

Polarisation of Electrons.

DR. RUPP¹ finds that if electrons of 80 kilovolts energy are reflected in succession from two gold surfaces at an angle of about one-third of a degree, there is a twelve per cent difference in the intensity of the twice reflected beam according as the two deviations are in the same or opposite directions. I have attempted to repeat this result for electrons scattered in succession through two thin gold films. The films were thin enough to give good ring patterns and the method is to measure photometrically the diffraction pattern formed by the twice scattered beam. The result is negative. Eight plates were taken, each with two exposures; the mean difference between the two sides for seven of these plates was 1 per cent. Of the individual pairs of readings, half differed by less than 5 per cent on the two sides, which corresponds to about 2 per cent probable error on the mean of the seven plates. The eighth plate gave a mean effect of 20 per cent in the reverse direction to that found by Rupp. I am unable to account for this plate, and as I have left Aberdeen, where the experimental work was done, I cannot attempt to repeat it. It is possibly due to uneven development.

In some cases the rays selected for the second scattering formed part of one of the diffraction rings formed by the scattering in the first film. In other cases they came from the part of this pattern between the rings. Since the regularly diffracted electrons are always in a minority, the polarisation might be greater than suggested by the above figures if it were limited to these electrons, but there is no sign of such an effect. The angles of scattering were of the order of 2°; the mean energy of the electrons was 65 kilovolts. The experiment is in agreement with the view that the detection of polarisation by such means is only possible with large angles of scattering. Since making the experiment I have seen a paper by Kirchner,² in which he mentions that he has satisfied himself that the effect, if any, is less than 10 per cent.

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¹ *Zeit. für Phys.*, 61, p. 158.

² *Phys. Zeit.*, 31, p. 772.

Heredity and Predestination.

SOME of us are wont to ascribe a super-papal infallibility to the editorial notes in NATURE, and it is, therefore, with much diffidence that I suggest a certain misunderstanding in the issue of Nov. 15, p. 781, as to my Lloyd Roberts Lecture. The place of moral values in modern arguments for theism is so fundamental that possibly space can be found for a few sentences which may stimulate biological experts to consider afresh the relation of evil to the evolutionary process.

Mutations, I stated, appear to be the raw material of evolution: and they seem to be devoid of any ethical character whatever. Changes in the genes—call them simply inheritance factors if their localisation in the chromosomes is doubted—are as near as we can at present get to creative activity: but in such changes we can discover no moral quality. Good and evil, as judged by our standards, are equally likely to arise in the variations associated with heredity.

The note in NATURE says that the 'evil and good' of my argument "are simply adjustment or mal-adjustment to environment". I would that it were so, for then the theologian's difficulties would be at an end. All that is good would flourish because adapted to its environment. The evil would disappear under

the operation of natural selection. We could then, indeed, affirm with Pippa, "God's in His heaven: all's right with the world". Huxley's war between man and the cosmic process would be unnecessary.

Unfortunately, however, the loathsome parasite is a result of the integration of mutations: it is both an exquisite example of adaptation to environment and ethically revolting. Civilised nations, as I emphasised, have of late been creating an environment to which the mental deficient can happily adapt himself: humane principles and social degeneration are thus conjoined. None the less—and here is the puzzle over which I ask biologists to ponder—out of the evolutionary process has come the progress which has led to man with his spiritual consciousness and moral loyalties. I reached the perplexing conclusion that, if we accept the moral argument for ethical theism, we must find Divine activity, albeit elusively, in the environment and not in the genetic changes through which apparently the creative process works. But, as I told my Manchester hearers, I was thinking aloud. My conclusion cannot claim the merit (or demerit) of orthodoxy; and I am willing to be converted to any other explanation for which better arguments can be adduced.

May I add, though it is a subsidiary matter, that I do not personally accept the notion that mutations "are causeless in the sense of being entirely fortuitous". It is part of my faith that the universe is rational for man. Belief in the possibility of successful scientific investigation rests upon such a faith. That faith has its difficulties: as we know, there are those who hold that science will always be limited to regions upon which man can impose his own sense of order. But, if the larger faith be true, the progress of research should in due course give us the 'causes' of mutations or, more accurately, sequences of which they are the end terms. But such sequences, as Hume pointed out long ago, will not lead us to efficient causation. For that we need some metaphysical postulate.

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Nov. 15.

The letter of Dr. Barnes raises two difficulties in our mind. 'Good' and 'evil', as applied to the organisms which in his lecture he grouped as "animals and insects", and on which he relies for his genetic data, can only mean relative adjustment or mal-adjustment to environment, for the biological end of a creature is to multiply its kind. A parasite is biologically evil because it has renounced the power of initiative, replacing it by dependence upon the success of its host, and because the more successful the parasite is, the more precarious its existence as a species becomes. The 'good and evil' of humanity, in so far as they are conventions sanctioned by custom or law, are acquired characters and have nothing to do, if Dr. Barnes is right about the non-heritability of acquired characters, with inheritance factors, but biologically conventions may be good or evil, as they encourage or discourage the best continuance of the race.

Feeble-mindedness is a mal-adjustment which in Nature would meet its own fate, and the morality which protects and encourages feeble-mindedness is also a mal-adjustment which also will meet its fate.

The second difficulty is Dr. Barnes's firm belief in the 'non-morality' or fortuitousness of mutations. It is an uncertain hypothesis, unacceptable to many biologists, yet on it the argument of the Lloyd Roberts Lecture was based. Our notion is that environment may be more than a mere eliminator, but any further power it may exercise must depend upon the response of the organism. THE WRITER OF THE NOTE.