $g \rightarrow g$, $u \rightarrow u$, $g \not\rightarrow u$. (3) For strong predissociation the spin, S, must not change, but weak predissociation may occur for $\Delta S = \pm 1$. (4) The rotational quantum number remains unchanged, that is, $\Delta J = 0$.

O=N−O−O−N=O
(i)

Now for predissociation of a $^1\Pi$ state by $^1\Sigma$, it follows from the $+ \not\rightarrow -$ rule that only one of the two components (due to Λ doubling) of the $^1\Pi$ state will be affected. This also appears, experimentally, to be the case for the predissociation of a $^2\Pi$ state, which is in Hund's case *b*, by a $^2\Sigma$ state, as, for example, in the spectrum[3] of MgH. In this case, however, each J value occurs twice for the $^2\Sigma$ state, once with $+$ symmetry and once with $-$ symmetry, so that with the selection rules as listed above there appears no obvious reason why both Λ components of the $^2\Pi$ state should not be affected. To account for the observed predissociation of one component only, it appears necessary to assume the further restriction $\Delta K = 0$. While not explicitly stated, this rule appears to have been tacitly assumed, and in case *b* where the rotational energy is determined chiefly by the quantum number K, this seems reasonable.

For nitrogen, however, the $B^3\Pi_g$ state approximates to Hund's case *a*. In this case the rotational energy is determined by J, and K is no longer a true quantum number. Thus the rule $\Delta J = 0$ may be expected to hold, but not $\Delta K = 0$.

Now the lowest dissociation products for nitrogen are $N(^4S) + N(^4S)$, and these products can, on the Wigner-Witmer correlation rules, lead to a $^5\Sigma_g^+$ state. In this state each rotational level will be split, by spin, into five components, so that each J value occurs five times, thrice with one symmetry (say $+$) and twice with the other symmetry (say $-$). Thus, assuming that for the predissociation of the case *a* $^3\Pi_g$ state, only the selection rule $\Delta J = 0$ holds, both Λ components of the $B^3\Pi_g$ state may be affected. Thus it appears that Van der Ziel's explanation of the predissociation is not the only one possible, but that it might equally well result from a repulsive $^5\Sigma_g^+$ state arising from normal dissociation products. This latter explanation is preferable, because, by using the higher value for the dissociation energy to which it leads, the non-crossing rule for the potential energy curves can be maintained.

It thus appears that the dissociation energy of nitrogen is 9·764 e.v.

The dissociation energy of nitric oxide is linked thermochemically with that for nitrogen, and the new value for $D(N_2)$ leads to $D(NO) = 6{\cdot}49$ e.v. instead of 5·29 e.v.

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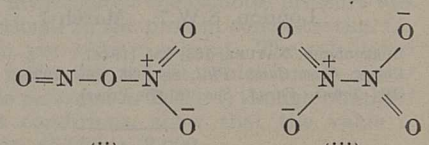
Structure of the Nitrogen Peroxide Molecule

HITHERTO three structures for the nitrogen peroxide (N_2O_4) molecule have received support:



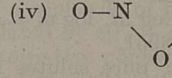
(ii) 2 resonance states (iii) 4 resonance states

Study of the electron-diffraction pattern of nitrogen peroxide gives no conclusive evidence as to the structure[1]. The X-ray diffraction pattern of the powdered solid suggests that the molecule is symmetrical, but gives insufficient parameters to fix the relations of the atoms[2].

Structures i and ii are *a priori* chemically reasonable. However, the vibrational (infra-red and Raman) spectra of N_2O_4 indicate that the molecule is highly symmetrical and non-linear[3,4]. The value of the entropy[5] also supports a more symmetrical structure.

Structure iii predicts satisfactorily the vibrational frequencies of N_2O_4, if it is supposed that the N−N link has the abnormally low force constant $1{\cdot}5 \times 10^5$ dynes/cm. On the basis of this model, the spectroscopic data give a value of the entropy in good agreement with the thermodynamically measured value, but only if it is assumed that there is no free relative rotation of the ends of the molecule about the central link[5]. This structure violates Pauling's adjacent charge rule[6], for which there is much empirical evidence; and it is difficult to reconcile the weakness of the N−N link with its torsional rigidity.

A fourth structure



(iv) (planar: 2 resonance states)

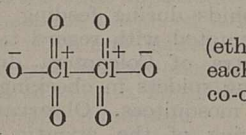
is here proposed. This model has the same symmetry as the planar form of iii, and gives precisely the same numbers of fundamental frequencies in both the Raman and infra-red spectra. Qualitatively, therefore, it gives as good a fit with observation as the planar model iii, which has been shown to account satisfactorily for the vibrational spectra[3], though Harris and King[7] consider that some of the molecules may have the twisted form. The observed fundamentals can be simply interpreted in terms of the valence-force model iv: in particular, the low Raman frequency at 283 cm.$^{-1}$, previously interpreted as the oscillation of a very weak N−N link, is now attributed to an angular deformation of the ring, which would be expected to involve a small energy change compared to that associated with the stretching of a covalent link. Moreover, there is no motion of iv corresponding to internal rotation in iii, so that there is no need to explain, as for the latter, why such a motion makes no contribution to the entropy. Detailed analysis of the vibrational spectra on the basis of iv is now in progress. Further, iv is in accordance with the adjacent charge rule.

