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NATURE

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FOUNDATIONS OF A NEW WORLD ORDER

THE Atlantic Charter has rightly been recognized as a political offensive of the first order. It is the starting-point for far-reaching and greatly intensified political warfare. Even more important, there is scarcely one of the eight points that is not a challenge to clear, fundamental and constructive thinking. That in certain respects most of the eight points require elaboration, if not elucidation, does not detract from the significance and value of the charter they constitute.

The many attempts already made to outline the basis of a new order which affords an adequate reply to that which the Nazis seek to impose on a prostrate Europe must therefore be given careful consideration. Two such recent efforts may be commended to the attention of scientific workers for their contribution to clear and constructive thinking. The first of these, by Prof. E. H. Carr, in the Democratic Order series of pamphlets*, deals particularly with the issues involved in the principle of self-determination and nationality, and should help to clarify thought about the second and third points of the Charter. The second, Mr. C. B. Purdom's "The New Order"†, goes even deeper into the social and economic changes involved in the establishment of any new order which worthily embodies the ideas of the fourth, fifth and sixth points of the Charter.

Prof. Carr's pamphlet derives its main value from its critical exposition of some of the fallacies which have initiated policy in the past, although he concludes with various constructive suggestions. He directs attention to the limited validity of the supposed coincidence between the principle of nationality and that of self-determination. Generally speaking, this is valid only for the limited area of western Europe, and self-determination should accordingly be carefully disentangled from those misleading associations with nationalism which nineteenth-century thought fastened upon it. It must be recognized in future that the self-determination of small nations is incompatible with unbridled economic power and complete economic independence.

Furthermore, Prof. Carr points out that the development of military technique and the conditions of modern warfare have broken down the conception of the independence of small States based on the principle of self-determination. In modern conditions of warfare, a small State cannot defend its independence against a great Power except by methods which in themselves constitute

* The Future of Nations: Independence or Interdependence? By E. H. Carr. (The Democratic Order, No. 14.) Pp. 64. (London: Kegan Paul and Co., Ltd., 1941.) 1*s*. net.

† The New Order. By C. B. Purdom. Pp. xvi+286. (London: J. M. Dent and Sons, Ltd., 1941.) 7*s*. 6*d*. net.

a surrender of military independence. Interdependence has become an inescapable military necessity. Neutrality has been virtually nullified for small nations in proximity to the theatre of war, both in the military and in the economic sphere. The small Power can in fact only survive by seeking the permanent alliance of a great Power.

Prof. Carr maintains that the failure of the settlement of 1919 was due, first to disregard of the economic factor, and secondly to neglect of the way in which military conditions had thus qualified self-determination. Moreover, many factors already introduced in the present War tend further to complicate the question of self-determination and independence. The offer of Great Britain to form a union with France, and also the Atlantic Charter, are the most striking examples of the extent to which nations have been prepared for close military and economic co-operation for the tasks of peace. The Inter-Allied meetings in London, a composite army, a navy and an air force in which units of different nationalities are embodied under a single command, the possession by one country of naval or air bases on the territory of another—all these are arrangements which need not disappear with the war. The Eight Points show that the democratic leaders have no intention of returning to the anarchy and confusion that marked the life of the world between the two wars.

Tentatively, Prof. Carr concludes, therefore, that we must discard the nineteenth-century assumption that nation and State should normally coincide, and lay far less stress on the absolute character of the right of self-determination and far more on its necessary obligations. Neglect of these correlative obligations was one of the cardinal errors of 1919, and Prof. Carr indicates how from this flow two lines of development towards international order : recognition of the need for a larger unit than the present nation for military and economic purposes and, within this unit, for the largest measure of devolution for other purposes, and recognition that the right of national self-determination can be valid only within the limits of this necessity for military and economic concentration.

Acceptance of these principles clearly involves a revolution in our whole thinking about neutrality, economic policy and defence, and that revolution must commence before the fighting ends. The lines of policy suggested by Prof. Carr are in fact well calculated to gain time for such a transformation of thought to occur. First, he urges the vital importance of maintaining, for the organization of peace, the forms of co-operation already established by those united in the struggle against Nazism. This machinery of interdependence and co-operation should be extended to other countries by an empirical process based on practical needs and possibilities. In the same way the constitutional forms of such co-operation must be determined, not theoretically according to some *a priori* conception of league, alliance or federation, but empirically as the outcome and expression of a practical working arrangement. The establishment and maintenance of *de facto* co-operation are far more important than the drafting of constitutional rules to regulate. At the present stage, interdependence is the practical problem of surrendering the habit of framing our military and economic policy without regard for the needs and interests of other countries.

In spite of the entirely different approach, Mr. Purdom's much more ambitious study gives a strikingly similar outline of a new order. The greater part of his book is indeed occupied by a comparatively detailed outline of a new order in Britain, but like Prof. Carr, he insists in the first place on the need for a new attitude, for a revolution in thought and the readiness to sacrifice old prejudices and ways of thought and living. The new order he outlines is built up of nations or States in which this changed outlook has already occurred, and the evolution of international institutions, whether in Europe or in the world at large, proceeds from the nation as model and as unit.

The structure of the new order conceived by Mr. Purdom is association in the State, society and nation, and it is to be built up through the recognition of the functional principle. International co-operation becomes practicable through the creation of functional organs within the nation and through the removal of sovereign power. The conversion of the British State into a functional organ involves the separation of economic and cultural from civic and political objects, those functions of the State now concerned with industry and trade being entrusted to an economic organ and those concerned with education, health, art and science to a cultural organ. The State would then be concerned strictly with its ancient functions of legislation, justice and order.

Mr. Purdom's proposals for the transformation of British institutions into a functional social order are detailed, and involve new conceptions of politics, of city life and of the value and significance of local government, as well as a new emphasis on cultural institutions ; the removal of trading services and education from civic government gives a new aspect to regionalism. In the structure tentatively outlined, there are three functional chambers, of which the Civic Chamber would continue the specific characteristics of the House of Commons for legislation and retain its name and rules and forms. The House of Lords would be transformed into the Senate, its members appointed

for life from among men and women distinguished in religion, science, art, letters, education, medicine, economics and civic affairs, and there would also be a Senate of Women and a Senate of Youth with consultative and advisory functions only.

The main element in the economic life of this new order would be the Economic Chamber, to which all the economic and industrial functions of the State would be transferred; it would be responsible for the reorganization of the economic life of the community, and the creation and supply and distribution of the goods and services required. This Economic Chamber would be concerned with all industries, primary and secondary, with power, transport, postal communications, agriculture, fisheries, shipping, distribution and banking. The individual, competitive, or monopolist units in every industry and service would be replaced by guilds composed of all engaged in the industry or service in whatever capacity. Through this system Mr. Purdom considers a new sense of vocation could be developed and a new standard of scientific production attained. Besides the guilds, the Chamber would work through a series of economic boards which would deal with proposals affecting the guilds or the Chamber, and consider and review regulations made by the guilds or legislation affecting them.

Parallel with the Economic Chamber, Mr. Purdom proposes a Cultural Chamber responsible for the bodily, mental and spiritual welfare of the community. This Chamber would consist of representatives of the churches and the various cultural guilds covering science, art, education, recreation, publication, etc., for which councils would also be formed through which the Chamber would work. These cultural organs, which unlike the economic organs, would not be limited to those less than forty-nine years of age, are intended to overcome the defects of specialization while enabling science and other cultural factors to exert their full humanizing influence on society.

Both in the economic and in the cultural sphere these institutions are visualized as reaching down into a system of co-ordinated local guilds in which the individual and the locality have full opportunity to make their own contribution. Similarly, while a Central Planning Board under the Minister of Planning as chairman, and formed jointly from the Economic Planning Board and the Board of Cultural Planning, would take care of the central planning required to avoid overlap and ensure consideration of all factors in national planning, it is from these same individual economic or cultural units that Mr. Purdom visualizes the beginning of effective international co-operation. The structure he contemplates for Britain would have its counterpart in the Dominions, from the political, economic and cultural chambers of which there would be formed three distinct federations: a Commonwealth Political Federation, a Commonwealth Economic Federation and a Commonwealth Cultural Federation. In addition, a Commonwealth Planning Council would be concerned with the higher direction of Commonwealth policy. The Colonies might be brought into the system as a commonwealth responsibility under a Commonwealth Colonial Council.

These Commonwealth federations are Mr. Purdom's model of the new world institutions. Functional federation on such lines, including a federal union of States with a federal defence council, federal court, currency council, colonial council and political planning council, a federal economic union, a federal cultural union, embracing a scientific council, a council for art and a planning council for culture, and federal planning institute, first for Europe and then extending to a world union on the same lines, offers, he considers, the most hopeful solution of establishing a European and a world order giving full satisfaction to human aspirations and ideals, and in which liberty and individuality would be reconciled. It offers, too, a solution of the problem of the place of Germany in a new Europe, and many of the changes he suggests can be built on developments or institutions already brought into existence by the War.

Mr. Purdom's proposals are no doubt ambitious—many would say visionary—but there is more to commend them than even the fact that some of his suggestions are taking crude shape under the stress of war. By far the most successful international co-operation of the last two decades has been on functional lines, and by concentrating on such developments, encouraging through them the development by education, through world planning and through cultural or economic contacts, of a widespread world consciousness, while preserving, as Prof. Carr insists, the institutions of co-operation established to serve our immediate tasks of defence or offence, it may be possible to move forward to a more concrete and formal organization when the time is ripe. Meanwhile, Mr. Purdom's proposals at least merit serious and critical examination. They indicate one way in which the points of the Atlantic Charter might be translated into action. Whether the particular proposals he details are adopted or not, no new order embodying the spirit of that declaration and safeguarding the four freedoms of mankind will ever be elaborated save by utilization of creative energy, and by readiness to face change and to accept sacrifice and responsibility. It is in that spirit alone that the immense opportunities that the War has brought can be seized and turned to the building of a new order, a new society of free men and free peoples.

REASON AND THE 'NEW ORDER'

Ideals and Illusions

By L. Susan Stebbing. Pp. xiii+206. (London: Watts and Co., Ltd., 1941.) 8*s*. 6*d*. net.

THIS book, which is written by a philosopher, deserves to be widely read. It could be used by 'advanced groups' studying the problems of the post-war world. It is suitable also for the isolated student and especially, I think, for the scientifically trained and for religious people.

It is not a very easy book to read. Some re-arrangement of the chapters might clarify the argument, but the difficulty arises rather from the nature of the subject than from faults in authorship.

The object of the book is to examine one of the three important causes that have led to the present "profound failure" of civilization. The method adopted is that of rational or Socratic criticism. The part played in Plato's Dialogues by his acquaintances is taken by a large number of leaders of modern life: political, economic, philosophical and religious. One by one, they are brought into the discussion by means of extracts from their books or speeches. Interesting results follow the rational criticism of their words.

The argument of the book is based upon the dictum that there are "three important factors that determine social change: economic structure, the possession of power—especially naked power—and ideas".

Prof. Stebbing deals only with the last of these factors. "The modern world over-emphasising power has neglected the significance of ideals." An ideal is described as being "something considered to be worth having", an idealist as "one who is influenced in his actions by his ideal". No description is given of an illusion, but it appears that an ideal that will not withstand rational criticism or is impractical, does not influence conduct, or is evil in its social consequences, is an illusion.

The close connexion between good ideals and good social conduct is repeatedly stressed—at least by implication: the need for a sound criterion of the rightness or wrongness of an action—the need, that is to say, for a sound basis for morals—is emphasized again and again.

Some people attack idealists because they believe them to be utopians and visionaries, but the attack may be due to verbal misunderstandings or to the careless use of words. Again, misunderstanding may arise from a confusion between ideals and illusions. Even the most ardent of the realists, from Machiavelli to Hitler, have possessed and have pursued ideals. It is an illusion to suppose that realists have no ideals: the question is whether their ideals are good or bad. Another illusion is to hold "that unless there be a goal for man beyond and outside the historical process, our lives are without significance and futile" and, in that case, that there "remains no basis for morals". But "many spiritual excellencies are valuable for their own sake" and do not depend upon a future life.

Everything points therefore to the "need for reflection" in order that we may be able to distinguish ideals from illusions. "The unexamined life is not a life worth living for a human being", said Socrates.

The modern tendency to disparage reason is considered. The 'retreat from reason' is found to be due, in part, to a longing for certainty and for absolute moral standards. Certainty is an illusion; in seeking for it we "always over-simplify our real problems".

Next we consider the "democratic ideal". A starting-point is found in a sentence in the American Declaration of Independence, "that Freedom and Happiness are the inalienable right of all men". The ideals of freedom and happiness are examined. The divergent ideals of democrats and totalitarians are made more clear to us. After that we consider an illusion, that happiness is irrelevant to the good life since, as some Christians have asserted, poverty, pain and suffering are disciplines for the soul. But "if our sensibilities are unblunted, we cannot ignore the tragic happenings in our world. Not to ignore them is to be forced to do something about them; and to do something, it is first necessary to make clear to ourselves our political ideals." Another common illusion is to suppose that democracy can be achieved simply by "playing the game".

Once again we examine the conflicting ideals of the democrat and the totalitarian, and as we do so we encounter the illusions that arise from the careless use of abstract words like war and poverty. At this point the author suggests a device by means of which some of our illusions may be evaded. She suggests that the main abstract word in a sentence should be translated into an "equivalent sentence" composed of corresponding but less abstract words. When this has been done, it is usually not difficult to discover to what extent our thinking has been confused by the abstract words. In this manner we shall learn to speak plainly and think more clearly. Abstract words such as 'conscience' and 'conscientious' are next examined.

Finally, we return to a point raised earlier in the book. This is what the author calls the "Last

Illusion", namely, the idea that morality is dependent (as most, but not all, Christians hold) upon a belief in *personal* and *conscious* immortality. This last chapter seems to me to fall below the standard set by the rest of the book both in clarity and significance. The argument aims at showing that a belief in personal immortality is an illusion and that a rational basis for morals can be found without invoking this belief. But it may be asked whether a *rational* basis for morals is sufficient for our present tragic circumstances. It seems to me that what is chiefly necessary is a sound *conative* basis for morals, that is to say, an adequate and an enduring 'drive' towards right conduct. May it not be that, even if a sound rational basis for morals can be found within the time-space order, adequate and persistent moral *drives* can only be found within an eternal order? A. N. Whitehead has said: "What Plato thought, Christ did." Within the difference that existed between Plato and Christ is to be found (as it seems to me) the 'drive' that the modern world needs. Dr. Stebbing asserts that a sound basis for morals can be found in "metaphysical materialism". I venture to doubt it. At least we should require an "equivalent sentence" for these highly abstract words before forming an opinion. Perhaps paper economy is responsible for the vagueness of her final chapter—or it may be that my illusions or her illusions are responsible for it.

I regret that the book has no index, not even an index of quotations. This last omission seems to be a serious fault in a book of this kind. But I hope that I have sufficiently commended a valuable discussion of an important topic.

HOWARD E. COLLIER.

PLASTICITY IN METALS

The Metallurgy of Deep Drawing and Pressing By Dr. J. Dudley Jevons. Pp. xvi+700+164 plates. (London: Chapman and Hall, Ltd., 1940.) 50*s*. net.

THE modern use of metals and alloys is dependent to a very large extent on their plasticity, which allows them to be worked into useful forms in the solid state, at ordinary or at raised temperatures, by methods causing plastic flow. It is not only in course of manufacture that this plasticity is useful, since the same property is a safeguard against sudden fracture under stress. Possibly the most striking example of the importance of plasticity in metals is the hot-rolling of vast quantities of steel into many different forms, but the pressing of metal sheet into finished shapes at atmospheric temperatures is also now a great and expanding industry. To give one example, the present-day motor-car body is essentially an assemblage of sheet steel pressings.

In the past, the hot and cold working of metals were both looked upon as primarily the province of the engineer, no doubt because of the engineering knowledge demanded in the design, construction and operation of the powerful rolling mills, hydraulic presses and other machines used. More recently, the metallurgical problems arising have received a larger share of attention. Organized co-operative investigations are now in progress in Great Britain on the rolling and on the deep drawing of metals. Prof. H. W. Swift, who has written a foreword to this book, has for some time been conducting a section of these researches on deep-drawing problems, and has, in particular, made advances in methods of determining the capacity of metal sheet for undergoing deep-drawing operations satisfactorily. "Deep" drawing imposes severe plastic deformation on sheet metal by means of a punch and a die in a press. The production of a brass cartridge case from a flat disk in successive drawing operations, with intermediate annealings to restore the plasticity lost in the hardening caused by cold work, illustrates the extent to which such cold-working operations can be carried in deep drawing.

