

pursuit of truth is one value among others and commands the devotion of men.

Canon Hodgson spoke of the creeds, or philosophies of life, by which men live, as needing to be at once rational and empirical. The Christian faith has its empirical side, as matter for theology; its rational side, as matter for philosophical criticism. It must hold fast to one, if it is to benefit from the other.

Prof. Dodds focused more narrowly upon the universities as the growing points of an educated democracy. Leadership must carry no suggestion of indoctrination. To train men with an educated intellectual conscience is the function of the universities, which are the very model of the 'open society'.

Prof. Dodds would presumably welcome the disorder in our beliefs to-day as at least a sign of the right of the individual conscience. Yet there may be some middle path. What we have to-day is not divergence within a pattern but divergence of patterns. The intellectual conscience is a fine conception, but it is only one side of man, who cannot be thus dissevered. It is man as indissolubly rational and moral that is the final test of all theories. Some theories are ruled out by this test; but experimentation must go on, because only in this way can they be ruled out. Modern thought has gone too far in proclaiming the irrationality of man, owing to the too narrow conception of reason with which it has operated. As Prof. Hill pointed out in his address, 'reasonable', in English, has a moral as well as an intellectual connotation. On linguistic grounds alone there must be something wrong with a conception of reason which does not do justice to this fact. It is the philosopher's duty to articulate those realms of reason which lie outside science, and it is time for him to take his courage in both hands and set about this task.

The reception was held in the rooms of the Royal Society. The venue was appropriate, if one remembers the wider aims which the founders of the Royal Society had in mind. There must to-day be many men of science who feel the need to discuss the wider philosophical issues of their work, which recent developments have forced into the forefront of the scientific consciousness. Certainly the Institute needs scientific men among its members. In this connexion it is worth noting that its journal has included a large number of philosophical articles by men of science.

It is interesting to compare the breadth of philosophic vision the Institute has shown in its twenty-one years career with the tendency in purely professional philosophy during the same period to contract into a highly specialized study of a narrow range of linguistic problems with the esoteric jargon and parochial pride of the typical sect. While eminent men of science like Jeans and Eddington were being driven into metaphysics by science, some professional philosophers were claiming that a true understanding of scientific inquiry showed that no other kind of inquiry was possible. There are signs that this period, valuable as its results have been, is drawing to a close. The joint session of the Aristotelian Society and the Mind Association, held in Manchester during July 5-7, showed that broader conceptions of philosophy are returning. Unofficial visits by members of the session to the University of Manchester to see the Bush differential analyser and the bust of Samuel Alexander by Epstein revealed an equal reverence for the machine and the metaphysician; and one philosopher was heard saying, as he left a group surrounding the bust, "Never have so many

positivists revered such a metaphysician". If these hopes are to be fulfilled, philosophy needs to be fertilized by contact with other subjects. Now that psychology is a grown-up science, it has no longer that close connexion with philosophy which afforded the latter continual stimulus, not to say provocation. A closer contact with all the sciences must take its place. If, as a result, the conception of philosophy as an activity of the sovereign mind—not in any spirit of dominating or controlling other activities of mind but simply as taking a broad and reflective view of the world as a whole—recovers its proper status, no small thanks will be due to the British Institute of Philosophy, whose lamp has burned boldly and brightly when other philosophical lamps were trimmed almost to extinction.

WINSTON H. F. BARNES

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THE only one known equation to describe particles of spin $\frac{1}{2}$ is that derived by Dirac in his treatment of the electron. It must therefore be employed in any theoretical discussion of nucleons (protons or neutrons), and since Dirac's treatment was able to predict the existence of the positron it is to be expected that anti-nucleons, produced by removing nucleons from negative energy states, also exist.

Experimentally, anti-protons, that is, particles with the mass of a proton but with negative electrical charge, are the more interesting. They have not as yet been observed. The Rev. J. McConnell (*Proc. Roy. Irish Acad.*, A, 50, No. 12, 189; 1945), in a mathematical discussion of the problem of the production and annihilation of negative protons, has shown that the rate of production of such particles is so small that it is not surprising that the negative protons have not been observed in experiments so far performed. With more suitable experimental arrangements, the negative proton could most probably be detected.

Negative protons arise through the formation of nucleon pairs. These pairs could be produced, like electron pairs, from light quanta, but the effect would be extremely small. Alternatively, the pairs could be produced by the collision of cosmic ray mesons with nuclear particles in the atmosphere. The simplest process is that in which two charged mesons collide; and it is shown that if the approximation method due to Dirac is applied to the field, the cross-section for the process increases steadily with the energy—an unreasonable result. It is necessary to make use of the Heitler-Peng theory of radiation damping, and the cross-section for extremely small values of the momentum p is then proportional to p , rapidly reaches its maximum value of 2.2×10^{-27} cm.² and finally decreases as p^{-6} . The process in which a meson collides with a neutron or proton at rest is also considered. By means of a Lorentz transformation the meson is brought to rest and the nucleon allowed to move, and applying the Weizsäcker-Williams method the field of the moving nucleon is replaced by a field of mesons.