Other compounds containing a 4-membered ring of this type are the carbonato- and sulphato-com-

plexes, and the molecule HI_3O_8. Such a ring is probably also present in chloride hexoxide (Cl_2O_6), as might be expected from the formal analogy between the pairs of compounds :

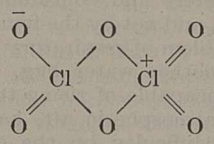
ClO_2	$ClO_3 \rightleftarrows Cl_2O_6$		Cl_2O_7	Cl_2O_8
NO	$NO_2 \rightleftarrows N_2O_4$		N_2O_5	N_2O_6

As usually written :



(ethane-like model, in which each double bond has partial co-ordinate-link character)

the structure of Cl_2O_6 violates the adjacent charge rule. The alternative structure



here proposed is similar to the structure iv above for nitrogen peroxide. There are four possible resonance states, not counting those in which some or all of the double bonds are replaced by co-ordinate links. In the structure shown, the right-hand Cl atom has the same valency state as the Cl in the tetrahedral [ClO_4^-] ion, and the left-hand atom is pentavalent as in the pyramidal [ClO_3^-] ion. Hence the chlorine atoms are probably tetrahedral, in which case chlorine hexoxide is geometrically analogous to the dimeric aluminium halides, and to the derivatives $M_2H_2R_6$ (M = B or Ga, R = H or alkyl) of boron and gallium[8,9]. However, the vibrational spectrum of Cl_2O_6 has not been measured, and there is no other direct experimental evidence yet for either structure.

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Feb. 24.

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Women with Colour-Blind Relatives

AN experiment was carried out on 98 women and 104 men with 'normal' red-green vision, on 4 women and 14 men who had various degrees of red-green blindness, and on 3 men who are green-anomalous because they reject the normal Rayleigh equation by a wide margin. The experiment was along the lines of Collins's research on the Rayleigh equation with rotating disks[1], and the details of the technique and other results will be published later.

The 'normal' women subjects were all asked to give information about any colour-blind relatives so far as they were able, and some of these relatives were among the colour-blind men and women tested. Colour-weak subjects, like the colour-blind, accept a wider range of matches in the Rayleigh equation than do the most sensitive normal subjects. These differences in range were measured by an efficient psycho-physical technique, together with the usual deviations in the Rayleigh equation.

If we pick out those women who pass the Ishihara test with little or no difficulty and therefore are not colour-blind, who accept or almost accept the normal Rayleigh equation and are therefore not anomalous, but who can make at least twice the modal range of matches in the Rayleigh equation carried out in this research, then the accompanying table can be constructed. For this table chi-squared is about 20, calculated from the marginal totals, showing that it is extremely unlikely that such differences could have been obtained by chance. The table is strong evidence that women who are blood-relatives of colour-blind subjects, and who, accordingly, must often be potential if not actual mothers of colour-blind sons, have a decided and measurable red-green weakness much more frequently than women in general.

WOMEN WITH 'NORMAL' RED-GREEN VISION.

	Known C-B relative	No known C-B relative
Twice modal range or more	11	7
Less than twice modal range	10	70

I am indebted to Dr. Mary Collins for her advice in setting up the experiment and to Mr. Joseph F. Simpson for frequent help.

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Colonial Geological Surveys

IN his article on Colonial Geological Surveys in NATURE of March 4, Mr. V. A. Eyles gave a useful résumé of recent discussions. There are, however, some further considerations to be noted. The figures he quoted from Sir Edmund Teale's paper of the results of mining operations, following upon the activities of Colonial Geological Surveys, do not include any statement of the amount and disposal of mining profits, or of the proportion of such profits set aside for the benefit of the local inhabitants as compensation for the loss of their national wealth. Thus arises the impression in some Colonial circles that Geological Surveys exist mainly for the benefit of outside mining interests—an erroneous impression which leads to friction between Geological Surveys and other Government Departments, administrative, agricultural, educational, etc., more directly engaged in promoting the welfare of the local inhabitants. Some change in Colonial policy after the War seems, therefore, desirable.

It is to be hoped that in the future the rights of ownership of their own mineral wealth by the people of the Colonies will be fully recognized, that the pre-war policy of exploitation of minerals by outside interests will become a matter of history and that the mineral resources of the people will be worked with the approval and for the benefit of the people, either by the people themselves or by the Colonial Governments on their behalf.

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THE research activities in zoology and botany conducted by the National Institute of Zoology and Botany of Academia Sinica during 1943 can be grouped into six sections, namely, ichthyology, entomology, protozoology, phanerogamic botany, algology, and cytology. The results are presented in epitome as follows :

Ichthyology

For four successive years the important edible fish, *Monopterus javanensis*, has been the main object of study. The anatomy as well as the physiology of its accessory respiratory organ, namely, the buccopharyngeal epithelium, its breeding habits and metamorphosis and the function of its larval organs have previously been discussed. In 1943, the whole blood vascular system was carefully worked out, and earlier accounts have required considerable modification. The integumentary serous glands of this fish, with their peculiar distribution around the pericardial region, were studied, and the hatching phenomena with which these glands are chiefly concerned were described. Particularly interesting was an investigation on the sexuality of this fish ; Monopterus starts its life always as a female, undergoes sex-reversal after laying eggs, becoming eventually a male. Its growth-rate under natural condition was also studied simultaneously.