Dr. Jevons has made the subject of deep drawing peculiarly his own and has taken full advantage of his special opportunities for investigating its application on the large scale. He has produced a comprehensive treatise in which none of the metallurgical aspects of deep drawing is neglected. He has indeed gone outside this field in giving excellent concise descriptions of the manufacture of the two chief materials of deep drawing, brass and steel sheet. While far more adequate accounts of, for example, the iron blast furnace are naturally to be found elsewhere, those engaged in deep drawing, for whom the book is mainly written, will be helped by the descriptions of the manufacture of the materials the properties of which are so important to them. Mild steel of the softest grades and annealed brass such as 'cartridge brass' containing about 70 per cent copper, 30 per cent zinc are specially suitable for deep drawing because of their very high plasticity.

The cold pressing of flat sheets into various forms is such a quick, convenient and economical way of

producing relatively intricate shapes that it is often applied to the utmost limit of the deformation the sheet will stand. Thus there is a never-satisfied demand for still better deep-drawing properties. Dr. Jevons has rightly given much space to the questions, less simple than might be thought, of what constitutes good deep-drawing properties in the various materials used, how these properties may be controlled, measured and specified, the many causes of defects and failures occurring in drawing or as a consequence of it, and means of overcoming these troubles. In this section special chapters are devoted to the season-cracking of brass resulting from internal stresses remaining after drawing (a trouble which should occur less frequently than it does as methods of prevention are well established) and stretcher-strain markings in steel. These markings, a form of 'Luder's lines', caused by local 'necking' under the tensile stress imposed by drawing, constitute a difficulty in the drawing of mild steel which is not easily surmounted. Presses, tools, lubricants, new applications of deep drawing, and the deep drawing of metals other than brass and steel are the headings of other chapters each dealing adequately with its subject. The avoidance of defects and failures by improvement in design of the pressing, in pressing operations or in the drawing qualities of the metal sheet is discussed in an impartial and authoritative manner.

Plasticity in metals is a property of the individual crystal. Dr. Jevons attaches full weight to such factors as size and orientation of the crystals and discusses 'directionality' in an illuminating way. The mode of deformation of metals, even in relatively simple and well-defined conditions, and the effects of such permanent deformation still present many obscurities. The scientific study of the severe and intricate plastic flow involved in deep drawing, of the changing conditions of stress and strain, and of the complex effects resulting, is full of difficulties, and practice rests mainly on empirical knowledge. Nevertheless, Dr. Jevons considers that there is urgent need for a much wider application to deep drawing of scientific investigation and control, which have already solved serious problems in this field.

Although the book is a very substantial volume Dr. Jevons has compressed his encyclopædic knowledge of the subject into manageable compass and has contrived to make it thoroughly readable. All the industries concerned and all those who have occasion to take a scientific interest in any aspect of deep drawing have reason to be grateful to him for this masterly treatise. Its appearance during the War has been most opportune because of the extent to which deep drawing is employed in the manufacture of aircraft, ammunition, transport vehicles and innumerable other war requirements. The lavish illustrations add to the value of the book, and the way in which it is produced is worthy of the excellence of its contents.

THE BARTRAMS: BOTANISTS AND EXPLORERS

John and William Bartram, Botanists and Explorers: 1699–1777, 1739–1823
By Ernest Earnest. Pp. vii + 177 + 2 plates. (Philadelphia: University of Pennsylvania Press; London: Oxford University Press, 1940.) 12*s*. net.

THIS book is delightful reading. It tells of pleasant people in happy times, for it is mostly about Philadelphia in Benjamin Franklin's day. John Bartram, member of the Society of Friends and poorly educated in a village school, bought a piece of rough land on the Schuylkill River, hard by the city, in the year 1728; there he built his house, drained his land and won his way to prosperity. Meanwhile he planted a garden and learned botany, became a friend of Benjamin Franklin, and signed his name next to Franklin's own on the Founders' Roll of the American Philosophical Society. He came in close touch with Peter Collinson, and was the chief source of new and rare American plants for him and his many gardening friends; sent pinecones to the Duke of Norfolk and seeds to Philip Miller and dozens more; was dubbed king's botanist for the American Colonies by George III, made a member of the Royal Academy of Sciences of Stockholm, and called by Linnæus the greatest natural botanist in the world.

He was indeed a remarkable man, and his son William was no less remarkable in his own way. When "Billy" was a schoolboy—"botany and drawing are his darling delights", said his father, "and I'm afraid he can't settle to any business else". The forecast came true. But William Bartram learned to draw exquisitely, knew his plants and his birds, was loved and trusted by the Indians, travelled far and wide and constantly, and at last wrote a famous and beautiful book. To write English undefiled was no rare accomplishment in the Quaker city, but Bartram wrote his "Travels" in such a style as influenced Chateaubriand and delighted Wordsworth and Coleridge himself. From Bartram, Wordsworth took his Indian scenes for "Ruth", and Coleridge

got his sacred river, with its "caverns measureless to man". As Coleridge says in his "Table Talk", "the book was written in the spirit of the old travellers". Wordsworth's "pulse of the machine" was Bartram's own "pulse of nature"; and what Bartram conceived as an "impulse" controlling the life of the plant grew in Wordsworth to "One impulse from the vernal wood May teach you more of man . . .".

Mr. E. Earnest has done his work admirably well; but he might have told us a little—for he tells us nothing—about the many plants which the Bartrams discovered and sent to England.

D'ARCY W. THOMPSON.

CHEMISTRY IN WAR

Annual Reports on the Progress of Chemistry for 1940

Vol. 37. Pp. 525. (London: Chemical Society, 1941.) 15*s*.

THERE is a proneness to designate this as a physicists' war in contradistinction to that of 1914–18, which was widely called a chemists' war. Then Great Britain was short of trained men, knowledge and the manufacturing equipment to make many materials essential for the State and the people; broadly speaking, the same applies this time to physics, which has changed during the last decade from a largely theoretical to a definitely applied science.

Though less is heard of the chemist it does not mean that he is stagnant: in fact both science and industry took the lessons of the War of 1914–18 very much to heart, perhaps more so than any other section of the community. A steadily increasing stream of highly trained students—chemists and chemical engineers—flows from the universities, while the industry has become both highly organized through its trade association, conscious of the value of more and more research, up to date in its methods of manufacture. As a result the outbreak of war found it able to supply the national needs of essential chemicals and medicinals and to undertake without much delay the manufacture of a few substances protected by patent and hitherto imported.

It is common knowledge that there is now increased pressure for every single thing that can be produced at home, and even this greatly enhanced demand for chemicals has been largely met. Substitutes usually mean synthetic materials in which chemicals are involved, and now that the stage has been reached of making substitutes for substitutes it is more than ever a question of more chemicals. Thus the very fact that little if anything is heard in public of the chemical industry, of the shortage of this or that chemical, of the need for trained men, is a tribute to the prevision of the industry and to its pre-war organization. We write "pre-war" in order that we may repudiate the term as indicating preparation: the industry was organized to supply the nation and the export trade with an expanding need for each and every chemical at competitive prices in normal times of peace. It has no interest in war chemicals as such; in war it diverts explosives from the mines to the guns and has to make so much more of this and that taken away from their multitudinous ordinary everyday uses. Those who are pleased to rant about the prostitution of science to war sometimes speak in ignorance.

The individual chemists are likewise playing their part, and the research workers, now a great army, are for the most part engaged in solving the nation's problems. In spite of this the scientific journals still contain original papers and abstracts of work in other lands; there is more than enough to form the subject of annual reports even more crammed with undigested material than usual.

These reports were originally issued in 1905, when Sir William Tilden was president of the Chemical Society, to present an epitome of the principal definite steps in advance "in order that specialists in any one department of the science may obtain without difficulty information as to the nature and extent of progress in other branches of the subject to which they have not paid special attention".

Judged from this criterion, the individual reports are a disappointment. The older man, the industrialist, the specialist in one field, as we nearly all must be nowadays, will not find it easy from them to discover the state of knowledge in other fields. In fact, the reports are written by a specialist in a field for others in the same field, described in the notation or shorthand, sometimes termed jargon, used in that particular subject, and therefore as incomprehensible to outsiders as the shorthand notes of their secretaries.

Surely it is possible for our future chemists to write clear statements in English about a subject of which they are masters. The Chemical Society should say whether it has departed from its original intentions: as they are to-day the "Annual Reports" appeal to specialists only.

E. F. ARMSTRONG.

SCIENCE AND HUMAN NEEDS

AMONG the many subjects that were discussed at the Conference on Science and World Order held during September 26–28, there was none that met with more support and general agreement than the need for an increase in the standard of living, especially as regards nutrition. Gone are the days of 'subsistence standards', that would give the necessary number of calories to keep body and soul together.

The right of every individual to the means of attaining his full inherited capacity for health and physical fitness, said Sir John Orr, of the Rowett Research Institute, Aberdeen, should rank equal with his right to religious and political freedom. We have now an authoritative standard of dietary requirements for health, but when diets in common use are compared with this standard, it is found that, even in the wealthiest countries, the diet of the poorest third of the population does not come up to the standard. This rough estimate gives an indication of the extent to which mankind can be freed from much of the burden of disease, poor physique and resulting suffering which formerly was thought to be due mainly to heredity and, therefore, inevitable.

In the decade preceding the outbreak of the War, some Governments realized the importance of the new science of nutrition for human welfare and took measures to improve the diet of the poorest. These measures have had striking results. The great decrease in deficiency diseases, the reduction in both infant mortality and tuberculosis death-rate, the increased stature and better physique of school-children which have taken place in Great Britain in recent years, are due mainly to the great improvement in the diet of the poorest. This gratifying and rapid improvement in national health shows how easily average health and vigour can be raised.

If we are going to plan for human welfare, we should begin with a food policy based on nutritional needs. This would do more to promote health and happiness, and alleviate the worst effects of poverty, than any other measure. If every family knew that, in any circumstances, they would have sufficient of the right kind of food to give their children full opportunity for the enjoyment of a healthy life, the worst fear of want would be eliminated.

Mr. Herbert Morrison, the Home Secretary, while careful not to commit the Government, expressed himself in equally unequivocal terms. Within the last generation, he said, science has given us a new body of exact knowledge about human and social needs. Social scientists have told us that in Great Britain nearly half the population, a few years before the outbreak of war, had a diet below the minimum needed for health. The great experiment made possible by the War has demonstrated that a people living on a diet more restricted in bulk and variety, need not suffer in health—indeed may even show some improvement as measured by epidemic statistics—when steps are taken to ensure that the food they get contains the right proportions of those ingredients needed for healthy living.

Our satisfaction about national health during the War must not blind us to the fact that we are, partly through ignorance, partly through poverty, still well below an optimum food standard; health, growth and expectation of life will all be greatly improved if we can attain that standard.

Turning to the question of housing and town-planning, Mr. Morrison pointed out that systematic study of the effect on health of immediate environment, and analysis of housing standards, have indicated that a certain minimum individual allowance of space, privacy, fresh air and sunlight is an essential for health. Yet, judging by the Government standard of overcrowding, which is by no means strict, more than 340,000 houses in England and Wales are found wanting. In one of our great cities nearly a third of the population are living in a state of overcrowding. The death-rate in the slums of one city is 28 per thousand, as against 18 per thousand in municipal houses.

As to clothing, the Board of Trade has given a flying start to exploration of this field, by the system of rationing now in force. We can accept sixty-six coupons, and what they will procure, as a useful first approximation to a minimum—not, of course, an optimum—welfare standard in clothing.

Dr. Agnes Hamilton, of the London County Council, dealt with the needs of a specific group, the housewives. She expressed the hope that time-saving appliances and fittings, now found only in the more expensive modern dwellings in Great Britain, will become available to all. The chromium sink, the electric mixer, the refrigerator, Bakelite fittings, and central heating and hot-water arrangements, if made available normally for the woman in the home, could revolutionize her life and that of her family. Not only could the home-keeper dispose of her household chores in a time limited enough to permit her to follow a career, if she wants to do so, but work in the house would also become a skilled profession, such as can enlist the services of regular workers who have the talent

for it that does not belong to every woman as such.

An account of some of the recent social work carried out in the United States for the relief of malnutrition and improvement of health was given during the session on world planning by Prof. Alvin Hansen, professor of political economy in Harvard University and special economic adviser to the Federal Reserve Board. In 1934, he stated, surplus farm products were purchased by the Federal Government for distribution to needy families and for use in school lunch programmes. In 1939 the Food Stamp Plan was inaugurated. That plan is now reaching about four million families and distributing foods worth 120 million dollars a year. Most of the foods so distributed are protective foods needed by under-nourished families. Free lunches are now available to about four million school-children. Low-cost milk is being distributed in several large American cities.

The Conference on National Nutrition for Defense, held in Washington last May, recommended vigorous and continual research in nutritional problems, more widespread education of medical men, dentists, social service workers and teachers, in the newer knowledge of nutrition; also the mobilization of motion pictures, the radio, the Press, and home and community demonstrations to spread knowledge of nutrition among the people.

The programme of nutrition should be attacked from an international angle. Arrangements could be made for international exchange of surplus products to be used for free school lunches, since the means exist now, for the first time in history, to produce abundant food for all mankind.

The level of health in the United States to-day, Prof. Hansen said, is higher than ever before, but it is none the less true that large sections of the people do not share in the general high health-level, and it is only just beginning to be realized that to ensure available treatment to all is a basic public concern. In 1934 President Roosevelt appointed a Committee on Economic Security to study, among other things, the country's health needs, and after the passage of the Social Security Act in 1935, he appointed the Inter-departmental Committee to co-ordinate health and welfare activities. This Committee, in its report, envisages a gradually expanding programme, reaching its peak by the end of the tenth year. The programme includes the creation of public health organizations and facilities for combating special diseases, and for maternal and child health services; also the expansion of present hospital facilities and medical care for the medically needy.

Lord Hailey, in his address at the session on world planning, discussed the needs of the peoples of the British and other colonies. We must see that they have the type of nutrition that will establish the necessary measure of resistance to disease. They must have access to medical facilities for dealing with physical disorders, epidemics and other sickness; and access to such measure of popular instruction as will enable the mass of the people to adjust themselves to the needs of new economic and cultural conditions. It is only in the last few years that we have inaugurated a general survey of nutritional conditions in the Colonies, and the extent of popular education was for long dependent upon missionary initiative.

Several of the papers presented to the session on post-war relief also dealt with problems that are of a permanent nature. Prof. Julius Löwy, of the University of Prague, mentioned that delicate and convalescent children are in need of mountain and sea air, and that industrial workers suffering from systematic poisons must be placed in suitable climatic conditions. Dr. Anni Noll pointed out that regular periodic health overhauls of family units, such as are carried out at the Peckham Health Centre, London, are essential.

Mr. Noel-Baker, M.P., supported earlier pleas for a balanced diet: "We know how much protective and energy-producing food every child and adult ought to eat, in other words, we know what our food policy ought to be. We know with mathematical certainty that if we could give every one a minimum standard for maximum health, the community as a whole would be richer, healthier and happier in every way, and we know that if we plan right, we could produce the food. Mr. McDougall Inglis, who is a very high authority, says that we could do it for North America and Australasia in five years, for the whole of Europe in eight or ten years, and for the whole world rather longer."

Returning to Sir John Orr's address, which set the tone to many of the subsequent utterances, it may be pointed out that he referred to several diet standards: the British Medical Association's "minimum", the League of Nations' "optimum", the American Agricultural Department's "moderate" and the American National Nutrition Council's "lowest" standard. He might have added to these Cadbury's "suggested" diet and the Engineers' Study Group "desirable" standard. Sir John did not go into the differences between these standards—and perhaps it is unnecessary to do so at this stage. The following article dealing with post-war relief makes it sufficiently clear that the diet-level in Europe and elsewhere is already very low, and likely to be at a starvation-level at the end of the War. It will not be practicable therefore to begin with the highest level, and we shall have perforce to pass through the stages represented by the several 'balanced' dietary standards.

SCIENCE AND POST-WAR RELIEF

OUT of the present terrible conflict there will arise upon its termination widespread calls for succour and help, said Dr. Wellington Koo, the Chinese Ambassador, at the Conference on Science and World Order, in opening a discussion on post-war relief. The need of care for the sick, food for the hungry, nourishment for the young, housing for the homeless, prevention of epidemics, and many other forms of assistance will be pressing. All this requires planning, and science can do much to facilitate it.

An example of the work which will have to be done was given by Mr. R. Allen, of the American Red Cross, who has recently returned from relief work in France. He described how they had found hospitals in Occupied France completely denuded of all supplies, the Germans having taken over not only the buildings but also all medical materials, and left the French to set up hospitals in churches and schools. The American Red Cross was able to help them with medical supplies without interference from the German military authorities, and in Unoccupied France distributed milk to children under fourteen, with excellent results.