The calculation is admittedly very approximate, but the results are claimed by Mr. McConnell to be of the correct order of magnitude. It is found that pair production does not occur unless the energy of the primary meson is greater than 4×10^9 eV. The cross-section then starts from zero, reaches a maxi-

of 7×10^{-29} cm.² at 8×10^9 eV. and afterwards falls slowly to zero. This corresponds to a mean free path of not less than 40 metres in lead.

Neglecting damping, the annihilation of nucleon pairs would, in the Dirac approximation, have the same probability for occurrence as the production, apart from a simple factor arising from the different density functions of the final states, and thus the anti-nucleons on being produced would be immediately annihilated. That this is not so is shown by the further application of the radiation damping theory. It is found that the probability that a high-energy negative proton will be annihilated into mesons on passing through lead is less than 20 per cent, and that on being brought to rest the negative proton is annihilated with emission of light quanta with a mean life-time of about 10^{-4} sec.

Thus, although the negative proton has not yet been observed, the above figures lead to the estimation that for every 1,000 cosmic ray particles observed at sea-level about 0.6 should be negative protons. Williams found that of two thousand particles observed, eight were protons, so that it is to be expected that of the number of detectable protons about 10 per cent are negative protons. It is suggested that experiments on showers of two particles, similar to those of J. G. Wilson (*Nature*, 142, 73; 1938) but with ten times the number of photographs, be performed in order to determine the charge on the particles and to verify the theoretical results.

POPULATION POLICY FOR GREAT BRITAIN

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A SERIES of broadsheets issued by Political and Economic Planning during the last few months are of considerable interest in relation to the proposed national health service in Great Britain. The first of them, "Vital Statistics" (No. 241), is concerned with the probable population trends. It points out that although there is scope for further reductions in total mortality, their effect on population growth could only be small compared with last century, when the rapid increase in population was entirely due to the reduction of mortality. Lower fertility within marriage is the main reason why the population has failed to replace itself for the last twenty-four years, and in the long run the declining trend can only be checked by increasing the average number of children per married couple. There are, however, clear signs that it is the deliberate limitation of families by methods of birth control which is mainly responsible for the present decline in fertility. Analysing various possible trends, *Planning* concludes that in no circumstances would it be realistic to expect an expansion of population in England and Wales comparable to that of the last century. The most that can be expected in the long run is a small increase, and this can only be achieved by reversing present trends.

In broadsheet No. 242, "Retreat from Parenthood", *Planning* examines the nature of the human impulses and attitudes responsible for this decline in population, and endeavours to set the most important of these factors in their correct historical perspective. Although there is evidence in all ages of some desire to avoid excessive fertility, there does not appear to have been in Europe any widespread desire severely to limit the size of families until the

transformation of life by the industrial revolution was far advanced. Thereafter the growth of financial penalties on parenthood as well as the state of public opinion encouraged the small family pattern. Children to-day are the cause of relative rather than absolute poverty, and limitation of the family is an obvious economy of energy as well as of money. The new awareness of insecurity was a further adverse factor, and the neo-Malthusian movement diffused the idea of family limitation far more widely than it succeeded in spreading actual knowledge of contraception. Again, the enjoyment of leisure, like the attainment of security, is apt to conflict with rearing a family, and the growth of sex equality and sexual knowledge have tended to reduce children from an integral part of the happy marriage to a welcome but not indispensable addition to it, if circumstances make a family appear worth while without too much sacrifice.

The broadsheet concludes by pointing out that the new freedom of parenthood in advanced societies marks the end of the epoch of automatic replacement of human numbers, and the institution of voluntary parenthood obliges society to adopt a population policy. Such a policy must take into account prevailing attitudes to marriage and parenthood, and seek to modify them in socially desirable directions. Simultaneously, it must recognize all the disabilities and obstacles to parenthood, and take action to abate or remove them.

One such line of action is discussed in a subsequent major broadsheet (No. 244. "A Complete Maternity Service"), in which the present condition of maternity services in Great Britain is outlined and the main deficiencies are indicated. Further, a full maternity service is outlined and the proper place of the midwife, the health visitor, the general practitioner, the clinic officer and the hospital are discussed and the functions which the health centre can perform in uniting these individuals in a team. The main, and much the most important, emphasis is laid in *Planning* on team-work and continuity of attention. The second point made in the broadsheet is the development of a more uniform service so that without rigid rules applicable through the whole of Britain for every detail of maternity care, the essential services should be readily available to the woman in a country district as well as to the town dweller and to all income groups. Thirdly, the need of simplifying the administrative structure behind maternity services is stressed. If the target is established and each move is made with that target clearly in view, the achievement of a really marked improvement should not be so difficult as it appears at present, when each section of the services concerned is apt to over-emphasize its importance. Lastly, there is the need for public education. First-rate administration and first-rate services could founder completely on the rock of ignorance or prejudice; the essential facts of the situation must be known and understood by the public for whose comfort and health maternity services are designed.

These three broadsheets belong to a series to be embodied in the PEP report on population policies, but the group responsible for this study has found itself unable to deal with the subject satisfactorily without entering on a wider and more difficult inquiry. Population policy must be seen in the context of a democratic society, and belief in the future of society, education in parenthood, and a higher valuation of parenthood by society are three vital factors making for a sound population policy.