As a proof of the capability of hypertonic excretion in a purely freshwater teleost as a means of osmotic regulation, the paradise fish, *Macropodus opercularis*, was shown in 1942 to produce a crop of chloride-secreting cells in its gill lamellæ when it is acclimatized in a strong sodium chloride solution. In order to ascertain whether the secretory activity of these cells is limited to chloride alone, as their name implies, the same experiment was repeated with sodium sulphate instead of chloride ; the result suggests that secretion is not limited to chloride (see NATURE, Feb. 26, p. 252).

An ichthyological survey has been made in the region covering Western Szechwan and Eastern Sikang. No less than a hundred species, including ten new ones, were collected and described. A comparative study of the much modified pectoral and pelvic girdles of the Homalopterid fishes, which are adapted with remarkable success to life in torrents, is now being carried on, in the hope of elucidating the phylogenetic relationship within the group.

Entomology

In systematic entomology, much emphasis has been laid on the white flies, Aleurodidæ, the fruit flies, Trypetidæ, and the leaf beetles, Chrysomelidæ. Investigations on the white flies of Szechwan and on the cucumber beetles of China have already been completed, and have proved of value not only to insect taxonomy as a whole, but also to the economic position of the groups studied.

Morphological investigations of insects have also been undertaken. The study of Malpighian tubes in Chrysomelidæ has helped to clear up the systematic position of the sub-family Eumolpinæ. In the study of the tibial tympanic organ of Conocephalus, attention has been directed particularly to the structure of the crista acustica and to the functional aspect of the whole organ. Comparisons of the elytral tracheation of Dermaptera with that of Protelytroptera, a Palæozoic order, were made, and the possibility of the Dermaptera being derived from Protelytroptera was taken into consideration.

Some experiments were conducted to demonstrate the effect of light on orientation of the cicada *Cryptotympana pustulata*, and also the change of position exhibited by aphids during feeding. Inquiries were likewise attempted with regard to the part played by the elytra of Coleoptera during flight, and by the jumping spiders in checking the spread of house-flies and mosquitoes. Observations on the mode of egg-laying of the aquatic bug, *Sphærodema rustica*, show that coition is immediately followed by the act of oviposition ; the two acts take place alternately and continuously, both activated by the male, and not by the female as generally believed. The problem of respiratory adaptation was investigated in another water bug, Cheirochela sp. This bug, being incapable of rising to the surface of water to obtain atmospheric air, has been obliged to overcome the difficulty by the development of pubescence on the thorax and abdomen for collecting air-bubbles under water, by the modification of certain parts of the integument to permit cutaneous respiration, and, most important of all, by the specialization of the legs to function as tracheal gills.

Protozoology

In the field of protozoology, work has been confined mostly to the dinoflagellates and Infusoria. For the former, studies have been centred in the thecal morphology of dinoflagellates, especially in the plates that constitute the ventral area, which has rarely been scrutinized by previous investigators. The thecal plates of a number of species belonging to Diplopsalis and to Ornithocercus were analysed and their number and arrangement determined. All the specimens studied were collected from the Hainan region during the years 1933 and 1934.

Surveys of infusorian fauna of Pehpei and other localities of Szechwan have been made from time to time. Five new species of epizoic ciliates were described. They are found attached either to the antennæ, legs and swimmerates or to the gills of the freshwater shrimp, *Palæmon nipponensis*. Other problems now being studied are the freshwater Sarcodina of Szechwan and the peritrichous Infusoria of Pehpei.

Phanerogamic Botany

The Umbelliferæ have been the main subject of investigation among the flowering plants. Aside from a general survey of Chinese umbellifers, the species of Bupleurum and Ligusticum, known as native drug plants, were separately treated. The anatomy of seedlings of *Coriandrum sativum*, *Fœniculum vulgare*, etc., has also been investigated. The results add much to our knowledge of the development of vascular bundles of the family Umbelliferæ as a whole.

In collaboration with the Kansu Provincial Government, a forest survey is now in progress in that province. Work is proceeding on utilization, growth-rate, and fungal diseases of timber trees. Land classification, stand and composition of the existing forests, and dendrological characters, which are exceedingly important for the formulation of forest management plans, are also being examined.

Algology

The section of algology dealt largely with the systematics of freshwater algæ. About 1,500 species were collected from different localities of Kwangtung, Kwangsi and Szechwan, and, among them, 4 genera, 75 species, and 24 varieties were described as new. Asterocapsa, a new genus of Myxophyceæ, is worthy of notice as it has reproductive cells with much the same appearance and mode of development as the more advanced autospores of Chlorophyceæ. Other three new genera, Hormothece, Brachytrichiopsis and Symphyonema, representing transitional forms of certain families, are deemed to be phylogenetically important.