Mrs. H. Priestman-Breal, of the Friends' Relief Mission, who was engaged in relief work after the War of 1914–18, showed much human understanding in her analysis of the problems of relief and reconstruction. These, she said, offer a great opportunity for international friendship and understanding, but one that might easily be misused, even with the best of intentions. Skill and knowledge are needed in such matters, otherwise some of the results might be the very opposite of what is intended, because the people one means to help, though they might be better off materially, might nevertheless feel sore, humiliated and indignant, no matter how irrational such a feeling on their part might appear.

Mrs. Priestman-Breal gave an outline of some of the work done in Poland after the War of 1914–18. In her opinion, merely handing out relief seems unsatisfactory, as it encourages certain people to beg. She has found various schemes for encouraging the initiative of the people to be helped which gave good results : in spring and summer, ploughing columns and seed distribution were started, in autumn and winter, timber hauling for rebuilding houses was organized, and spinning, weaving and embroidery, in exchange for food rations, was encouraged.

A superior attitude on the part of the relief worker would be fatal. One must remember that while it is pleasant to give presents, it is sometimes less pleasant to receive them. In such countries as France and Germany the danger of giving offence would perhaps be greater, and any superior attitude might be even more resented.

Sir John Russell, of the Rothamsted Experimental Station, delivered one of the most vivid speeches of the Conference, in discussing the steps that will have to be taken towards "restoring the scorched earth". The Russian and Ukrainian peasants, he said, are following their traditional policy of burning their villages and destroying all crops and animals which they cannot remove to safety. The inevitable consequence is famine and pestilence, and large-scale relief will be necessary. Agricultural reconstruction will be, if anything, more important.

Fortunately, the destruction of the soil is not likely to be serious. The conditions in the Ukraine do not favour soil erosion such as occurred in the 'Dust Bowl' of the United States, in spite of the high proportion of cereal cropping—always a predisposing cause.

The reconstruction of agriculture will, however, be very difficult. Russian plant breeders have produced numerous varieties of crops specially suited to their different regions. Drought has always been a serious problem in the U.S.S.R. ; indeed the yields of grain are more dependent on favourable rain and snow fall than on any other factor. Rain- and snow-fall are out of human control, but in all countries the search for drought-resistant varieties is recognized as the surest way of coping with the problem. Russian men of science have been very successful in that field, and it would be a tragedy if the varieties produced as the result of so many years of labour should be lost. It would greatly facilitate reconstruction if selected varieties could be sent to western Canada and multiplied there in readiness for the time when the seed will be needed.

The reconstruction of the Soviet livestock population will be more difficult. It took five or six years to recover from the low level of 1933, which brought great distress to the U.S.S.R. Recovery would now be more rapid if the pedigree stock could be saved by sending animals eastwards out of harm's way. Selection and improvement have been steadily going on, and the technique of artificial insemination whereby a high-class male animal can fertilize a much larger number of females than is otherwise possible would be very helpful.

The destruction of trees is pathetic because it takes so long for them to grow again, but the British could help in regard to fruit trees, not by sending British varieties, which would not be at all

suitable, but by carrying on the Russian varieties, so as to ensure that the patient work of their fruit experts should not be lost. Very little material is needed, and it could be carried by air.

All these problems of reconstruction in the U.S.S.R., Sir John said, will arise in Poland also, but they will be intensified by the circumstances that Poland has no hinterland into which pedigree seeds or animals can be sent for safety, and the cutting down of the forests in the north will lead to soil destruction. We can greatly help agricultural reconstruction by maintaining British pedigree flocks and herds so as to supply breeding stock. After the War the planning of agriculture will become essential and special responsibility will devolve upon us as the largest buyers of agricultural produce. We must plan so as to safeguard British agriculture and to ensure that the distribution of British imports yields the maximum of benefit both to the producers of the materials and to ourselves.

Dr. E. Kodicek, formerly lecturer in psychology in the University of Prague, gave the warning that the organization of post-war relief will have to be based on a wide scheme of total post-war reconstruction rather than on charity. All attempts of the latter kind after the War of 1914–1918 were unable to deal adequately with the great tasks with which they were confronted, nor can they hope to do so after this War. To deal with these problems an efficient organization of scientific experts and politicians is needed which would have to possess sufficient executive powers to implement the plans upon which they decide.

There will be nutritional deficiencies in Europe in the west as well as in the east, and immediate measures will have to be taken to prevent a major disaster. But even more important is a constructive food policy for building up a post-war Europe. The relief programme will be the starting-point for mutual understanding and collaboration between nations. Plans for food distribution, food-growing, exchange, stocks of vitamin concentrates, care of mothers, children and the sick, and many other problems, will have to be organized from the wider outlook of nation-wide needs. The help of the separate Governments will be necessary, working in collaboration with each other and under an international organization.

The same considerations apply to health organization. Medical relief will have to be organized on the basis of State medical services, but will also have to pay regard to *inter*national as well as *intra*national requirements. Such services require to be directed by a central organization with executive powers. The immediate help needed after the War will include : medical supplies of all kinds, such as therapeutic sera and vitamin concentrates, the distribution and training of doctors to be sent to the distressed areas, etc.

As Mr. Hugh H. Smith, of the Rockefeller Health Foundation, pointed out, among the multiplicity of urgent problems which will face the post-war world that of health will be of prime and pressing importance. In no field will the 'good neighbour' policy be more necessary. Since no effective barrier can be raised against the entrance of many infectious diseases, each nation must concern itself with the health conditions of all other nations. Workers properly trained in the principles of epidemiology, supported by essential laboratory facilities, must be employed in the field. International effort must be co-ordinated and information must be collected by central agencies, for distribution to all.

Another urgent need of post-war reconstruction in the first days after the War, emphasized by Dr. Kodicek, is the planning of housing and the possibility of securing constructive work for the people. An international settlement of this kind would remove potential causes of discontent and unrest internally and internationally. The psychological re-education and enlightenment of people, who during the past few years have lost their faith in the pledged word, must be started now and intensified a hundredfold immediately after the War. Such re-education will be best helped by practical measures to be put into operation at the earliest moment. The simple force of the objects so achieved, together with the underlying idea of world understanding, repeated and again repeated by all methods of propaganda, would do much to persuade and convince people of the sincerity of Britain's aims.

The great opportunity offered by a concerted action in the matter of international post-war relief cannot be better expressed than in the words of Mr. Philip Noel-Baker, M.P., who recalled that President Roosevelt and Mr. Churchill have emphasized the need for building up a stock of food for post-war distribution. "The Allied Council has drawn up plans for the assembling, transport and distribution of such stocks. We know that Europe will be bankrupt, that this work will have to be done on lease-lend lines. It would be the greatest deed of charity in the history of mankind, ending the hunger of the people, saving scores of thousands of threatened lives.

"If the Government would treat relief as the first step in a long-term policy of world-wide scope, if they would hand it over to international control, if they would use that opportunity to replan for a new system, and mobilize behind it all the dynamic power of opinion that supports the Atlantic Charter, a new perspective of human welfare would indeed be opened up."

HUMAN LIFE AND DEATH AT HIGH PRESSURES

By Prof. J. B. S. Haldane, F.R.S.

MEN are exposed to high pressures in a number of circumstances. They may be working in compressed air in a caisson or diving-bell, working under water in a diving dress, or attempting to escape from a sunken submarine. In the latter case it is obviously necessary that the air pressure inside a part of the ship should be equal to that of the water outside before a man emerges. This can be achieved either by flooding a small escape chamber holding only two men, or a whole compartment of the ship. Men have escaped by both these methods. They can rise through the water either holding their breath or breathing from a Davis submarine escape apparatus. The former method is not to be recommended, but it is not quite so hazardous as it sounds, for a lung-full of air at 5 atmospheres contains as much oxygen as a lung-full of oxygen at atmospheric pressure, and will allow a man to hold his breath for more than twice the normal time. The Davis submarine escape apparatus consists of a rubber bag and a soda-lime canister to absorb carbon dioxide. The bag is filled with oxygen from a small cylinder of the compressed gas. It has the advantage over air that it can be used almost to the last dreg. We shall come to its disadvantages later.

In June 1939, H.M. Submarine *Thetis* was sunk with civilians as well as naval officers and ratings. The Amalgamated Engineering Union and the Electrical Trades Union asked me to attend the investigation of this disaster, as some of their members had been killed. I was only able to carry out some very rough experiments during the course of this inquiry, but they made it clear that certain physiological factors concerned in escape from submarines had not been fully considered. I was therefore asked by Admiral Sir Martin Dunbar-Nasmith's physiological sub-committee on escape from submarines to undertake further research on this question, and it has very kindly permitted me to publish certain results. Messrs. Siebe Gorman and Co. put their plant and staff at my disposal. All the experiments described here were carried out in a small steel chamber at their works, which holds two, or at a pinch, three people in a sitting position. The experiments were conducted by Dr. E. M. Case and myself, on ourselves and twenty volunteers, including not only physiologists such as Dr. J. Negrin, the former Spanish Prime Minister, and Dr. B. M. Matthews, but also a number of working men. Four of our subjects were women. An account is in the press.

The physiological dangers fall under six different heads. The literature concerning (A) and (F), with a full discussion, has been given by Haldane and Priestley[1].

A. Mechanical Effects

During rapid compression violent ear-ache, and even rupture of the tympanum, may occur if the pressure on the two sides of the tympanic membrane is not equalized. Most people can easily be taught to do this. Four working men who had never been in compressed air before were compressed to 10 atmospheres (corresponding to 300 ft. of sea water) in 5 minutes. A trained subject was compressed to 7 atmospheres in 90 seconds, and this rate could certainly be exceeded. About one subject in five cannot be taught to equalize the pressures rapidly.

During decompression there is less pain, but more danger to life. A number of men have died from rupture of the lungs, which forced air or oxygen into the pulmonary circulation, so that the circulation was blocked by air embolism. This was probably caused by a rapid rise of intra-pulmonary pressure, due to the subjects holding their breath while rising through the water. Any obstruction of the valve by which excess air leaves the escape apparatus would have the same effect. We have had no cases of embolism, but one of our subjects, Mr. J. M. Rendel, developed a pneumothorax.

At 10 atmospheres the density of the air is very striking. The voice becomes nasal, and the increased resistance of the air is obvious even when the hands are moved, and still more so when attempts are made to stir it. The resistance in breathing apparatus may be greatly increased, since the volume of air breathed is unchanged, but the mass increases tenfold, and turbulence may develop, increasing the resistance still further.

B. Nitrogen Intoxication

Behnke, Thomson and Motley (1935)[2] made the remarkable discovery that nitrogen is a narcotic at high pressures. We confirm their findings. In air at 10 atmospheres all our subjects felt very queer, and many behaved in an irresponsible manner. Manual dexterity was little affected, but arithmetical performance fell seriously in most cases. Some subjects became hilarious; others were greatly alarmed, and thought they were dying. Few could cope with several tasks at a time. There were, how-

ever, great individual variations. One subject, H. Spurway, though subjectively affected, was so resistant that her arithmetical performance was actually slightly improved at a pressure corresponding to 250 ft. The symptoms disappear when hydrogen or helium is substituted for nitrogen.

Behnke and Yarbrough (1939)[3] found that argon is rather more narcotic than nitrogen. These results are of importance for the general theory of narcosis, and further experiments with gases such as krypton, xenon and methane, which are regarded as physiologically indifferent, will be of great interest. It is also likely that at sufficiently high pressures, say, 20 atmospheres or more, hydrogen and helium will become narcotic. These gases would also perhaps reach the threshold concentration for taste or smell, as nitrogen and oxygen do for many people at a partial pressure of about 7 atmospheres.

C. Carbon Dioxide Intoxication

If a compartment of a submarine contained 1 per cent of carbon dioxide, this would not be noticed at atmospheric pressure. If, however, the compartment were flooded at 200 ft., the partial pressure would rise to 7 per cent of an atmosphere. This would make many people unconscious in less than five minutes, although fine work, such as gas analysis, is quite practicable in air containing 7 per cent of carbon dioxide at atmospheric pressure. The effects of carbon dioxide and nitrogen are additive. We investigated this question on a number of subjects. Their attitude may be exemplified by the notes made by Dr. H. Kalmus, a Czechoslovak refugee, just before losing consciousness at 10 atmospheres with a partial pressure of 6 5 per cent of carbon dioxide: "This is enough. This is enough.—Not necessarily too much." Consciousness was rapidly regained on decompression, and there were no appreciable after-effects.

D. Oxygen Intoxication

Paul Bert (1878)[4] found that oxygen is a convulsant at high pressures. At 7 atmospheres the convulsion comes on with little warning. There is a slight feeling of anxiety, which would, however, be disregarded under Service conditions. The clonic convulsions are very violent, and in my own case the injury caused by them to my back is still painful after a year. They last for about two minutes and are followed by flaccidity. I wake up into a state of extreme terror in which I may make futile attempts to escape from the steel chamber, whereas, like others, I am quite calm on recovery from carbon dioxide-nitrogen narcosis. Behnke, Johnson, Poppen and Motley (1935)[5] found that convulsions or syncope developed in men after about forty minutes at 4 atmospheres. We find that all of seven subjects could breathe oxygen for five minutes at 6 atmospheres. At 7 atmospheres, five minutes exposure is about the limit tolerated. It is obvious that convulsions of this sort would be fatal if they occurred while a man was wearing an escape apparatus under water.

E. After-effects of Carbon Dioxide

J. S. Haldane and J. L. Smith (1899)[6] reported vomiting on breathing ordinary air after breathing air containing a high percentage of carbon dioxide for some time. Alexander, Duff, Haldane, Ives, and Renton (1939)[7] reported vomiting and severe headache in several subjects after breathing air containing 6–7 per cent of carbon dioxide for an hour or longer. The same symptoms may occur if oxygen is breathed. We have not found such effects after breathing 6–7 per cent of carbon dioxide for so short a period as half-an-hour. Only one of the numerous subjects who lost consciousness when breathing air containing added carbon dioxide at 10 atmospheres even retched appreciably, and this was before losing consciousness, not on recovery.

It is clear that vomiting would be fatal during an attempted escape from a submarine, and it may have accounted for some of the deaths in the *Thetis*. It can be avoided by purifying the air, or by breathing oxygen or pure air for some minutes before attempting escape; this will give time for vomiting to occur if it is going to do so. On the other hand, this danger would not arise after a short exposure to a high partial pressure of carbon dioxide, such as is discussed under heading (C).

F. Bubble Formation during Decompression

This has been the principal physiological danger to divers in the past, and has been fully studied. The tissues take up nitrogen at high pressures. On decompression they become supersaturated and bubbles may form. With very rapid decompression, capillaries in the lungs and brain may be blocked with froth. This causes asphyxia and death unless the subject is at once recompressed. However, such embolism cannot occur if the blood has a reasonable opportunity of unloading its surplus nitrogen. The pressure should never be halved in less than a minute or so, which gives the blood from most organs an opportunity to release its nitrogen in the lungs. With slower rates the main symptoms are 'bends', that is to say, pain referred to the joints and bones, and other nervous symptoms such as paralysis and paræsthesia. These

are due to the formation of bubbles in the white matter of the central nervous system, and perhaps in the synovial fluid and bone marrow. Nitrogen is a good deal more soluble in lipoids than water, and this may account for the symptoms in question.

J. S. Haldane introduced stage decompression as a prophylactic, and Sir Robert Davis (1935)[8] found that this could be greatly accelerated if oxygen were breathed in the later stages. Even when oxygen is used, decompression lasts for an hour after 15 minutes exposure to 10 atmospheres. Unfortunately, no published figures exist on the limits of safety after very rapid compression to high pressures, followed by rapid decompression, such as occurs during escape from a submarine. We have obtained some data on this important problem. As regards decompression after longer exposures, some of our subjects have had slight symptoms when following the official tables, but these have never been serious. Others can be decompressed much more rapidly without any pain. We do not know the cause of this individual variation. Fatness may be a slight handicap, but I am fairly fat, and have had no trouble when following Sir Robert Davis's schedules of decompression, while thinner men have had 'bends' while doing so. Nor do we know the cause of the itching which is almost universal during decompression from high pressures, the rash which sometimes accompanies it, and the rarer symptom of nose bleeding.