Since 1941, attention has also turned to the study of algal ecology. Observations on algal communities of the Kialing River have been made at regular intervals. As affected by the condition of river-bed, the velocity of water currents, and the intensity of light, the distribution of algæ in this river naturally falls into seven distinct communities, always isolated and never forming horizontal adjoining zones like those prevalent in stagnant waters. Each community consists of only a single or very few dominant species. In addition, the seasonal distribution of algæ in a freshwater pond was thoroughly studied. Temperature, sunlight and rainfall are factors influencing the periodic occurrence of the species of phytoplankton.

Cytology

In the field of cytology, investigations on the number and behaviour of meiotic chromosomes of *Brachytrupes portentorsus* and the meiotic division in *Gesonia punctiforons* have been completed. The former demonstrates the number and structure of autosomes and the behaviour of the *X*-chromosome, whereas the latter deals especially with chromonema structure and the time of its splitting. In both cases the so-called chromomeres are believed to be mere artefacts or twists in the chromatids.

TRADE AND ECONOMICS IN THE INTERNATIONAL SPHERE

THE Economic, Financial and Transit Department of the League of Nations has issued two studies in a series on international trade and commercial policy with the view of contributing to those objectives of commercial policy, "the elimination of all forms of discriminatory treatment in international commerce" and "the reduction of tariffs and other trade barriers", which have found fresh expression in the Mutual Aid Agreements. The first of these, "Quantitative Trade Controls: their Causes and Nature"*, by Prof. G. Haberler, of Harvard University, in collaboration with Mr. M. Hill, considers what were the forces which induced Governments to adopt these measures of quantitative control; what were the relative advantages and disadvantages of such restriction compared with tariffs and other measures designed to influence trade through the price mechanism; whether quantitative controls were the most suitable instrument, and why they were so generally condemned both by international conferences and by economists, the likelihood of their adoption after the present War and the policies which should then be pursued.

This study leads to the conclusion that if the trend towards economic isolation, autarky, regimentation and State control, characteristic of the nineteen-thirties in many parts of the world, were to be renewed after the War, quantitative trade controls would necessarily take an ever-greater role. A movement in this direction would not only belie the intentions of the Governments of the United Nations as expressed in the Atlantic Charter and the Lend-Lease Agreements as well as innumerable statements of national policies; it would also prevent the achievement of those basic economic and social objectives which most of them have proclaimed—greater human welfare and full employment, within the framework of a social system designed to preserve individual liberty. These ends cannot be attained without an expanding international trade. Except over short periods, we cannot have generally regimented and socialized international trade and a domestic economy based on free enterprise.

Many countries may find it necessary to maintain exchange controls for a considerable time after the War as regards capital movements. If effective machinery is established to overcome the initial difficulties of financing the essential needs of countries left after the War without adequate means of external payment, and to facilitate multilateral clearing, it should be possible to liberate commodity trade rapidly from control via the exchanges. Of the circumstances facilitating a removal of import quotas a growth in exports appears to be the commonest, and the whole history of commercial policy in the inter-war period confirms the view that the difficulties in scaling down the barriers to trade are least formidable in times of rising prosperity.

In the period considered, the most clearly discernible factor leading governments to introduce quantitative controls was currency instability accompanied by exchange dumping. A primary cause of the currency instability was the breakdown of the mechanism of international trade and settlements as a result, first of the war dislocation and second of the catastrophic fall in prices. Discrepancies in national price structures can only be overcome by changing prices in terms of domestic purchasing power, or by changing the external purchasing power of currencies by a modification of the exchange-rates. This is one reason in favour of the establishment of special machinery by means of which credit may be furnished to meet changes in the balances of accounts, by which orderly changes in currency parities may, if necessary, be carried through, by which national monetary policies may be co-ordinated and kept in line, and multilateral trade and clearing facilitated.

Such machinery requires for its effective working concerted measures against economic depressions and for the maintenance of full employment, and these elements in a possible long-range plan for the preservation of an international economic system provide a challenge to the constructive vision and the co-operative spirit of our generation. The failure to break down the system of quantitative restrictions in the 'thirties was due not so much to a lack of understanding of the technical issues at stake as to the unwillingness of certain great States to abandon their designs for political aggrandisement or the methods by which they are able to exercise pressure on others. Wise concerted economic measures are one of the bases of a durable peace; but they provide by themselves no solution of the political problem on which the success of all efforts to create a better economic world ultimately depends.

* League of Nations, II, A.5; 1943. Pp. 45. (London: George Allen and Unwin, Ltd.) 2*s*. 6*d*.

In the second study, "Trade Relations between Free-Market and Controlled Economies"*, Prof. J. Viner analyses the difficulties which in the nineteen thirties confronted countries maintaining a substantially free trading system and relying primarily on the tariff method of trade regulation; it supplements a critical appraisal of the attempts made to meet these difficulties with constructive proposals for the future. There may be, from the national point of view, a case for national resort to direct foreign trade controls under conditions of world-wide depression, of over-valued and unstable currencies, of collapse of international credit facilities, of imminent threat of war, of the prevalence of similar controls in many other countries, and of the absence of any promise of effective concerted action to obtain relief from these evils; but Prof. Viner regards these direct methods as in general injurious to world prosperity and as barriers to international economic collaboration and harmony. Their substantial elimination is a prerequisite for the attainment of a peaceful and prosperous world.

Against all three major types of direct government regulation of foreign trade—exchange controls applied to commercial transactions, import quota systems, and government monopolies of foreign trade—six charges may be made, in different degrees. They 'tie up' diplomacy closely with the detailed conduct of foreign trade and thus promote international controversy and facilitate the injection of political and military considerations into trade relations. They lend themselves more effectively than ordinary import duties to the application of monopolistic methods to foreign trade, to the economic injury of the world as a whole. They promote bilateralism in foreign trade at the cost of multilateral trade and of the suppression of profitable foreign trade. They lend themselves to discriminatory treatment of the trade of different countries for economic or political purposes. They promote or require the development of internal monopolies and the restriction of the field for private enterprise, and especially small-scale enterprise. Finally, by placing other countries not following similar practices in a position of relative disadvantage in trade-bargaining, they tend to spread these practices to other countries.

Hope for better results from future attempts to obtain reform in this field must depend in part on the attainment, through provisions for collective security, of a reasonable expectation of a peaceful world. It must also depend on reduction of the levels of ordinary import duties in high tariff countries, on the attainment of substantial stabilization of currencies, on the establishment of procedures for concerted action to deal with mass unemployment and on provision of reasonable facilities for international credit. Rapid progress in the elimination of direct controls by bilateral negotiation cannot be expected unless greater success is attained in formulating and obtaining acceptance of unambiguous, rational and easily enforceable criteria for determining the absence or presence of discrimination and of the illegitimate use of monopoly power in trade relations; and unless there emerges from the bilateral negotiations a common pattern of policy with respect to relations with countries which continue to adhere to rigorous direct controls of their foreign trade. Equally the participating countries in their bilateral negotiations must also consider not only the protection of their own export trade from discrimination or from monopoly pressures, but also the need for refraining from pressing for, or from accepting, concessions which involve discrimination against innocent third countries.

Prof. Viner sees brighter prospects of success in an attempt to deal with the problem in a multilateral conference. Such a conference would have as objective multilateral agreement binding the participating countries to move towards the elimination of direct controls on a mutually agreed time-schedule; to define the practices which would not be permissible in their trade relations with one another; to formulate the procedures to be followed in trade relations with non-participating countries adhering to direct controls; and to participate in the establishment of an international agency, to which questions of violation of the convention, of revision of its terms, and of admission of new countries could be referred. The technical difficulties of framing and administering a multilateral agreement of this kind would be comparatively moderate if wide acceptance could be obtained for definite and unqualified outlawry of the questionable practices, at least after a transition period had elapsed. Further progress in obtaining significant agreement in this field may be impossible except as international agreement is reached in other fields of international economic relations, notably in limiting the heights of ordinary tariffs, in establishing international credit facilities for monetary stabilization and for long-term investment purposes, and for collaboration in dealing with the problem of the business cycle and of mass unemployment. Slow progress need not be fatal, provided there is early agreement on the direction in which movement shall take place, and on procedures of negotiation which will assure that the achievement of one stage of reform will lead promptly to endeavours to accomplish the next stage.

* League of Nations, II, A.4; 1943. Pp. 92. (London: George Allen and Unwin, Ltd.) 4s. 6d.

INDUSTRIAL POISONS

THE delivery by Dr. Donald Hunter of the Croonian Lecture of the Royal College of Physicians for 1942 was prevented by the War: but it is now printed (*Quart. J. Med.*, 12, 185; Oct. 1943). Remarking that the medical man of to-day must know something of the dangers of working in chemical, metallurgical, aircraft, munitions, ceramics, textile, cellulose lacquer and moulded plastics industries, Dr. Hunter points out that new materials for industry are frequently being discovered and used, and that their dangerous properties may not be realized until some workman loses his life or becomes severely ill. The medical man practising in an industrial area may have to deal with symptoms produced by substances which even the chemists may not fully understand. Such substances may attack the workman through his skin or lungs; some of them attack the liver, kidneys, blood or bone marrow. The toxicologist has to add to his medical equipment a considerable knowledge of chemistry and of the processes of various trades as well.

Dr. Hunter discusses the effects of lead, arsenic and mercury among the metals; among aromatic compounds he deals with benzene and its amino- and nitro- derivatives and also tri-*ortho*-cresyl phosphate; he concludes with the chlorinated hydrocarbons and substances of the glycol group. It is, of course,

impossible in a short article to summarize the results of experimental work and the wealth of other information contained in this lecture, which tells us many interesting things about industry as well as about toxicology.