Helium has been recommended as a preventive of decompression symptoms, and is used for this purpose in the United States. There is no question that it is of value at high pressures, as it completely does away with nitrogen intoxication. But I am much more doubtful of its value against 'bends'. Last December I was decompressed according to the Davis schedule after breathing a helium-oxygen mixture at 10 atmospheres. I developed severe pain over a good deal of my body which lasted for an hour or so, and which was followed by itching and 'pins and needles' over the area of the skin supplied by the 4th and 5th sacral roots. This was probably due to a bubble of helium in the conus, the tip of my spinal cord. Even after seven months I prefer a cushion to a hard chair, and may perhaps be excused for scepticism of the alleged prophylactic value of helium.

This failure of helium to prevent 'bends' throws a good deal of doubt on the current theories as to their causation. Helium is less soluble in water and fat than nitrogen; and whereas nitrogen is more soluble in fat than in water, helium is less so. For this reason it was erroneously concluded that it would be less likely than nitrogen to produce 'bends'. The whole problem demands a systematic experimental study with a number of gases. The experiments could be made on animals, whereas experiments on the narcotic effects of gases must be made on men. Animals give very unclear results in this case. Thus a canary flew normally in air at 10 atmospheres, while Drosophila refused to do so even when stimulated.

G. Cold

Even when the surface water is fairly warm, the sea may be below 40° F. at a depth of 200 ft. Among the questions which we investigated in this connexion was whether cold increases the narcotic effects of nitrogen and nitrogen + carbon dioxide. Dr. Case lay in a bath of melting ice until, after 12 minutes, he began to shiver violently. He was then compressed to 10 atmospheres, but retained his faculties sufficiently to multiply 47 by 13 in his head. I propounded this question, but was unable to solve it correctly, being more susceptible than he to nitrogen intoxication. A still more drastic experiment showed some adjuvent effect of cold, but it does not seem that any measures need be taken to combat it which would not be justifiable at ordinary pressures.

The main physiological problem to be tackled in planning escape from submarines at depths of 100 ft. or more is how to steer, so to say, between the Scylla of nitrogen poisoning and 'bends', and the Charybdis of oxygen poisoning. The detailed solution must depend on the details of construction of submarines and escape apparatus, so a full discussion is impossible at the present time. However, it also involves physiological investigations such as those here summarized, some of which will be published in greater detail elsewhere. I am convinced that physiologists have been far too negligent in investigating the limits of human existence, or at least of human consciousness. Physicists often find that mathematicians have already provided them with methods which they need for a theoretical account of their findings. It would be well if physiologists were to investigate the effect of abnormal conditions on human beings before, rather than after, these conditions have killed numerous people, whether in war or in industry.

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CENTENARY OF QUEEN'S UNIVERSITY, KINGSTON, CANADA

By Dr. R. C. Wallace
Principal and Vice-Chancellor

ON October 16, 1841, a Royal Charter was granted to Queen's College, to be established in Kingston in Canada. The Presbyterian Church of Canada, resentful of the position which had been taken by the Anglicans in the management of higher education, felt that it was necessary to have a college at which men might be educated in arts and theology for the ministry of the Church, and made application for the charter. Thus Queen's began as a denominational college, and remained under denominational control until 1912, when the Presbyterian Church relinquished all connexion with the University. A Theological College then was established under separate administration, though closely connected with the University, and was associated with the Presbyterian Church until 1925, when, on the Union of Presbyterians, Methodists and Congregationalists in Canada, the Theological College became affiliated with the United Church of Canada, and still maintains that affiliation.

From the beginning the College took a liberal view of its responsibilities. It established teaching in the humanities, mathematics and theology, but almost immediately decided to embark on the teaching of medicine. The Faculty of Medicine was eventually established in 1856. Applied science came later, when the need developed for mining engineers and metallurgists to guide the growing mining industry in Canada. The School of Mines was set up in 1893, and when its activity had widened it was incorporated as a Faculty of Applied Science in 1916. Courses in commerce, banking and chartered accountancy, which had been carried on in association with the Faculty of Arts for several years, were organized under a School of Commerce in 1937.

These are the dry bones of detail of organization. They are not the things that are most in mind when one thinks of the hundred years which have passed over the head of the embryo Queen's College of 1841. Some of the more intangible elements of the story of Queen's University deserve mention, for they have much to do with the remarkable sense of loyalty and devotion which the graduates of Queen's show to their Alma Mater.

The most striking fact in the history of Queen's University is the constant struggle against difficulties, financial and otherwise, with which the institution was faced. Few universities are free from financial worries, but Queen's in her history has had more than her share. In time of difficulty students as well as staff took off their coats and worked, until the situation was relieved. Out of this sharing of hard times together there developed a sense of co-operate responsibility which has welded Queen's people into a solid community.

A second fact of importance in giving the University its own individuality has been the personality of the teachers. The older graduates, when they gather together, recall the days under the outstanding administration of George Munro Grant, when a galaxy of men, such as it has been the good fortune of few university heads to gather together, moulded the intellectual life and character of those who were fortunate enough to sit at their feet. Grant was a great Canadian statesman, who gave Queen's the status of a national university; and Watson, McNaughton, Jordan, Dupuis, Shortt and Cappon were names to conjure with. We like to feel that Queen's has not departed from the tradition. It is, *par excellence*, a teaching university.

Its service to teaching and to education found a special method of expression. Queen's instituted a system of extramural correspondence courses, by means of which students who could not take the winter terms at the University were able by correspondence work and summer sessions to complete the work for the degree, the condition being that more than half the work must be taken intramurally. This system, in which Queen's was the pioneer and is still the chief exponent, has been of very great service to the teaching profession throughout the Dominion. In normal years, in a student body of 4200, some 2400 are taking courses under the extra-mural system, and are sitting for the regular university examinations for the degree in arts, or the special examinations of the Institute of Chartered Accountants or the Canadian Bankers' Association.

The University has made a special contribution to the public services. Under the direction successively of Shortt, Skelton, Clark, Norman Rogers, McArthur and Mackintosh, all of whom have given distinguished service to the public administration, a long list of Queen's students have gone into the public life of Canada. Ottawa has leaned heavily on Queen's for men, and continues to do so; while in the provinces, and more particularly in

Ontario, the Civil Service has drawn in large measure from those who received their inspiration from the men who served Queen's on the teaching staff, and served their country later in significant administrative capacities.

Though the emphasis has been on teaching, Queen's has not failed in contribution to knowledge during these years. John Watson was for more than thirty years the exponent of speculative idealism on the American continent, and he exercised a very real influence on philosophical thought. Jordan and Scott led a school of liberal interpretation of theological dogma. Cappon, sparing in writing, was recognized to be one of our ablest Canadian literary critics Shortt had proved himself to be an authority on banking and currency before he undertook to reorganize the Civil Service system at Ottawa. Skelton, in like manner, had become known for his researches in Canadian political history before he went to Ottawa to build up the Department of External Affairs. The economic studies of Mackintosh, and the studies in Canadian history of McArthur, Trotter and Graham, maintain for Queen's a high place in the social sciences.

In the physical and natural sciences, the University has gained a reputation in geology, for which Brock and Miller laid the foundation, now maintained by Bruce and his fellow-workers. The practical problems in the Canadian Northland, from the metallurgical point of view, have been faced by Kirkpatrick, who made an important contribution to the recovery and utilization of cobalt. Clark has done much work on the critical state of fluids, and Gray is well known for the contributions he and his co-workers have made to knowledge of atomic structure. One need only name the work of Humphrey in psychology, Vlastos in social ethics, Miller in pathology, Sinclair and Boyd in lipids, Reid in gas gangrene, Hebb in intelligence testing, McRae in organic synthesis, Ettinger in physiological reactions, to refer only to a few of the present-day workers, to show that in variety and—may I add—in quality of scientific research Queen's is playing its part.

Queen's celebrates its centenary by reviewing the progress of thought during the last hundred years. To that progress universities have made important contributions. In the development of knowledge during the next hundred years the universities will have an even greater part to play.

OBITUARIES

Dr. Walter Gardiner, F.R.S.

THE name of Walter Gardiner, whose death occurred on August 31, will always be remembered by botanists and physiologists for his epoch-making histological researches and discoveries on the continuity of protoplasm. Owing to many years of ill-health, he was unknown to recent scientific workers, except by his classic papers.

Born on September 1, 1859, he died on the eve of his eighty-second birthday and was one of the veteran fellows of the Royal Society—only three now living having been elected before 1890, the year of his election, at the early age of thirty and a half years.

He was the younger son of Mr. Stephen T. Gardiner and was born at Burwell, on the edge of the Fens, between Cambridge and Newmarket. He was educated at Bedford and was a scholar of the Royal Agricultural Society during 1874–1876, and proceeded with a scholarship to Clare College, Cambridge. In 1881 Gardiner obtained first class honours in the Natural Sciences Tripos and took his B.A. degree in 1882 and M.A. in 1885, in which year he was elected to a fellowship at Clare College; afterwards he was made an honorary fellow of the College (1915). In 1883 he was appointed science lecturer at Girton College and the following year, University demonstrator in botany. This post he held until 1888 when he was promoted University lecturer. He resigned the lectureship in 1897. He was elected bursar of Clare College in 1895.

Gardiner was associated with the Cambridge Botany School during the last years of Prof. C. C. Babington's professorship, when botanical teaching and research was at a low ebb and was being conducted mainly on uninspiring descriptive lines. The appointment of S. H. Vines, however, as reader in botany in 1883 and his conjunction with Francis Darwin, opened a new era in Cambridge botany. Into this new atmosphere Gardiner threw himself with energy, giving remarkable lectures to the advanced students, building up the Museum—founded originally by Prof. J. S. Henslow—and carrying on his own histological researches, in which he was influenced and greatly encouraged by Michael Foster and by Thiselton-Dyer, then assistant director of Kew.

Botanical teaching in Great Britain being so unsatisfactory, as Prof. F. O. Bower has pointed out in his "Sixty Years of Botany in Britain", Gardiner, like several other young botanists, went to Germany and he worked in the Botanical Institute at Würzburg during the summer of 1882 under Prof. J. von Sachs, for whom he had a profound admiration. At

Würzburg he started his work on protoplasmic continuity, demonstrating its occurrence in the pulvini of *Mimosa pudica*. He was also able to prove the existence of connexions between the cells of the leaf of Dionea, between the parenchyma cells of the stamens of Berberis, and in many endosperm cells and in ordinary vegetable tissue. These results were given in several communications to the Royal Society, the Cambridge Philosophical Society, and the *Quarterly Journal of Microscopical Science* 1882 and 1883, and in the *Arb. a.d. Bot. Institut Würzburg*, Bd. III, in 1884. His best-known paper, with figures showing the connecting threads, is that in the *Philosophical Transactions of the Royal Society*, Part 3, 1883, pp. 817–63, with three plates. His earliest paper was on the development of the water glands in the leaf of *Saxifraga crustata*, illustrated by his own drawings (*Quart. J. Micro. Sci.*, 21, 417; 1881). Vegetable tannins, the constitution of the cell wall and middle lamella, and the mucilage-secreting cells of Blechnum and Osmunda (with Tokutaro Ito) (*Ann. Bot.*, 1, 1; 1887) were among the other subjects on which he published important papers. Protosplasmic continuity, however, was his dominant research, and he was indefatigable in attempting to perfect his methods and to demonstrate the existence of the fine protoplasmic connexions across the pit-closing membrane of all vegetable cells. Nothing but the best would satisfy him, and weeks might be spent—as the writer well remembers—before a result which he would pass could be obtained.

I was singularly fortunate in being asked by him in 1898 to work in his own laboratory, and here several happy years were spent with him in perfecting methods and demonstrating continuity between the cells of every plant subjected to investigation. Much of this work has never been published, but our joint papers on "The Histology of the Endosperm of *Tamus* during Germination" (*Proc. Camb. Philos. Soc.*, 11, Pt. 6; 1902) and on the connecting threads in *Pinus sylvestris* and other allied species (*Phil. Trans. Roy. Soc.*, 194; 1901) embody important aspects of his work.

Walter Gardiner was a remarkable lecturer and spared no pains fully to illustrate his lectures in an unusual and arresting manner. His afternoon lecture on "The Plant in the War of Nature" at the Royal Institution in 1888, and his evening lecture at the British Association meeting at Newcastle, 1889, on "Plants in the Struggle for Existence", were specially memorable.

Gardiner was awarded the Rolleston Prize by the University of Oxford in 1888, he and William Bateson being declared equal. In 1898 he received the Royal Medal from the Royal Society and in 1905 the degree of Sc.D. was conferred upon him by the University of Cambridge.

A keen naturalist, with a highly developed artistic sense, Gardiner had a very extensive knowledge of his subject, which was enhanced by his frequent visits to Kew, where he did much of his early work in the Jodrell Laboratory. Histological research in Great Britain suffered a great loss when he was incapacitated by illness from continuing his studies.

He married Miss I. W. Campbell, a great-niece of Sir Joseph Hooker, in 1893, to whom, and to their son, Mr. Alan Gardiner, F.L.S., and their daughter, we extend our sympathy. ARTHUR W. HILL.

Prof. Otfrid Foerster

PROF. OTFRID FOERSTER, one of the most prominent neurologists of the day, whose recent death has been announced, was born in Breslau on November 9, 1873. After receiving his medical education at Breslau, Kiel and Freiburg, he qualified in 1897. He studied under Prof. Dejerine at La Salpêtrière, and then became assistant to Prof. Wernicke in the psychiatric clinic at Breslau, where he was appointed professor of neurology and psychiatry in 1921.

Foerster is perhaps best known for the operation to which his name is attached for the treatment of spastic paralysis and tabes, but his most important work consisted in his studies of the motor cortex and peripheral nerves. His principal publications were on the physiology and pathology of co-ordination (1902), co-ordinated movements in health and nervous and mental disease (1903), the essence of choreic motor disturbances (1904), contractures in pyramidal lesions (1906), diseases of the central and peripheral nerves (1923), hyper-ventilation in epilepsy (1925), and the paths of conduction of pain in flaccid and spastic paralysis (1927). He was, formerly, co-editor with Prof. O. Bumke of the "Handbuch der Neurologie" and on the editorial board of the *Deutsche Zeitschrift für Nervenheilkunde*.

Foerster was a good European and therefore no friend of the Nazis, which may account for his name not appearing in *Wer Ist's*, the German *Who's Who?* A eulogy of him, however, appears in the *Deutsche Zeitschrift für Neurologie* of 1933, on the occasion of his sixtieth birthday, by Prof. Max Nonne of Hamburg. He was well known in Great Britain, where, in 1927, he was elected an honorary member of the Section of Neurology of the Royal Society of Medicine, before which he delivered the ninth Hughlings Jackson Lecture in 1935, published in *Brain*, 59, 135 (1936), his subject being "The Motor Cortex in Man, in the Light of Hughlings Jackson's Doctrines". He was elected an honorary fellow of the Society in 1933. J. D. ROLLESTON.

WE regret to announce the following deaths:

Baron Mataro Nagayo, formerly president of the Tokio Imperial University, director of the Japanese Foundation for Cancer Research, and editor of *Gann*, the Japanese journal of cancer research, on August 16, aged sixty-three years.

Prof. Rudolf Schoenheimer, associate professor of biochemistry in Columbia University, formerly head of the Department of Pathological Chemistry in the University of Freiburg, known for his work on the application of isotopes for the study of intermediary metabolism, on September 11, aged forty-three.

Mr. M. M. Ussishkin, president of the Jewish National Fund and chairman of the Zionist General Council, one of the founders of the Hebrew University, Jerusalem, on October 2, aged seventy-eight.

NEWS AND VIEWS

The Declaration of Scientific Principles

MR. H. STRAUSS, M.P., has written stating that the wording of Clause 4 of the Declaration of Scientific Principles presented at the British Association meeting on September 28 (see NATURE, Oct. 4, p. 393) is capable of misinterpretation. The British Association, through Prof. Allan Ferguson and Dr. O. J. R. Howarth, has acknowledged that it does not wish to prescribe any documentary statement as final, and that it is fully prepared to alter the wording of the Declaration in the light of friendly and constructive criticism, while leaving the spirit of the pronouncement unchanged. So far as science is concerned, the formulation of basic laws is undoubtedly profoundly influenced by the structure and state of the civilization in which the laws are formulated, but the shorthand statement, the so-called *law*, possesses neither sanctity nor finality. It is a policy rather than a creed. It is accordingly proposed to amend the wording of Clause 4 to read: "That the service of science requires independence combined with co-operation and its structure is influenced by the progressive needs of humanity."

International Youth Rally

AN impressive and stimulating International Youth Rally for Victory was held in London on September 11. A message from H.M. the King emphasized how clearly the young men and women of to-day appreciate the true meaning of the present struggle and the gravity of the task which the years of reconstruction will lay upon their shoulders. As Mr. Bevin, the Minister of Labour, pointed out, the Allied Governments are fortified in their present tremendous tasks by the support of the masses of the people, and are reinforced by the vision, enthusiasm and energy of the youth who are engaged on the battlefield, in the air, on the seas, in civil defence, in transport, in the workshop, and in the fields; to this might well be added the laboratory. "It will be yours to rebuild and shape the new world" said Mr. Bevin, so it is to be hoped that youth of the present and future will be given every opportunity to do so when that time comes.

That more than twenty nations took part is of more than casual significance. Youth are awake to their responsibilities, and are clearly anxious to give their all in the present struggle; they must be encouraged to give of their best in the long period of reconstruction which will follow the victory towards which they are now contributing the majority of practical effort. The very fact that such a rally was held was indicative of the desire of youth for new sources of inspiration and for genuine bases for co-operation between the youth of all nationalities in order to prepare them for their future responsibilities. The movement is deserving of every encouragement. Youth must be given greater chances, they must be given more sympathetic hearing, they must be represented to greater degree on all national and international counsels (including science) than they have in the past. Youth have often felt and sometimes expressed a feeling of frustration, a feeling of being overlooked or even overruled merely because of their youth. Such feelings must not be manifest in the youth of the future, if they are to play their just part in the world of to-morrow.

The Faraday Society and the U.S.S.R.

AT the annual meeting of the Faraday Society held on September 26, the following letter, signed by Prof. E. K. Rideal (president) and Mr. G. S. W. Marlow (secretary), to the Physical and Chemical Society of the U.S.S.R. was read and heartily approved by the members for dispatch: "At their first meeting after the invasion of Russia, the Council of the Faraday Society desires us on their behalf and on that of the Society to send greetings to our colleagues in the Union of Soviet Socialist Republics. Our two countries proudly stand allied as guardians of the freedom of the World against wanton aggression. By restoring such freedom to the temporarily enslaved peoples of Europe and Asia we shall enable the work of our men of science to bless mankind. The work of Russian men of science has assuredly shewn to all the world what splendid results can be achieved. Russia's heroic resistance against the ruthless aggressor is a source of immense pride to her ally and will ever be remembered in history. We look forward with confidence to the day when the aggressor will be conquered and in the blessings of peace and freedom the members of our two Societies can meet in fraternal comradeship as allies in the peaceful quest of the laws of nature, just as now we are allies in the war on barbarian man."

Legislation on Town and Country Planning

IN the House of Lords on October 7, replying to a question from Viscount Samuel as to when the proposed legislation on town and country planning would be presented to Parliament, Lord Reith repudiated the suggestion that no progress has been made and that departmentalism is still obstructive. Lord Reith stated that the Council of Ministers has already produced a Bill which is in an advanced stage and excellent reports have already come from the interdepartmental committee associated with him on reconstruction problems. His statement, however, that as a result the Ministry of Health has appointed regional planning officers for all the regions to deal with problems that might arise and that the Minister of Works and Buildings is himself about to appoint regional authorities for propaganda purposes and to encourage local authorities to establish joint committees where they do not already

exist, was much less reassuring from the point of view of the central planning recommended in the Uthwatt report and endorsed from all quarters. Much is being done, however, said Lord Reith, with regard to the preparation of designs, and the supply of materials for post-war use, by standardization, economy of design and the use of alternative materials. He hopes to give an account of such activities and to make a more definite statement later, but assured the House that the need and urgency of the problem is realized and that the Government shares his view that the problems of peace are much more serious than the problems of war.

Chemical Society: New President

Dr. W. H. Mills, recently elected president of the Chemical Society, has for a long time been one of the outstanding figures in the scientific world: his influence on chemistry at Cambridge has been profound. An independent thinker, his researches bear no resemblance to those of his teachers: he founded a 'school', but he never had a 'team'. A paper by Mills is something to be read not only for instruction, but also for the intellectual pleasure it gives. His work on the cyanines, the photographic sensitizing dyes, was largely responsible for settling their chemistry, to which his former student, Dr. Hamer, has added so much. But it is for his stereochemical work that Mills is best known. In 1910 and 1914, with Miss Bain, he demonstrated the configuration of the doubly linked nitrogen atom, adding compelling evidence in 1923, with Schindler, and in 1931 with Saunders. The proof, with Warren, of the tetrahedral configuration of the ammonium ion compares for elegance with the proof, with Quibell and Lidstone, of the planar configuration of the 4-co-ordinated platinous and palladous atoms. The resolution of an allene, with Maitland, was also a remarkable achievement.

Mills's stereochemical investigations, in succession, of restricted rotation in naphthalene, quinoline and benzene derivatives, with Elliott, Breckenridge, Kelham and Dazeley are highly important. Reference must also be made to the 'Mills-Nixon' effect; to the mechanics of the Beckmann change; to a theory of absolute asymmetric synthesis; and to Mills's supreme skill with molecular models, by means of which he never fails to entrance an audience.

Dr. Dorothy Wrinch

Dr. Dorothy Wrinch has been appointed to a research professorship jointly by Smith, Mt. Holyoke and Amherst Colleges, in Massachusetts, to conduct a lecture and seminar course for advanced students on structure problems in the biological sciences. Dr. Wrinch is widely known for her exploratory work in mathematics, physics and biochemistry. During the past six years she has been working as a research fellow of the Rockefeller Foundation and has made an extensive study of the chemistry and physics of the proteins, the results of which have been published from time to time in Nature and in other scientific journals. Her research work on the structure of proteins, especially their two- and three-dimensional patterns, has attracted much attention. A distinctive feature of the new approach to the problem of protein structure which is employed by Dr. Wrinch is that it is based on the study of live proteins, while most previous structural studies have been conducted with dead proteins such as hair and silk, or with proteins which have lost their native configuration. Dr. Wrinch's views on the structure of globular proteins, based on the cyclol hypothesis, have provoked intense controversy, and while they are still by no means generally accepted, the discussion of their implications has provided a valuable demonstration of the interrelations of biology, chemistry, physics and mathematics.

Evaporation in the Sugar Industry

The first meeting of the session of the Newcomen Society was held on October 8. Two papers were read, the first by Messrs. N. Deerr and A. Brooks dealing with the "Development of Evaporation in the Sugar Industry", and the second by Mr. S. Withington on "Automobiles in 1830". There were three phases in the progress of the practice of evaporation, it was said, the first reaching back to the time when evaporation was conducted over a direct flame, the second phase being marked by the use of steam-heated appliances and the boiling of syrup under reduced pressure, while from this was developed the present practice of multiple-effect evaporation in a series of vessels. The review of Messrs. Deerr and Brooks ranged all over the world, and refefence was made to many inventors, manufacturers and plants. One outstanding event was the patenting in 1813 by the Hon. Edward Charles Howard (1774–1816), a cadet of the ducal House of Norfolk, of the vacuum pan, a master patent appearing complete and successful in operation in its first trial. The first crude idea of multiple-effect evaporation was to be found in a patent of 1826. One of the chief improvers of the practice was Norbert Rillieux, who was born at New Orleans in 1806 and died in Paris in 1894. In 1934 persons connected with the sugar industry all over the world placed a tablet to Rillieux in the State Museum in New Orleans. Multiple-effect evaporation is to-day used not only in the sugar industry but also in others in which large quantities of liquids are dealt with.

Influence of War on Surgery

Mr. V. Zachary Cope gave a Chadwick Lecture on October 7 in which he discussed the influence of war on surgery. Surgery, or the handicraft of healing, he pointed out, has always been an art, but only recently a science. In pre-historic and historic times up to the time when Harvey discovered the circulation of the blood, surgery was a crude art, and for the most part surgeons learnt their lessons on the battle-field. When first there began to be an anatomical and physiological basis for surgery, it was upon the battle-field that trials of various discoveries were made. Antiseptics were given their first big trial in the Franco-Prussian war. Modern wars are upon

so large a scale that they provide unparalleled opportunities for the trial of new remedies, and the intensive research necessitated by the demands of war may concentrate within a year what would usually take ten years to do. The War of 1914–18 led to great advances in surgery. The prevention of tetanus by prophylactic administration of specific serum was standardized, and the treatment of shock and hæmorrhage by blood transfusion made readily available.

Moreover, the treatment of wounds underwent great changes during 1914–18. Antiseptics put into a wound were found to have little effect, and it was soon shown that the best results were obtained by excising the damaged parts of a wound. There is no doubt also that the same war was the chief means of putting thoracic surgery upon its present sound foundation. Even more striking was the rapid and wonderful development of plastic surgery whereby hideous deformities of the human face were remedied. In the recent Spanish Civil War, the main contribution to the advance of surgery was the discovery by Trueta that wounds treated by excision and encasement in plaster of Paris healed better than those which were treated by splinting and daily dressing. This was a useful application of the Winnett-Orr treatment and could be applied to simple wounds, to wounds of joints, and to open fractures. The present War has already provided some important contributions to surgery. The work of Colebrook on the local antiseptic action of the sulphonamide group of drugs, and the experimental results of Zuckerman's researches on the effect of blast, are noteworthy.

Vitamin B_1 in Buds of Trees

LARGE quantities of vitamin B_1 have been found in the buds and leaves of many common American trees by Prof. P. R. Burkholder and Prof. E. W. Sinnot. Using a constant-temperature tissue culture laboratory, they found heavy concentrations of the substance in the buds of oak, red maple, horse chestnut, elm, sycamore and white pine trees. Although vitamin B_1 is now produced by synthetic chemical processes, this discovery points to a large natural source of vitamin B_1, and this finding may offer a clue to the source of essential vitamins for many forest animals, according to Prof. Burkholder. The vitamin seems to be formed in the young leaves and growing points of the shoot, whence it is transported to the roots and various portions of the plant.

Experiments in which basswood and maple trees were ringed in the spring show that almost no vitamin B_1 has appeared below the ring in midsummer. Yet huge quantities of the vitamin have been found above the ring. This seems to indicate that ultimately a ringed tree may die not only from lack of food but also from vitamin starvation. These researches show that most green plants contain sufficient amounts of the vitamin for their normal growth. The amount of essential minerals in the soil and sunlight apparently influence the amount of B_1 which green plants are able to produce. Vitamin B_1 is heavily concentrated in the buds, according to Prof. Burkholder, just as it is in grain.

Health of Paraguay

IN the July issue of the *Boletin de la Oficina Sanitaria Panamericana*, Dr. Ricardo Odriosola, Minister of Health for Paraguay, states that organized public health work in his country began on August 16, 1889, with the creation of the National Health Council, which was merged in 1917–18 with the National Public Assistance and Welfare Commission (created in 1915) to form a Department of Health and Welfare. This was succeeded on June 15, 1936, by the present Ministry of Health, with its five departments—Public Health of the Capital, Rural Hygiene, Hygiene, Child Welfare and Odontology. Paraguay's most serious problems at present are surveys of the causes of death and the system of school lunches, to which 15 per cent of the municipal income has been assigned, and which are now being supplied in eighty towns. Leprosy comes next in importance. Compulsory vaccination against typhoid fever has been introduced. Malaria has become increasingly severe, and fourteen sanitary commissions have been organized to combat it by distributing quinine, oiling breeding-places of mosquitoes and draining swamps. Hookworm disease is also being combated.

Announcements

DR. A. EICHHORN, director of the Animal Diseases Station, Beltsville, Maryland, has recently visited Great Britain for consultations with the Ministry of Agriculture and Fisheries and the Agricultural Research Council. He has visited several institutes concerned with problems of animal health, and discussed with members of the staff the experience in Great Britain and in the United States in the control of various diseases of livestock. It is hoped that the liaison thus established between American and British veterinary scientists will be continued and extended.

THE following appointments have recently been made in the University of Sheffield: Miss A. R. Murray, assistant lecturer in chemistry; Mrs. Margaret G. Happey, assistant bacteriologist; Mr. H. I. C. Page, assistant demonstrator in radio physics.

THE following appointments and promotions have recently been made in the Colonial Service: D. J. Billes, agricultural superintendent, Gold Coast; P. L. Bradley, agricultural officer, Nigeria; H. M. Tickler, agricultural officer, Northern Rhodesia; M. S. Parry, assistant conservator of forests, Tanganyika; J. McCulloch, veterinary officer, Nigeria; G. C. Weatherhead, veterinary officer, Uganda; A. B. Killick (deputy director of agriculture, Tanganyika), deputy director of agriculture, Kenya; G. W. Lock (agricultural officer), senior agricultural officer, Tanganyika.

ERRATUM. In the letter entitled "Constitution of a Sulphonamide" in NATURE of October 4, p. 409, Mr. M. A. Phillips referred to "a tautomeric mixture of the forms II and III"; this should read "forms I and II".

LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. They cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

An X-Ray Criterion for Distinguishing between Lattice Curvature and Fragmentation

ASTERISM in Laue photographs and the arc-shaped smears in monochromatic X-ray photographs show that, in plastically deformed crystals, regions of different orientation are present. This may be due either to local curvatures of the lattice[1,2], or to its

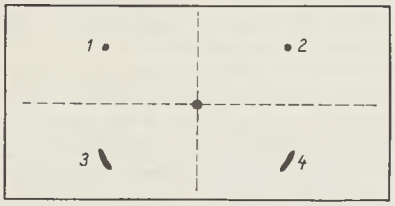

Fig. 1.

disintegration into a mosaic of small fragments the orientations of which are independent of those of their neighbours[3,4]. It has been considered that X-ray methods could only reveal the existence of regions of different orientation, but could not give information as to how these regions were joined together, and thus could not tell which of the two alternatives, curvature or fragmentation, was present.

Rotation photographs of moderately extended cadium crystals have shown, however, that in many cases X-ray methods are capable of deciding this question. Such photographs often contain remarkably sharp spots (sometimes sharper than the spots obtained before distortion). Whenever a spot 1 (Fig. 1) is unusually sharp, the corresponding spot 2 on the same side of the equator (reflected by the same lattice plane) is equally sharp, but the two corresponding spots 3 and 4 (reflected by the other side of the same plane) are smeared out to arcs. Fig. 2 shows this effect on an enlarged portion of a rotation photograph.

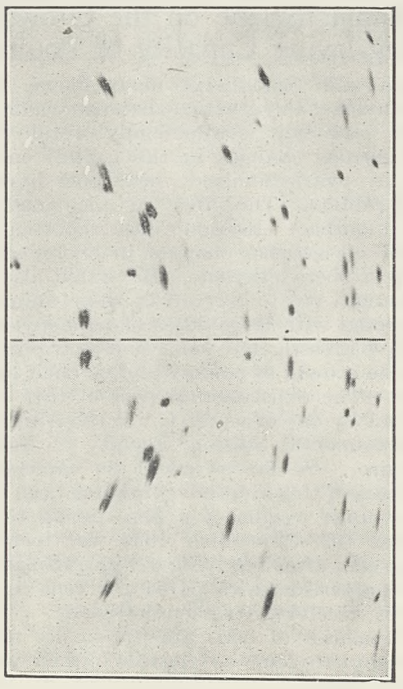

Fig. 2.

PART OF A ROTATION PHOTOGRAPH, ENLARGED 1·62 TIMES. Cd CRYSTAL, ABOUT 1 MM. THICK; EXTENSION ABOUT 2 PER CENT. THE DOTTED LINE IS THE EQUATOR. CuK_α-RADIATION; CAMERA RADIUS 3·0 CM.

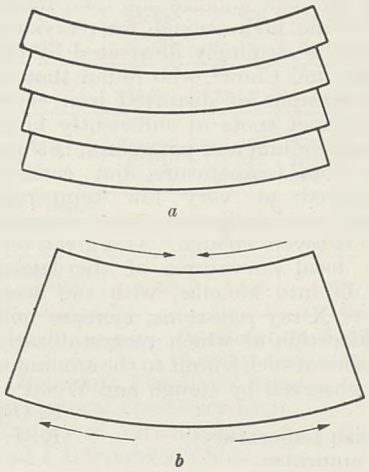

Fig. 3.

To explain the dissymmetry of corresponding spots above and below the equator, we have to assume that the lattice plane is curved and the beam emerging from the pin-hole is focused on the film as if it is reflected from the concave side of the plane; in this case a particularly sharp spot results. If, on the other hand, the beam falls upon the convex side of the plane, it is reflected with strong divergence, and a smear is produced.