It is interesting, for example, to note that the substitution of machine for hand labour has abolished lead poisoning among some kinds of lead workers and that, since 1899, the lead manufacturers of Great Britain have spent more than £200,000 on measures designed to provide healthier conditions for their employees. On the other hand, new methods and new industries have introduced new causes of lead poisoning. Motorists will note that spray painting of cars with leadless cellulose paints has reduced the incidence of lead poisoning in this trade, but the use of a lead and tin solder to strengthen steel motor-car bodies has created a new hazard. There is little risk of poisoning by the exhaust gases of car engines using petrol to which tetra-ethyl lead has been added, although it must not be used for cleansing the skin. Householders will be glad to know that aniline colours are now generally used to colour wall-papers, so that there is little risk of the symptoms once produced by living in rooms papered with wall-papers containing cupric arsenite. The mould *Penicillium brevicaule*, growing in the paste of such wall-papers, liberated dimethylarsine from the arsenical compounds used in the colours. It is worth noting, however, that, so late as 1931, a child died in the Forest of Dean from inhalation of dimethylarsine from the mouldy walls of a damp house, the arsenic having come from coke breeze used in the plaster of the walls. For this reason the use of concrete blocks containing coke breeze and the addition of arsenious oxide to cements to make them harden more quickly are not desirable.

It is in the field of the coal-tar derivatives that the toxicologist is hard put to it to keep pace with the chemist who produces them. Benzene, which must be carefully distinguished from benzine, is of outstanding importance, because of its destructive effect on the bone marrow.

Dr. Hunter states that medical workers all over the world are urging the abandonment of its use as a solvent. The same advice has recently been given by Drs. Hamilton-Paterson and Ethel Browning (*Brit. Med. J.*, March 11, 1944, p. 349). After two years of work on the effects of the inhalation of benzene used in rubber solutions in thirteen British factories, these authors conclude that some other solvent, such as solvent naphtha, should be substituted for benzene, which can cause permanent damage to the bone marrow; they recommend, among other precautions, that the blood of workers using benzene should be examined every six months. Further details about the effects of benzene are given by Dr. Hunter, who deals also with the dangers of the use of other coal-tar derivatives employed in industry.

It is interesting to learn that German factory workers at Münster, who were suffering from a shortage of fats, took home from their place of work a fat substitute and used it for frying potato pancake; they suffered from poisoning by tri-*ortho*-cresyl phosphate. In 1931, Continental women seeking abortion were poisoned by this substance, occurring as an adulterant of apiol, and in 1937 its presence in soya bean oil used for cooking caused other cases of poisoning in Natal. Many will remember the poisoning of some 15,000 people in the United States in 1930, when they took samples of a drink called Jamaica Ginger ("Jake") adulterated with tri-*ortho*-cresyl phosphate.

The chlorinated hydrocarbons will interest the general public because of their extensive use as refrigerants, fire extinguishers, cleaning agents and so on. Many of them are liver poisons. Carbon tetrachloride, which is the least harmful of them in practice, is used in fire extinguishers, in dry shampoos and as a household cleaning agent; it is also a valuable anthelmintic. The most dangerous of them is tetrachlorethane, which is also used in fire extinguishers, and as a dry cleaner and parasiticide. Its use for making waterproof coatings for aeroplane wings has been discontinued since 1917; in 1914 it caused poisoning of workers in this trade.

Dealing with substances of the glycol group, Dr. Hunter points out that, since 1925 or so, a great new aliphatic chemical industry has grown up, which is bigger than the coal-tar or aromatic industry, and this has produced a host of new solvents used in the textile, artificial silk, lacquer and celluloid industries, and in dyeing and dry cleaning and the making of paper, linoleum, polishes, cements and glues, cosmetics and other things. One substance of this group, dioxan, has a particular interest to laboratory workers, who may use it during the process of embedding material for section-cutting.

A bibliography extending to six pages adds greatly to the value of this detailed and very interesting paper. Apart from its value to industrial medicine, it should be read by the chemist, the manufacturer, the biologist and the social worker as well.

G. LAPAGE.

SMALL ERMINE MOTHS IN IRELAND

BRYAN P. BEIRNE has recently published an illustrated article* on certain species of these moths which belong to the genus Hyponomeuta. All stages of the three species, *H. padella* L., *H. cognatella* Hübn. and *H. evonymella* L., are distinguished; but the paper is mainly concerned with the biology and control of the first-named. In an outbreak of *H. padella* on hawthorn in Co. Dublin, an average of more than 95 per cent of the larvæ were destroyed by birds including starlings and other kinds. Of the remaining larvæ and pupæ about 50 per cent were killed by other enemies, including a species of Gregarina, which was found to be the most important single enemy of the larvæ after birds. Some 10 per cent and probably more were accounted for by this protozoan. An average of 3 per cent were destroyed by the well-known polyembryonic Chalcid parasite *Ageniaspis fuscicollis* Dalm.—the number bred out from individual Hyponomeuta larvæ ranging from 35 to 87. Some 3 per cent of the larvæ were also killed by the ichneumon *Angitia armillata* Grav. Less than 1 per cent were killed by other parasitic insects, including another species of Angitia, a species of Apanteles and what appeared to be Tachinid larvæ. A large proportion of the pupæ of the Hyponomeuta were killed by the predaceous larvæ of a sarcophagid fly, apparently *Agria mamillata* Pand. The ichneumon *Herpestomus brunnicornis* Grav. killed 8 per cent of the pupæ and *Pimpla turionellæ* L. 2 per cent of them. The immature stages of the parasites and predators are described and figured, together with

Econ. Proc. Roy. Dublin Soc., 3 (Dec. 1943).

the adults of most of them. Some 4 per cent of the Hyponomeuta larvæ and 5 per cent of the pupæ died from unknown causes.