The lattice planes from which the spots in Fig. 2 were reflected were plotted in a stereographic net, and the degree of dissymmetry between the reflexions from the two sides of the planes indicated by markings. The dissymmetry was a maximum for the basal plane (reflexions (0004) and (0006)) and for planes inclined at small angles to it (for example, $(10\bar{1}6)$ and $(10\bar{1}5)$); with increasing angle it decreased, and became small and of rather irregular variation for planes approaching the zone of the hexagonal axis. Since the curvature of the glide plane in an extended single crystal is approximately cylindrical, with the cylinder axis perpendicular to the glide direction, it was to be expected that lattice planes perpendicular to this axis remained plane. It did not seem to make any difference, moreover, whether or not a plane was

nearly perpendicular to the cylinder axis; the dissymmetry of the reflexion diminished for all planes with increasing angular distance from the basal plane. This may be attributed to a disintegration of the bent crystal into glide lamellæ (Fig. 3*a*). Such a process is bound to occur, as otherwise bending would produce extremely high tensile stresses on the convex side, and extremely high compressive stresses on the concave side of a thick block (Fig. 3*b*). If the crystal consists of thin bent lamellæ, lattice planes perpendicular to these will show no dissymmetry of the X-ray reflexions, since initially plane sections perpendicular to the surface of a lamella remain approximately plane in elastic bending.

In the case of polycrystalline metals, the mutual interference of neighbouring grains will give rise to particularly sharp curvatures and thin lamellæ. The dissymmetry effect cannot be observed if the focal length of the curved lattice planes becomes too small compared with the radius of the X-ray camera, but the reflexions will show the diffusion and broadening (Scherrer effect) usually attributed to random fragmentation. With increasing deformation, the elastic energy of the bent lamellæ and their mutual surface energy become high enough for recrystallization to occur. This is strikingly illustrated by observations of Andrade and Chow[5], who found that the tails in Laue photographs of distorted iron crystals broke up into distinct spots at sufficiently high temperatures; with sodium and potassium, this process took place at room temperature, but continuous tails were observed at very low temperatures. All metals may recrystallize at room temperature if the distortion is severe enough. At a given temperature, therefore, local curvatures of the lattice and its splitting up into lamellæ, with the accompanying diffusion of X-ray reflexions, increase only up to a critical distortion at which recrystallization begins[6]. The existence of such a limit to the amount of diffusion has been observed by Gough and Wood[4].

E. OROWAN.
K. J. PASCOE.

Cavendish Laboratory,
Cambridge.
July 30.

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Photo-Electric Alloys of Alkali Metals

IN order to obtain very thin photo-electric layers, P. Görlich[1] investigated alloys of alkali metals with other metals and found that very thin layers of cæsium-antimony and cæsium-bismuth alloys are sensitive to visible light. I have made some further experiments with these alloys and obtained some results which are summarized below; a more detailed description will be published elsewhere.

The most sensitive alloys of cæsium and rubidium with bismuth and antimony correspond to the stoichiometric formulæ BiM_3 and SbM_3, M representing the alkali metal.

The alloy layer with the highest photo-electric quantum yield is $SbCs_3$. At the optimum wavelength of 4600A., one electron is emitted for only five incident light quanta.

The electric resistance of the antimony-cæsium alloy rises sharply with increasing Cs : Sb ratio. The specific resistance of pure antimony is 4×10^{-5}, the specific resistance of $SbCs_3$ is $1 \cdot 6 \times 10$. The alloys of lower photo-electric sensitivity have a lower specific resistance than $SbCs_3$. The rise of resistance during the formation of the photo-electric alloys is accompanied by the disappearance of metallic reflection. The alloys of the $SbCs_3$ type can therefore be regarded as semiconductors. They represent borderline cases between metallic alloys and ionic crystals, as is to be expected from the position of bismuth and antimony in the periodic system.

It has been impossible to obtain antimony-cæsium alloys in which the ratio of cæsium to antimony is greater than 3 : 1. The same is probably true for corresponding alloys.

Superficial oxidation of the alloys increases the photo-electric sensitivity to light of longer wavelengths. This effect can be explained by the lowered work function of the surface.

From theoretical considerations one would expect that a semiconductor with low surface work function, as represented by the $SbCs_3$ alloy, would be a good photo-electric emitter. But to explain the exceptional properties of the $SbCs_3$ alloy, as compared with the other alloys of the same type, the structure of these alloys would have to be investigated in more detail.

A. SOMMER.

Cinema Television, Ltd.,
London, S.E.26.
Feb. 11.

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Influence of the Synthetic Œstrogen Triphenylethylene on the Growth and Egg-laying Capacity of Poultry

Robson and Schönberg[1] have shown that triphenylethylene, a synthetic substance which is easily prepared and now commercially obtainable, will induce œstrous changes in the genital organs and mating in ovariectomized mice and hypophysectomized rabbits. The effect in mice may last for several months. Robson[2] has reported on the induction of œstrous changes in the monkey and bitch by triphenylethylene. He stated also that no toxic changes were observed in these animals or in mice injected with large doses of triphenylethylene[3].

We have investigated the action of triphenylethylene on the growth of poultry and on their egg-laying capacity. The experimental part of this work was carried out by one of us (A. G.) at the Animal Nutrition Experimental Station, Faculty of Agriculture, Giza, Cairo. So far as could be ascertained, no experiments of this kind have hitherto been reported.

The average weight of a hen during the period September 1938–November 1939 was increased by 74·23 per cent after receiving 0·7 gm. triphenylethylene in comparison with 64·54 per cent increase of those not receiving triphenylethylene. The egg-laying capacities of hens are practically unaffected by triphenylethylene as regards either weight or number of eggs.

The average weight of the male turkey chicks was almost uninfluenced by triphenylethylene, in contrast to females, which increased their average weight by 311·5 per cent after receiving 2·73 gm. triphenylethylene a head. Female birds to which no triphenylethylene

was given increased their weight by 244·6 per cent only (compare table at end).

(1) *Experiments with white native* (*Baladi*) *hens.* Experiment *A T* was carried out on 25 hens. Triphenylethylene (0·5 gm.) was given with the morning ration for every ten hens three times a week, on Saturday, Tuesday and Thursday, during March 14–April 13, 1939 (0·7 gm. per hen per month). Experiment *B* was carried out on 26 hens to which no triphenylethylene was given. Feeding and age (4 months and 10 days at the beginning of the experiment) were the same for Groups *A T* and *B*. The results are given below.

	Group *AT*	Group *B*
Average weight of hen at the beginning of the experiment	939 gm.	939 gm.
Average weight of hen at the end of experiment	1636 gm.	1545 gm.
Average increase in weight	74·23 per cent.	64·54 per cent.
Total number of eggs laid per hen in 15 months (Sept. 38–Nov. 39)	115·08	123·67
Average number per month per hen	7·67	8·24
Average weight of an egg (Sept. 38–Nov. 39)	39·2 gm.	39·33 gm.

It seems, therefore, that triphenylethylene had little or no effect on the number or weight of eggs laid, as Group *B* was a little better than Group *A T* before, during and after the period during which triphenylethylene was given.

The ration for the white native hens consisted of: maize, 28; barley, 28; beans, 13; bran, 20; sesame cake, 8; fish powder, 1½; meat powder, 1½ per cent. In addition, we added for every 100 kilos, 1·5 kgm. fish powder (instead of bone powder, which was not available) and 0·5 kgm. sodium chloride.

The starch equivalent of the ration was 63·41 per cent, and the digestible protein 13·00 per cent. The daily ration was 90 gm. a hen. This quantity was given in two parts: (*a*) the mixture of bran, sesame cake, meat powder, fish powder and sodium chloride was given in the morning, slightly wetted; (*b*) the mixture of barley, maize and beans was given at noon. In addition to this daily ration, a hundred grams of barsim clover (*Trifolium Alexandrinum*) was given to each hen.

(2) *Experiments with turkeys.* The turkey chicks were put in four groups: *MT*, *FT*, *M* and *F*. In Group *MT* there were five males weighing 7·900 kgm.; in Group *FT*, eight females weighing 8·360 kgm.; in Group *M*, four males weighing 6·780 kgm.; and in Group *F*, eight females weighing 9·720 kgm.

Four equal quantities of the following mixture were prepared and put in different bins: maize, 29·5; barley, 29·5; beans, 12·0; bran, 20·0; sesame cake, 7·0; fish powder, 1·0; meat powder, 1·0 per cent. In addition to this, 1·5 kgm. shell powder and 0·5 kgm. sodium chloride were added.

The starch-equivalent of the ration was 67·82 and digestible protein 12·00 per cent.

Each bin was allotted to one of the groups of the chicks, and they were allowed to eat from this as much as they could every day by putting plenty of food before each group. The quantity of the ration consumed every fortnight was found by weighing that which remained in each bin.

3·8 gm. of triphenylethylene was added in the morning three times a week, on Saturday, Tuesday and Thursday, to the food of Group *MT* and Group *FT* during the whole experiment; no triphenylethylene was added to the food of Groups *M* and *F*. The total amount of triphenylethylene given to Groups *MT* and *FT* was 19·335 and 21·856 gm. respectively.

In addition to the above-mentioned food, barsim clover (*Trifolium Alexandrinum*) or green maize was also given to saturation. The quantities consumed daily were the difference in weight between what was put in front of each group in the morning and what remained in the afternoon. The total green diet consumed in every fortnight was recorded with the dry diet.

At the end of every fortnight, the chicks of every group were weighed to obtain the growth of each group.

These operations have been repeated during the whole of the experiment, which began on August 24, 1940, and ended on February 7, 1941. The summary of the experiments is tabulated as follows:

	Males		Females	
	Group *MT*	Group *M*	Group *FT*	Group *F*
Weight in kgm. on 24/8/40	7·900	6·780	8·360	9·720
Weight in kgm. on 7/2/41	38·450	31·970	34·400	33·500
Total growth	30·550	25·190	26·040	23·780
Percentage increase in weight	386·70	371·53	311·48	244·65
Food per kgm.—				
Grains and bran	176·805	161·428	232·860	230·348
Green maize	140·910	118·212	203·028	191·932
Barsim clover	100·500	100·500	108·500	113·000
Total starch value during the experiment (kgm.)	133·799	122·130	175·414	173·368
Kgm. starch value for every kgm. growth	4·380	4·848	6·736	7·291

ALEXANDER SCHÖNBERG.
AHMED GHONEIM.
Dept. of Chemistry, Faculty of Science
and Agricultural Chemistry Dept.,
Faculty of Agriculture,
Fouad I University, Cairo.
July 30.

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Siderocytes in Man

SIDEROCYTES are erythrocytes in which the presence of some non-hæmoglobin iron can be demonstrated by the Prussian blue reaction[1]. They occur in the embryos and new-born young of normal rats and mice, and are greatly increased in numbers in the blood of mice suffering from the transitory anæmia associated with the gene for flexed-tail and belly-spot.

It has been suggested[2] that siderocytes in small numbers may occur in normal human babies at birth, but on account of their scarcity no definite decision was possible. Material has now come to hand which leaves no doubt that siderocytes are a normal embryonic feature in man, as in rodents. A 14-weeks-old fœtus (therapeutic abortion, heart-blood) had 94·3 per cent normocytes, 1·25 per cent normoblasts, and 4·45 per cent siderocytes (n = 2,000). Data on premature and full-term fœtuses are summarized in the accompanying table. The two 36-weeks-old

fœtuses are fraternal twins. The amount of siderotic material per siderocyte is generally small; in most cases a single granule is found, except in the earlier stages, where up to four granules per siderocyte are common. It seems safe to predict that a feature common to mouse, rat and man will be found to be widely spread among higher mammals.

Age in weeks of pregnancy	Sex	Siderocyte Percentage	Cells counted
33	♂	3·65	2,000
36	♀	1·15	2,000
36	♂	0·14	5,000
40	♀	0·10	2,000
40	♀	0·25	2,000

It is perhaps worth pointing out that in this case the study of an inherited disease of the mouse has led to the discovery of a normal embryonic feature of apparently wide distribution, including man.

I am greatly indebted to Dr. H. H. F. Barns, of University College Hospital, London, for the blood films on which this report is based.

HANS GRÜNEBERG.

Department of Biometry,
University College, London,
at
Pathology Department,
Mount Vernon Hospital,
Northwood, Middlesex.
Sept. 15.

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Pterygoquadrate Connexions in the Embryos of *Ichthyophis glutinosus* (Apoda)

THE pterygoquadrate in the embryos of *I. glutinosus* Linn. shows the ascendens and the otic processes; in the orbitotemporal region the basal process is not developed, and, therefore, the union of it with the basitrabecular process as seen in Siphonops (70-mm. larva, Edgeworth, Fig. 386) is absent. The relation of the processus ascendens with the orbital cartilage has been variously described. According to Edgeworth[1] and Winslow[2], a connexion is established in embryonic stages, while Peter[3], who examined a slightly older stage than that of Edgeworth, does not show it. Prof. E. S. Goodrich suggested to me (*in litt.*) that this difference may be due to the two authors examining two different species of Ichthyophis, but this may not be so, for both secured their material from Dr. F. Sarasin. In my sections of a 30-mm. embryo of *I. glutinosus* at any rate the ascendens connexion is not present, thus resembling Hypogeophis.

On the other hand, the uniform occurrence of the otic connexion in Ichthyophis (the processus oticus of the pterygoquadrate uniting with the stapedial process of the stapes) is noteworthy, though Edgeworth[1] and Goodrich[4] quoted to the contrary. This connexion is noticed in all the embryos examined by me, and in the adult it becomes a joint. In Hypogeophis also Marcus, Stimmelmayr and Porsch[5] described a transient otic connexion. But according to de Beer[6], the definite chondrocranium in Ichthyophis with no connexions of the pterygoquadrate with the cranium conforms to the primitive autodiastylic type, whereas in Hypogeophis, with the temporary otic connexion, the larval cranium is 'amphistylic'. As an otic connexion was also noticed by me in all the embryos of *I. glutinosus* examined[7], the chondrocranium does not conform to the autodiastylic type.

L. S. RAMASWAMI.

Department of Zoology,
Intermediate College,
Mysore. Sept. 1.

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A New Antibacterial Agent produced by a Mould

IT has been shown in this department that penicillin, a substance produced by the Penicillium discovered by Fleming[1], has very remarkable chemotherapeutic properties[2]. Consequently, it became of interest to see whether other species of moulds produced substances with similar properties. Of a considerable number of air-borne moulds studied, two were found to produce substances very similar to penicillin, both in its chemical and biological behaviour. Recently, however, a mould, probably belonging to the genus Aspergillus, was found to produce a powerful antibacterial agent with chemical properties different from penicillin and with an antibacterial range considerably greater than that of penicillin. In addition to the Gram-positive organisms known to be inhibited by penicillin, the growth of a number of Gram-negative organisms, such as *Bact. coli*, *B. dysenteriæ* (Shiga), the typhoid and paratyphoid bacilli and *Vibrio choleræ*, is inhibited by the culture filtrate, of this mould. An extract of this new antibacterial substance has been prepared from the culture filtrate, and it was found that it inhibited the growth of both the Gram-negative and Gram-positive organisms in a dilution of approximately 1 : 200,000. It remains to be seen whether this substance bears any relation to the bactericidal agent in culture filtrates of *Aspergillus flavus*, described by E. C. White[3].

G. A. GLISTER.

Sir William Dunn School of Pathology,
University of Oxford.

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Rotifer vulgaris and Tetanus Toxin

DURING an estimation of anti-tetanic serum, 0·02 c.c. of a filtrate of a meat broth culture of *Clostridium tetani*, 0·01 c.c. of which filtrate, injected intraperitoneally, had previously killed a mouse in eighteen hours, was slowly added to 0·03 c.c. of water from a rain-gutter

containing five *Rotifer vulgaris*. All the rotifers were dead at the end of four minutes. In one specimen observed, addition of 0·01 c.c. of the filtrate caused retraction of the ciliary wreath, and some slowing of bodily movement, though the jaws remained active. Addition of the remainder caused the jaws to slow, and the body gradually contracted, without convulsions, into a double mass with a central constriction. The other four rotifers presented the same post-mortem appearance. Small monads also present in the water showed no diminution of activity after fifteen minutes.

ERNEST GRAY.

Veterinary Research Laboratories,
Pakenham,
Bury St. Edmunds. Sept. 2.

Epidermal Papillæ and Dermal Bones of the Chick Sclerotic

THE article in NATURE by Moy-Thomas[1] and Westoll's comments[2] discuss the interesting relation existing, in fish, between certain structures of ectodermal origin and certain dermal bones. It seems appropriate to report briefly upon a similar relation which I have recently studied in the embryonic chick. A more complete account will be published elsewhere. It is well known that the fowl has fourteen dermal bones in its sclerotic, forming a ring round the pupil, and that the same number of epidermal papillæ develop in the conjunctiva at about seven days of incubation but disappear before hatching. Nussbaum[3] and Dabelow[4] both studied the papillæ, but as their descriptions are in several respects unsatisfactory, I have examined these structures, and especially their relation to the dermal bones, afresh.

The papillæ first appear as flat thickenings of the epidermis. Later, on the eighth and ninth days, the central part of each thickening increases greatly and projects downwards as a conical mass of epithelial cells into the underlying mesenchyme, against which it is bounded by a basement membrane. I call this downward projection the 'tongue'. The papilla also projects slightly above the general epidermal level. There is a condensation of mesenchyme cells below and around the tongue; these cells are the *Anlage* of the future scleral bone. Careful study shows, in sections stained with azan, that very delicate blue-staining collagen fibres run off from the basement membrane of the papilla, and especially from its tongue, among these mesenchyme cells. Even while it is forming, degeneration sets in among the epithelial cells at the base of the tongue and in its substance. This continues during the ninth and tenth days, and the result is the liquefaction of the greater part of the cells forming the tongue, which gradually retracts and finally disappears. At the same time the elevation of the papilla above the general level of the epidermal surface increases and the papilla is transformed from a solid mass projecting principally downward into the mesenchyme, into a hollow, more or less filiform structure, projecting upwards from the epidermis and joined to it by a rather narrow neck. Its cavity is open to the mesenchyme below, and contains mesenchyme cells.

Meanwhile, the cells of the mesenchyme condensation, originally grouped round the 'tongue', stream from this position downwards and outwards, and become arranged as a flat sheet of cells below the papilla and separated from it by mesenchyme which at last shows little or no condensation. The first collagen fibrils of the developing bone are now deposited among these cells, which take the histological character of osteoblasts. A connexion with the papilla is, however, maintained. The delicate collagen fibrils, mentioned above as running from the papilla among the mesenchyme cells around the tongue, have increased in number and thickness, and when the histological differentiation of the bone is beginning they form a very obvious strand of fibres running from the cavity of the hollow papilla, down through the intervening unspecialized mesenchyme, to the bone, with the developing collagen fibrils of which they are continuous.

The papillæ disappear completely before hatching, and it is difficult to imagine what function they can serve if it is not concerned with the development of the scleral bones with which they are so closely connected. Experimentation must wait until eggs once again become available for purposes other than food; but it will be as surprising as Moy-Thomas's results if the relationship proves to be without morphogenic significance.

P. D. F. MURRAY.

Department of Biology,
St. Bartholomew's Hospital Medical College,
at the Zoological Laboratory,
Cambridge.
Sept. 5.

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Poultry as Food Converters

THE article by Mr. E. T. Halnan in NATURE of September 20 threw an interesting light on the problem of achieving the maximum efficiency in live-stock farming from the point of view of war-time food production. He made out a good case for giving prior right to the hen in the distribution of available feeding-stuffs, over meat-producing animals. The milk-cow easily takes first place as an efficient food converter, and its performance is still more amazing when one considers that, besides utilizing concentrated feeding-stuffs such as hens and pigs need, it also utilizes cheap, home-produced foods such as grass, hay, straw, etc.

This question of the kind of material an animal can utilize is, of course, practically as important as the efficiency of conversion. Grass is by far the cheapest and most plentiful feeding-stuff in Great Britain. There is one egg-producing animal which can utilize grass, namely, the goose. Would it not therefore be worth while making an effort to increase its efficiency as an egg-producer by systematic trap-nesting and selection, as has been done in the case of the hen and the duck? It did not take a very long period of systematic selection to increase the egg-production of ducks from a few dozen a year to the level of that of the most high-yielding hens, and the same thing would probably prove true of geese. At the same time, a smaller strain, producing an egg of a smaller, more convenient size, could be evolved by selection.

If, by these methods, geese could be made to replace hens largely as egg-producers in Britain, I think it would be an achievement of very great national importance.

E. E. JONES.

3 Canterbury Way,
Rickmansworth, Herts.

STANDARDIZATION OF VITAMIN E

IF war had not broken out, it was intended by the Health Organisation of the League of Nations to hold a third meeting of the International Conference on Vitamin Standardisation, in preparation for which the Vitamin E Sub-Committee of the Accessory Food Factors Committee (Lister Institute and Medical Research Council), at the request of the Health Organisation, set on foot a co-operative study of *dl*-α- tocopheryl acetate as a possible international standard for vitamin E. It has in the interval been decided that it would be more accurate to use the name synthetic racemic tocopheryl acetate, and this will be done in future.

A supply of the substance sufficient for extensive biological and stability tests, and to provide a standard should the substance ultimately be adopted, was very kindly provided by Messrs. Hoffmann-La Roche of Basle, through the British associated company, Messrs. Roche Products, Ltd., Welwyn Garden City.

Workers in Europe and the United States experienced in vitamin E tests were invited to participate, and solutions were prepared by Dr. P. Hartley and issued to seventeen laboratories. The workers were asked to test four solutions of the tocopheryl acetate of graded strengths, the proportion in which the series was graded being stated, but no indication being given of the identities of the numbered solutions corresponding with the different strengths.

The object of the test was to obtain the relation between dosage and response, the response used being the fertility-rate defined as the percentage of positively mated female rats which produced a litter. Vitamin E deficiency is a condition which in an individual animal is not cured in a smoothly graduated series of stages; for statistical purposes the response is treated as of an all or none, not of a graded, type. However, the dosage response relation can, as is usual in such cases, be transferred into a linear one by plotting the normal equivalent deviation (or probit) of the percentage response against the logarithm of the dose.

Arrangements were made whereby the stability of the feeding solutions after the tests and of the original material after keeping was tested spectrophotometrically by Dr. R. A. Morton, who reported that the stability of all the materials was entirely satisfactory.

Thirteen of the seventeen laboratories invited completed the biological tests and sent in reports which were submitted to Dr. J. O. Irwin and Dr. E. J. Williams, then at Cambridge, for statistical analysis. In four of the laboratories the slope of the dosage-response curve proved not to differ significantly from zero; in other words the responses to the graded doses were not themselves significantly graded. No determination of the median fertility dose could therefore be made, and the results did not lend themselves to further statistical analysis. For the remaining nine laboratories such a study could be made and the results are summarized in the accompanying table.

Laboratory	No. of rats used	Slope of probit/log dose line	Standard error of slope	Median fertility dose (mgm.)	Limits of error 95%	Limits of error 99%
1	83	5·17	1·09	0·56	86–117	82–122
2 (*a*)	40	5·34	1·42	0·55	82–123	77–131
(*b*)	42	7·00	1·73	0·66	85–118	80–125
3	91	3·60	0·99	0·66	72–139	65–155
4	68	2·63	0·96	0·72	58–172	49–204
5	48	9·23	3·35	0·84	85–117	81–123
6 (*a*)	79	6·83	1·32	1·13	88–114	85–118
(*b*)	50	5·07	1·30	1·14	82–123	77–131
7	78	5·52	1·03	1·36	87–116	83–121
8 (*a*)	52	5·89	1·48	1·50	85–117	81–123
(*b*)	52	11·55	3·17	1·05	90–112	86–116
9	58	6·53	1·62	1·71	84–119	80–125
Means and errors Total	689	4·989	0·383	0·986	78–128*	72–139*

2 (*a*) and (*b*). Ratio of 4 doses the same in each case, but bigger absolute dose given in 2 (*b*).

6 (*a*) and (*b*) Virgins used in 6 (*a*); rats which had resorbed in 6 (*b*).

8 (*a*) and (*b*) Criterion in 8 (*a*) birth of at least one living young one; criterion in 8 (*b*) birth of at least one young one, living or dead. Rats used in 8 (*a*) same as in 8 (*b*).

* This error includes error due to inter-laboratory difference.

The table shows the number of rats used by each worker, the slope of the probit/log. dose line, the median fertility dose and the limits of error for each worker's result. The median fertility dose is that dose which enables 50 per cent of the rats used to bear a litter. The results have been arranged in the table to show the variation in size of the median fertility dose, from 0·56 mgm. synthetic racemic tocopheryl acetate in the first laboratory, to 1·71 mgm. in the last laboratory, the average value being almost exactly one milligram. The reasons for the variation will be discussed when a fuller report is made, but it is interesting to note that the size of the median fertility dose varied in laboratory 2 in two separate tests, and in laboratory 8 when the definition of a litter was varied so as to require the inclusion of at least one living young one in the litter. These observations of the great variation in the size of the median fertility dose add further evidence, if that were needed, of the necessity for establishing an international standard for vitamin E so long as biological tests are needed.

The accuracy of the biological technique, as evidenced by the limits of error, seems to be about the same as that usually found with vitamins for a biological method which has been fully elaborated and in use for some time, and the whole co-operative study affords a satisfactory basis for recommending that synthetic racemic tocopheryl acetate should be adopted as international standard for vitamin E.

The workers who took part were: A. L. Bacharach, Glaxo Laboratories, Greenford, Middlesex; A. Z. Baker and M. D. Wright, Vitamins Ltd., Hammersmith, London, W.6; F. Bergel, Roche Products Ltd., Welwyn Garden City, Herts.; A. M. Copping Lister Institute, London, S.W.1; K. H. Coward and B. G. E. Morgan, Pharmaceutical Society, 17

Bloomsbury Square, London, W.C.1; V. Demole and H. M. Wüest, F. Hoffmann-La Roche and Co., Basle; H. von Euler, Biokemiska Institutet, Stockholm 6, Sweden; H. M. Evans, University of California, Berkeley, California; P. Hartley, National Institute for Medical Research, Hampstead, London, N.W.3; J. O. Irwin, Queens' College, Cambridge; B. C. P. Jansen, University of Amsterdam, Laboratory of Physiological Chemistry, Jon. Dan. Meijerplein 3, Amsterdam, Holland; C. Kennedy and L. S. Palmer, University of Minnesota, Department of Agriculture, University Farm, St. Paul, Minn.; K. E. Mason and W. L. Bryan, Department of Anatomy, Vanderbilt University School of Medicine, Nashville, Tenn.; H. A. Mattill, Department of Chemistry, State University of Iowa, Iowa City; T. Moore, Dunn Nutritional Laboratory, Milton Road, Cambridge; R. A. Morton, Department of Physical and Inorganic Chemistry, The University, Liverpool; A. R. Todd, Department of Chemistry, The University, Manchester, 13; S. W. F. Underhill, British Drug Houses Ltd., Graham Street, City Road, London, N.1; E. J. Williams, Forest Products Research Laboratory, Melbourne, Victoria.

E. M. HUME.
(Secretary, Vitamin E Sub-committee of Accessory Food Factors Committee, appointed by Lister Institute and Medical Research Council.)
Lister Institute,
London, S.W.1.

AN INTERNATIONAL STANDARD FOR VITAMIN E

It is now announced that an international standard for vitamin E has been established and that, as in the case of the international standards for the vitamins A, B_1, C and D, the National Institute for Medical Research, Hampstead, London, N.W.3, acting on behalf of the Health Organization of the League of Nations, has undertaken its supply to laboratories, institutes and research workers, throughout the world.

Synthetic racemic α-tocopheryl acetate ($C_{31}H_{52}O_3$) has been adopted as the international standard for vitamin E. The investigation of the chemical, physical and biological properties of this substance, its suitability for adoption as the international standard, and the manner of its application in biological assay was carried out, at the request of the Health Organisation of the League of Nations, by the Vitamin E Sub-Committee of the Accessory Food Factors Committee of the Lister Institute and the Medical Research Council. The sub-Committee was able to enlist the co-operation of experts in laboratories in Europe and the United States, and, as a result, it was able to recommend the adoption of synthetic racemic α-tocopheryl acetate as the international standard for vitamin E. The Sub-Committee further recommended that the international unit for vitamin E should be defined as the specific activity of 1 mgm. of the standard preparation, this quantity being the average amount which, when administered orally, prevents resorption-gestation in rats deprived of vitamin E.

In normal circumstances the results of the co-operative investigation would have been submitted for discussion at the Third International Conference on Vitamin Standardisation, which had been arranged for the autumn of 1939. On account of the War this Conference could not be held. The report and recommendations of the Sub-Committee have, however, been placed before those members and officers of the League of Nations' Permanent Commission on Biological Standardisation and of the International Conference on Vitamin Standardisation, who were available and accessible, and these consented to accept the responsibility of taking such decisions as would normally be accepted by a properly constituted International Conference and by the Permanent Commission. They have accordingly adopted the proposed standard for vitamin E, accepted the recommendation defining the international unit, and authorized the National Institute for Medical Research, Hampstead, to proceed with the distribution of the standard.

The international standard for vitamin E is issued in the form of a solution in olive oil of which one international unit is contained in 0·1 gm. It will be supplied to directors of national control centres in those countries in which these have been established, for local distribution; also to laboratories, institutes and research workers in Great Britain, and in those countries in which national control centres have not yet been established. Application should be made to the Department of Biological Standards, National Institute for Medical Research, Hampstead, London, N.W.3.

PSYCHOLOGICAL HANDICAPS IN THE SEARCH FOR TRUTH

By Dr. J. HETTINGER

THERE are three main psychological factors which handicap the mind in its search for truth, irrespective of the nature of the subject. They are:

(1) The limitations of the field of mental vision;

(2) Our personal mental worlds; and

(3) Our lack of knowledge of the true relationships between *all* existing realities and, accordingly, lack of unity in our personal mental worlds in correspondence with the unity reigning in the universe.

(1) LIMITATIONS OF THE FIELD OF MENTAL VISION

All forms of sensory perception have their respective limits, for example, as regards space, time, clearness, intensity, etc.; purely intellectual perception, such as we experience in mental contemplation and meditation, and which may be referred to as 'mental vision', extends over a field which has its own specific limits.

The first limitation of the field of mental vision is determined by the amount of knowledge we have

individually stored mentally by personal experience, observation and learning, out of the total knowledge acquired by the human race. We can scarcely imagine anyone possessing that total knowledge; and the latter is most likely still infinitesimally small as compared with the knowledge yet capable of acquisition in the course of the future history of mankind. Let us assume that there are some erudites who have followed the precept that "Everyone ought to know everything about something and something about everything". In these, presumably ideal, instances, the limitations are implied in the precept itself. It will thus be readily conceded, that in any controversial discussion, especially when a number of inter-related subjects are concerned, the fields of mental vision of the different participants will most likely vary to a great extent as regards the knowledge they respectively possess on the subjects which come into question; and in any event be limited as compared with the sum total of the knowledge at present available to the human race plus that which is still capable of acquisition.

The second limitation is imposed by the extent to and the rapidity with which knowledge stored as memory can be summoned from the subconscious into the conscious in order that it may be contemplated and meditated upon. The failure of any knowledge pertinent to a particular subject or set of subjects of emerging into the field of mental vision results in a limitation which may lead to wrong conclusions in the search for truth. Even if none failed to appear, unless the parts of pertinent knowledge emerged simultaneously or in sufficiently quick succession to enable the mind to contemplate them in their entirety, the conclusions may again be wrong.

A third limitation is that the field of mental vision often lacks clearness and stability, mainly due to uncertainty as to the accuracy of the knowledge displayed therein. This limitation is a great handicap in the perception of new from old knowledge according to the noegenetic principles of cognition enunciated by Spearman[1].

(2) Our Personal Mental Worlds

This concept stands for the whole of the contents of individual minds, including all the factors, namely, thoughts, feelings and actions, responsible for their having been absorbed or built up therein. According to how our respective minds have gradually grown, altered, been acted upon, and reacted, they attain a characteristic state of their own, and they become more or less crystallized into a pattern which determines our mental attitude and behaviour.

We need not go into details to show by way of example how our personal mental worlds are gradually built up differently from early infancy, through the imitative and destructive periods, through the years of elementary and secondary school education, and so on, often in a haphazard way. Nor need we refer to the different inherited abilities and predispositions, emphasize the importance played by environment, dwell on the question of desires and ambitions, or point to the many present-day glaring examples indicative of the petrifying effect on our personal mental worlds exerted by all kinds of vested interests and by fear. The influence of all these factors on our psychological make-up is too well known.

In fact, we are now passing through a period of history which is a striking example of how the mental worlds of individuals may be so formed and transformed, that, although we are all living in one and the same world, facing one and the same reality, the mental worlds of some of us are poles apart from, and in conflict with, one another; and between these two extremes there are endless variations of personal worlds which conflict with one another in some respect or other.

We find that not only are the personal worlds of, for example, many representatives of religion totally different from those of many men of science, of many alleged to belong to the so-called 'capitalist class' equally quite different from those of many stated to be of the 'working class', of many nationals of one country opposite to those of nationals of another country, but also that within one and the same group the personal worlds of many are in conflict with one another, even as regards the facts supposed to constitute the very foundations of the group. Most of these are firmly convinced that they are right; but obviously it is a logical impossibility for all of them to be right if the views are mutually exclusive.

The fact that these conflicts are attributable to different patterns of individual mental worlds, and the pattern differences to the ways and circumstances in which those worlds were formed, shows the theoretical and practical value of the concept we have just discussed, as regards the study of psychological factors which handicap us in the search for truth.