The causes of outbreaks of Hyponomeuta are discussed. Outbreaks appear suddenly, and it is thought that in a particular year the greater proportion of the larvæ escape attack by birds. Heavy outbreaks are always eventually controlled by parasites. But the parasites do not multiply at the same rate as the moths, and it is usually several years before they are sufficiently abundant to check an outbreak, and several additional years before they reduce it.

FORTHCOMING EVENTS

Thursday, March 30—Tuesday, April 4

BRITISH PSYCHOLOGICAL SOCIETY (at the Training Centre, Jordanhill, Glasgow, W.3).—Annual General Meeting.

Saturday, April 1

BRITISH ASSOCIATION OF CHEMISTS (LONDON SECTION) (at the Chemical Society, Burlington House, Piccadilly, London, W.1), at 2.30 p.m.—Prof. R. G. W. Norrish, F.R.S.: "Chemistry and the Community".

Monday, April 3

SOCIETY OF CHEMICAL INDUSTRY (AGRICULTURE GROUP) (joint meeting with the FOOD GROUP AND LONDON SECTION) (at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1), at 2.30 p.m.—Mr. W. E. Rhodes and Mr. A. F. Davis: "The Selection and Pre-processing of Potatoes for Canning, with special reference to Control of Texture by Calcium Chloride"; Mr. F. Hirst and Mr. W. B. Adam: "The Processing and Laboratory Examination of Canned Potatoes".

SOCIETY OF ENGINEERS (at the Geological Society, Burlington House, Piccadilly, London, W.1), at 5 p.m.—Mr. R. N. Cotton: "The Planning of Working Hours".

ASSOCIATION OF AUSTRIAN ENGINEERS, CHEMISTS AND SCIENTIFIC WORKERS IN GREAT BRITAIN (at the Austrian Centre Swiss Cottage, 69 Eton Avenue, Hampstead, London, N.W.3), at 7.15 p.m.—Mr. J. Rubinstein: "Modern Trends in Electrical Insulation".

Tuesday, April 4

ROYAL ANTHROPOLOGICAL INSTITUTE (at 21 Bedford Square, London, W.C.1), at 1.30 p.m.—Mr. J. W. Layard: "Song and Dance in Malekula".

Wednesday, April 5

ROYAL SOCIETY OF MEDICINE (at 1 Wimpole Street, London, W.1), at 2.30 p.m.—Sir Walter Langdon-Brown: "William Gilbert (1544–1603) and his Position in the Medical World"; Prof. Sidney Chapman: "William Gilbert and the Science of his Time".

INSTITUTION OF ELECTRICAL ENGINEERS (WIRELESS SECTION) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Dr. D. Gabor: "Energy Conversion in Electron Valves".

APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

GRADUATE TEACHER OF GENERAL SUBJECTS, particularly MATHEMATICS—The Principal, Leicester College of Technology and Commerce, Leicester (April 5).

GRADUATE LECTURER IN MECHANICAL ENGINEERING at the Lincoln Technical College—The Director of Education, City Education Offices, 4 Lindum Road, Lincoln (April 6).

ASSISTANT MASTER OR MISTRESS on the staff of the Day School to teach MATHEMATICS and some PHYSICS up to School Certificate standard—The Clerk to the Governors, South-East Essex Technical College and School of Art, Longbridge Road, Dagenham, Essex (April 11).

ENGINEERS with good Degree and some Research experience, preferably in HYDRAULICS, for Research and Development Department of large Engineering concern (location, Newcastle area)—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Advertising Section, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. C.2011XA) (April 12).

DIRECTOR OF THE ART GALLERY AND MUSEUMS—The Town Clerk, Council House, Birmingham 1 (endorsed 'Art Gallery Director—Room 1') (April 12).

CHIEF ENGINEER, ELECTRICAL AND MECHANICAL, by the Jamaica Government Public Works Department—The Ministry of Labour and National Service, Room 432, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. D.788A) (April 12).

LECTURER OF STATISTICS (temporary, full-time) to take charge of the teaching of Statistics—The Registrar, The University, Liverpool (April 14).

RESIDENT LECTURER IN CHEMISTRY—The Principal, Newnham College, Cambridge (April 15).

UNIVERSITY LECTURER IN ANTHROPOLOGY—The Secretary of the Appointments Committee, Faculty of Archæology and Anthropology, Museum of Archæology and of Ethnology, Cambridge (April 15).

SENIOR LECTURER IN NATURAL SCIENCE at the Hull Technical College—The Director of Education, Guildhall, Hull (April 15).

HEADMASTER of the Junior Technical School, Doncaster—The Chief Education Officer, Education Offices, Doncaster (April 15).

ASSISTANT MASTER FOR TECHNICAL SUBJECTS in the Municipal Technical College—The Secretary, Education Office, Town Hall, Widnes (April 22).

CHAIRS OF MATHEMATICS, PHILOSOPHY and PHYSICS, tenable at Bedford College for Women—The Academic Registrar, University of London, Richmond College, Richmond, Surrey (April 24).

ASSISTANT MASTER to teach MATHEMATICS at any stage up to University Scholarship work at the City of London School—The Town Clerk, 55–61 Moorgate, London, E.C.2 (May 1).

DRUMMOND PROFESSORSHIP OF POLITICAL ECONOMY—The Registrar, University Registry, Oxford (May 13).

W. H. COLLINS PROFESSORSHIP OF HUMAN AND COMPARATIVE PATHOLOGY—The Secretary, Royal College of Surgeons of England, Lincoln's Inn Fields, London, W.C.2 (July 31).

BROADCAST ENGINEERS (male) by Government for service in Far East—The Ministry of Labour and National Service, Appointments Department, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. O.S.90).

LECTURE ASSISTANT IN THE PHYSICS DEPARTMENT—Prof. H. Dingle, Imperial College of Science and Technology, Imperial Institute Road, South Kensington, London, S.W.7.

ASSISTANT TEACHERS to take MATHEMATICS, MECHANICAL DRAWING, GENERAL SCIENCE, and GEOGRAPHY, in a Special Course in the Stroud District for R.A.F. Students—The Secretary, County Education Office, Shire Hall, Gloucester.

PSYCHIATRIC SOCIAL WORKER for Child Guidance, Delinquency and other Child and Adult cases—The County Medical Officer, 4 Barnfield Crescent, Exeter.

ASSISTANT TEACHERS for (1) ENGINEERING SUBJECTS, (2) MATHEMATICS AND SCIENCE, at the Staple Hill Junior Technical School, near Bristol—The Secretary, County Education Office, Shire Hall, Gloucester.

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Proceedings of the Royal Society of Edinburgh. Section A (Mathematical and Physical Sciences), Vol. 62, Part 1, No. 5: On Whittaker's Solution of Laplace's Equation. By E. T. Copson. Pp. 31–36. (Edinburgh and London: Oliver and Boyd.) 1*s*. [103

Transactions of the Royal Society of Edinburgh. Vol. 61, Part 1, No. 5: Studies on the Soils Developed on Basic Igneous Rocks in Central Aberdeenshire. By Dr. Robert Glentworth. Pp. 149–170. (Edinburgh and London: Oliver and Boyd.) 6*s*. [103

Memorandum and Articles of Association of Institute of Medical Laboratory Technology. Pp. iv+34. (Wakefield: Institute of Medical Laboratory Technology.) [133

The Development of British Universities. By Sir Ernest Simon. Pp. 20. (London: Longmans, Green and Co., Ltd.) 1*s*. net. [133

Quarterly Journal of the Royal Meteorological Society. Vol. 70, No. 304: Report on the Phenological Observations in the British Isles from December 1942 to November 1943. By Major H. C. Gunton. Pp. 32. (London: Royal Meteorological Society.) 3*s*. [133

Agricultural Education. Statement by the Executive of the National Union of Teachers on the Report on Post-War Agricultural Education in England and Wales. Pp. 20. (London: National Union of Teachers.) [133

Chemicals in War and Reconstruction. Pp. 28. (London: Association of Scientific Workers.) 3*d*. [133

Other Countries

Ministry of Finance: Survey of Egypt. Paper No. 46: The Use of the Conformal Sphere for the Construction of Map Projections. By J. H. Cole. Pp. iii+31. (Giza: Ministry of Finance.) [63

Ministry of Public Works, Egypt: Physical Department. Paper No. 43: The Nile Basin. Vol. 6: Monthly and Annual Rainfall Totals and Number of Rainy Days at Stations in and near the Nile Basin for the Period ending 1937. By Dr. H. E. Hurst and R. P. Black. Pp. vii+613. (Cairo: Government Press.) P.T. 50; 10*s*. [63

South African Journal of Science. Vol. 40: Being the Report of the Forty-first Annual Meeting of the South African Association for the Advancement of Science, Johannesburg, 1943, 28th and 29th June. Pp. xxvi+396. (Johannesburg: South African Association for the Advancement of Science.) 30*s*. net. [63

Carnegie Corporation of New York. Report of the President, the Secretary and the Treasurer for the Year ended September 30, 1943. Pp. 116. (New York: Carnegie Corporation.) [63

City of Durban: Durban Museum and Art Gallery. Annual Report for the Year ended 31st July 1943. Pp. 8+4 plates. (Durban: Durban Museum and Art Gallery.) [63

Continental Drift and Plant Distribution. By Douglas Houghton Campbell. Pp. 44. (Stanford University, Calif.: The Author, Stanford University.) [73

Commonwealth of Australia: Council for Scientific and Industrial Research. Bulletin No. 168: A Survey, Census and Statistical Study of the Horticultural Plantings on the Murrumbidgee Irrigation Areas, New South Wales. By A. Howard and G. A. McIntyre. Pp. 88+7 plates. Industrial Chemistry Circular No. 4: Separation of Ergot from Rye Corn. By Enid C. Plante and K. L. Sutherland. Pp. 12. (Melbourne: Government Printer.) [93

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