(3) Lack of Knowledge of the True Relationships between All Realities

It has already been pointed out above that the human race is far from possessing all the knowledge that it can, or may possibly, acquire. This applies also to the true relationships between *all* existing realities, including intangible ones, such as the relation between body and mind, natural phenomena and reasoning, gregarious instinct and moral behaviour, etc. Whether we shall ever be able to determine all of them may be left an open question. It is clear, however, that unless we know the actual relationships between *all* realities, including the mind, we cannot perceive the unity reigning in the universe and, consequently, assemble the total knowledge of our personal world in a corresponding unitary system. This means, however, that so long as our knowledge is wanting as regards the interconnecting links of *all* realities, our personal worlds necessarily lack the assurance that what we know represents "the truth, the whole truth, and nothing but the truth".

In spite of all the progress that may be made by the specific sciences and the many partial truths that may thereby be revealed, the facts representing the 'whole truth' may continue to elude us for yet a long time, and deprive our personal mental worlds of the safest guide in our manifold searches.

I have purposely refrained from encumbering this concise analysis by details which might have tended to obscure the essence of the three concepts I ventured to put forward. They represent important handicaps in the search for truth; and to bear them in mind in controversial discussions may prove helpful.

[1] Spearman, "The Nature of Intelligence."

ROAD CONSTRUCTION IN WAR-TIME

IN co-operation with the Ministry of War Transport, the Road Research Laboratory of the Department of Scientific and Industrial Research has now issued the second of a series of Wartime Road Notes*.

Road-building and road-maintenance in time of war differ in many respects and also in degree from peace-time practice. Not only are roads required for special and temporary purposes which demand different standards of design from those employed on the highways, but also speed in construction is vitally important and the use of local materials is a necessity. These war-time notes are intended to assist engineers in dealing with the special problems created by these conditions, and they present in brief form the latest findings of research and practical experience.

The recommendations in the first of these two publications refer to tar carpets (or thin surfacings) $\frac{3}{4}$–1 in. thick and surface dressings, and are based on systematic full-scale trials supported by laboratory investigations. Bituminous carpets of this description have been introduced quite recently and are capable of providing a non-skid surface having a reasonably long life and costing less than the British standard surfacings. The nature of the aggregate as well as its grading determines the quality of the carpet. Crushed rocks are preferable, but gravel may have to be used, and this has also been investigated. The recommendations, which can best be described as concise working instructions, cover the materials, the mixing procedure, and the laying of the materials on the road.

The second of the notes in this series has been prepared in collaboration with the Geological Survey and Museum, and supplies very necessary information as to the numerous sources in Great Britain of naturally coloured chippings such as might be used for surface-dressing roads and for similar purposes. It deals mainly with black or dark grey stones, and with the darker shades of red, brown and green. The colour of the rocks most widely quarried for use as roadstone are dark grey, pink, grey or buff, and whitish or pale brown or pale red as represented by such sources as Clee Hill basalt, Mountsorrel granite, dolomite and Hartshill quartzite. After describing the igneous rocks, the sedimentary rocks, metamorphic rocks and other potential materials, the note provides a valuable list of quarries arranged in three tables referring to three different groupings of colours.

Although an important consideration for the engineer, the question of strength is not discussed. It is stated, however, that the Road Research Laboratory is available at all times to answer inquiries or to amplify the contents of the notes where this is desired.

* Wartime Road Notes. No. 1 : Recommendations for Tar Carpets and Surface Dressings. No. 2 : Sources of Naturally Coloured Chippings in Great Britain. (London : H.M. Stationery Office, 1941.) 6*d*. each.

FOREST RESEARCH IN INDIA

THE annual report on forest research in India and Burma is issued in two parts (Manager, Govt. of India Press, Delhi, 1940 and 1941). Part 1 is devoted to the Forest Research Institute at Dehra Dun ; Part 2 to provincial reports for Burma and the provinces of India, all of which have special research officers in one or more of such branches of forestry as sylviculture, forest utilization, working plans and statistics, entomology and so forth. Perhaps only to those who witnessed the beginnings of research at the Forest Institute and out in the provinces of India and Burma are in a position to realize the great progress which the last three and a half decades have brought about in research problems in many branches of forestry. The reports must be consulted for a full appreciation of this statement.

That for the Institute for 1938–39 commences with the remark that although handicapped by serious financial restrictions the year in question had been for the Institute one of the busiest in its history ; and the provinces, especially in sylviculture and forest utilization, appear to have been engaged upon equally important work.

The most numerous inquiries were in connexion with the manufacture of paper and ply-wood ; but smaller industries such as the making of pencils, umbrella handles and cigarette-holders were equally to the fore. Other subjects had reference to suitable woods for semi-industrial purposes, such as the use of bamboo as reinforcement in concrete structures, and the chemical values of a large range of minor forest products—a branch so long neglected at the Institute owing to lack of funds. The co-ordination of the research of provincial research officers with that of the Institute involves a large amount of work—for inevitably the latter has to form a central clearing and co-ordinating centre for investigations carried out throughout India and Burma.

It has become evident that the staff sanctions for certain branches of the Institute in 1924 is no longer adequate to meet present-day demands. In connexion with minor products it is of interest to note that a permanent incumbent is to be appointed to the chemical branch of the Institute. This is apparently the result of a valuable report on the branch submitted by Dr. S. S. Bhatnagar, professor of chemistry at the University of the Punjab, after a visit to the Institute.

The War may have brought to the notice of smokers and the housewife that matches made in India are now on the English market. It was the Research Institute at Dehra Dun in the early years after the War of 1914–18 which assisted in establishing this industry in India. Umbrella handles have been mentioned above. In the days before the Institute a young Indian forest officer addressed a big umbrella merchant, stating that he had in his forests quantities of an excellent bamboo for umbrella handles. The price at length quoted by the merchant would not have paid for the cost of carriage of the bamboo from forest to the Indian coast ! It required the establishment of the research institute to enable such problems to be elucidated—for research paves the way to utilization.

FORTHCOMING EVENTS

SATURDAY, OCTOBER 18

NUTRITION SOCIETY (at Cambridge).—Conference on "The Evaluation of Nutritional Status". (See page 433 of last week's issue.)

THURSDAY, OCTOBER 23

INSTITUTION OF ELECTRICAL ENGINEERS (at Savoy Place, Victoria Embankment, London, W.C.2), at 4 p.m.—Sir Noel Ashbridge: Inaugural Address.

FRIDAY, OCTOBER 24

INSTITUTION OF CHEMICAL ENGINEERS (at the Institution of Civil Engineers, Great George Street, London, S.W.1), at 2.30 p.m.—Sir Richard Gregory, Bart., F.R.S.: "Scientific Knowledge and Action" (Fourth Hinchley Memorial Lecture).

INSTITUTION OF MECHANICAL ENGINEERS (at Storey's Gate, St. James's Park, London, S.W.1), at 2.30 p.m.—Mr. W. A. Stanier: "The Position of the Locomotive in Mechanical Engineering" (Presidential Address).

APPOINTMENTS VACANT

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

MAINTENANCE ENGINEER—The Borough Electrical Engineer and Manager, Halifax Electricity Department, 19–23 Northgate, Halifax (endorsed 'Maintenance Engineer') (October 21).

LECTURER IN CHARGE OF THE MARINE ENGINEERING SCHOOL, Hull Municipal Technical College—The Director of Education, Guildhall, Hull (October 27).

INSPECTOR OF SCHOOLS (WOMAN)—The Director of Education, Education Offices, Deansgate, Manchester 3 (October 31).

ENGINEER AND MANAGER of the Belfast Gas Undertaking—The Town Clerk, Belfast (November 5).

REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Proceedings of the Royal Society of Edinburgh. Section B: Biology. Vol. 61, Part 2, No. 12: The Avian Ulna, its Quill-Knobs. By Dr. George H. Edington and Agnes E. Miller. Pp. 138–148+8 plates. (Edinburgh and London: Gurney and Jackson.) 3*s*. [249

Proceedings of the Royal Irish Academy. Vol. 46, Section A, No. 12: On some Applications of Quaternions to Restricted Relativity and Classical Radiation Theory. By P. Weiss. Pp. 129–168. 2*s*. Vol. 46, Section A, No. 14: Further Studies on Solving Eigenvalue Problems by Factorization. By E. Schrödinger. Pp. 183–206. 1*s*. Vol. 46, Section B, No. 11: Investigations on Grey Speck Disease in Oats on some Irish Soils. By Patrick H. Gallagher and Thomas Walsh. Pp. 143–160+plates 11–14. 2*s*. Vol. 46, Section B, No. 12: The Behaviour of the Osmic Reducing Substance of Protozoa during Cell Division. By J. Bronte Gatenby. Pp. 161–172+plate 15. 1*s*. Vol. 46, Section B, Nos. 13, 14: Studies in Irish Quaternary Deposits. 2: Some Lacustrine Deposits near Ratoath, Co. Meath; 3: The Reindeer in Ireland. By G. F. Mitchell. Pp. 173–188. 1*s*. Vol. 46, Section B, No. 15: The Morphology of the Osmiophile Material in some Ciliates. By J. D. Smyth. Pp. 189–206+plates 16–18. 1*s*. 6*d*. (Dublin: Hodges, Figgis and Co., Ltd.; London: Williams and Norgate, Ltd.) [249

Lecture on The Use of the Spekker Photo-Electric Absorptiometer in Metallurgical Analysis. By E. J. Vaughan. Pp. 48+7 plates. (London: Institute of Chemistry.) [249

Chromatographic Analysis. By Dr. A. H. Cook. Pp. 36. (London: Institute of Chemistry.) [249

Freshwater Biological Association of the British Empire. Scientific Publication No. 5: A Key to the British Species of Freshwater Cladocera with Notes on their Ecology. By D. J. Scourfield and Dr. J. P. Harding. Pp. 50. (Ambleside: Freshwater Biological Association of the British Empire.) 1*s*. 6*d*. [249

Experimental Researches and Reports published by the Department of Glass Technology, The University, Sheffield. Vol. 23, 1940. Pp. iii+255+25 plates. (Sheffield: The University.) 7*s*. 6*d*. [269

City and Guilds of London Institute. Report of the Council to the Members of the Institute for the Year 1940. Pp. xlviii. (London: Gresham College.) [269

Department of Scientific and Industrial Research. Index to the Literature of Food Investigation. Vol. 12, No. 4: March 1941. Compiled by Agnes Elisabeth Glennie, assisted by Gwen Davies and Catherine Alexander. Pp. iv+227–310. (London: H.M. Stationery Office.) 4*s*. 6*d*. net. [269

Caradoc and Severn Valley Field Club. Record of Bare Facts for the Year 1940: a List of the More Noteworthy Observations made by Members of the Caradoc and Severn Valley Field Club and Others. (No. 50.) Pp. 44. (Shrewsbury: Caradoc and Severn Valley Field Club.) [299

Dove Marine Laboratory. Report for the Year ending July 31, 1940. (Third Series, No. 8.) Pp. 16. (Cullercoats: Dove Marine Laboratory.) 5*s*. [110

Other Countries

Colony of Mauritius: Department of Agriculture. Eleventh Annual Report of the Sugarcane Research Station, 1940. Pp. 32. (Port Louis: Government Printer.) 40 cents. [179

British Honduras. Abridged Report of the Forest Department for the Year ended 31st December 1940. Pp. 4. (Belize: Forest Department.) [179

Imperial College of Tropical Agriculture. Tenth Annual Report on Cacao Research, 1940. Pp. 33. (Trinidad: Government Printing Office.) 5*s*. [249

U.S. Department of Agriculture. Circular No. 607: The Black Grain Stem Sawfly and the European Wheat Stem Sawfly in the United States. By E. J. Udine. Pp. 9. 5 cents. Technical Bulletin No. 775: The Yellow Chapote, a Native Host of the Mexican Fruitfly. By C. C. Plummer and M. McPhail. Pp. 12. 5 cents. Technical Bulletin No. 778: The Biology and Control of the Sorghum Midge. By E. V. Walter. Pp. 27. 10 cents. (Washington, D.C.: Government Printing Office.) [249

U.S. Office of Education: Federal Security Agency. Biennial Survey of Education in the United States, 1938–40. Vol. 1, Chapter 6: School Hygiene and Physical Education. By Dr. James Frederick Rogers. Pp. iii+27. 5 cents. Vol. 1, Chapter 7: Practices and Concepts relating to City Boards of Education. By W. S. Deffenbaugh. Pp. iii+27. 5 cents. Bulletin 1940, No. 6 (Monograph No. 3): Financing of Schools as a Function of State Departments of Education. By Timon Covert. Pp. vi+34. 10 cents. Bulletin 1940, No. 9: Education and Service Conditions of Teachers in Scandinavia, the Netherlands and Finland. By Alina M. Lindegren. Pp. vii+149. 20 cents. Bulletin 1940, No. 11: Financial Aids for College Students. By Fred J. Kelly and Ella B. Ratcliffe. Pp. v+35. 10 cents. Education and National Defense Series, Pamphlet No. 15: Education under Dictatorships and in Democracies. Pp. vi+19. 15 cents. (Washington, D.C.: Government Printing Office.) [249

Newfoundland: Department of Natural Resources. Act No. 28 of 1934: An Act respecting Game, Fur-bearing Animals and Inland Fisheries, with Amendments to April 14th, 1941, also Regulations issued thereunder in effect as at April 14th, 1941. Pp. vi+34. (St. John's: Department of Natural Resources.) [249

Astrographic Catalogue 1900·0. Sydney Section, Dec. − 51° to − 65°, from Photographs taken at the Sydney Observatory, New South Wales, Australia. Vol. 21: R.A. 0h. to 6h., Dec. − 56° to − 58°, Plate Centres Dec. − 57°. Pp. 30. (Sydney: Government Printer.) [249

Smithsonian Miscellaneous Collections. Vol. 99, No. 22: The Ice Age Problem. By Walter Knoche. (Publication 3633.) Pp. ii+6 (Washington, D.C.: Smithsonian Institution.) [249

Smithsonian Institution: United States National Museum. Bulletin 177: The Herpetology of Hispaniola. By Doris M. Cochran. Pp. vii+398+12 plates. 70 cents. Contributions from the United States National Herbarium, Vol. 28, Part 4: Plants collected by R. C. Ching in Southern Mongolia and Kansu Province, China. By Egbert H. Walker. Pp. vi+563–675+vii–xii+plates 21–27. 30 cents. (Washington, D.C.: Government Printing Office.) [249

Indian Forest Records (New Series). Entomology, Vol. 6, No. 8: Immature Stages of Indian Lepidoptera (2) Noctuidæ, Hypsidæ. By J. C. M. Gardner. Pp. 253–298+2 plates. 2.4 rupees; 3*s*. 9*d*. Silviculture, Vol. 4, No. 3: Notes on Cultivation of the Tung-Oil Tree (Aleurites spp.) in India. By M. V. Laurie and J. N. Sen Gupta. Pp. v+133–160+2 plates. 1.10 rupees; 2*s*. 6*d*. (Delhi: Manager of Publications.) [269

Survey of India. General Report, 1940, from 1st October 1939 to 30th September 1940. Pp. vi+43. (Calcutta: Survey of India.) 1.8 rupees; 2*s*. 6*d*. [269

Report for the Year 1940 of His Majesty's Astronomer at the Cape of Good Hope to the Secretary of the Admiralty. Pp. 8. (Cape of Good Hope: Royal Observatory.) [299

Proceedings of the United States National Museum. Vol. 90, No. 3109: A History of the Division of Vertebrate Palæontology in the United States National Museum. By Charles W. Gilmore. Pp. 305–378. Vol. 90, No. 3112: Cestode Parasites of Teleost Fishes of the Woods Hole Region, Massachusetts. By Edwin Linton. Pp. 417–442+plates 60–62. Vol. 90, No. 3115: Notes on Mexican Turtles of the Genus Kinosternon. By Leonhard Stejneger. Pp. 457–460. (Washington, D.C.: Government Printing Office.) [299

U.S. Office of Education: Federal Security Agency. Bulletin 1940, No. 10: Expressions on Education by Builders of American Democracy. Pp. viii + 90. (Washington, D.C.: Government Printing Office.) 20 cents. [299

Catalogues

Cooke Horizontal Comparator. (Publication No. 887.) Pp. 20. (York: Cooke, Troughton and Simms, Ltd.)

A Collection of Books on the History of Bacteriology and other New Acquisitions in the History of Science including some fine Early English Medical Books. (Catalogue 64.) Pp. 40. (London: E. P. Goldschmidt and Co., Ltd.)

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