scattered rather evenly over the entire time from the generation after treatment until two or three times the length of the 'latent period' had elapsed It is to be noted, further, that this protracted 'latent period' does not mean that the mutated genes would tend, collectively, to become lost in the interim, since for each gene that died out by accident, in its 'covered' state, another would, on the average, increase in numbers, and so the final number of individuals first manifesting the mutations would fairly accurately represent the number of individuals produced in the first generation after treatment who had received the newly mutated genes. That is, the damage would be long postponed, but not prevented.

In so far as the individuals manifesting the abnormalities might themselves reproduce they would give them a chance to reappear repeatedly, until competition with the normals finally eliminated them. The recognition of these abnormals as having been produced by the original treatment would, however, be impossible, not only because of the long latent period but because they would appear merely as one relatively small part of the vast number of mutations that had occurred in the distant past, from all causes combined, and that had accumulated in the germ plasm. It can be shown that even if the mutation frequency of the population as a whole were doubled, in a given generation, by treatment of all of them with an average dose of, say, 300 r. the frequency of mutations that *manifested themselves* in the population would not be increased, in any one generation, by as much as 1 per cent of their own total, since the manifestation of the new additions to the store of mutations would be scattered over so many generations. If, however, the exposure that doubled the mutation frequency were to be continued generation after generation, the manifestation frequency would gradually rise and finally (after some hundred generations) attain the double value representing the double mutation frequency.

In these circumstances, the advisability of allowing the gonads of a person of reproductive or pre-reproductive age to be exposed to radiation must be decided by balancing the chance of benefit to him against the chance of detriment to future generations. Far more quantitative research is needed on this matter, but it will often be clear that the decision should be in favour of the exposure. Whenever possible, however, a person's gonads should be protected by a lead shield.

As for the question of the mutational effects of natural radiation, while this has been calculated to be of no consequence in flies, the 700-fold greater length of the human generation gives a chance for the accumulation of a sufficient dosage—some 10–15 r. —to have an appreciable effect in view of its also being continued generation after generation. More exact studies are therefore called for concerning the circumstances attending exposure of populations to unusually high amounts of such radiation, as well as of radiation of artificial origin.

SKIN EFFECT IN COMPOSITE AND FERRO-MAGNETIC WIRES

THE British Electrical and Allied Industries Research Association has published a report by G. G. Sutton on the high-frequency properties of wire specimens*. Novel results have been found in connexion with the effect of a longitudinal magnetic field on wires made of magnetic material. Ferro-magnetic wires are shown to have very high 'skin' factors, but the effective permeability determined from the experimental results is shown not to be constant but decreases to a small value as the frequency increases.

Earlier mathematical calculations have assumed a uniform known permeability, but it is known that with ferro-magnetic conductors the permeability varies with the magnetizing force, and hence it must vary over the cross-section of the conductor. It also varies with the current density and the temperature. In addition, hysteresis losses must be considered. Accordingly a mathematical solution is intrinsically very difficult, and it therefore seems necessary to have some direct means of measuring skin factor for magnetic and composite conductors.

The author describes two methods of doing this, both methods being based on thermal measurements. The first apparatus consists of two parallel brass tubes inside which were the specimen wire and a standard wire of eureka respectively. The heating effect of the current in the two wires was measured by observing the extensions by means of a travelling microscope. Both the eureka and iron wires were calibrated with direct current. A simple mathematical relation is then deduced to give the required skin factor. A more accurate method was afterwards developed, mercury being used at first as the indicating fluid, but it was abandoned as it was not sensitive enough. Finally, the liquid decided on was nitrobenzene as its physical properties were found most satisfactory.

The method of measurement developed for skin-factor measurements is shown to give consistent results with different types of specimen. The calculation of results in the case of ferro-magnetic materials is difficult, and in the case of composite materials it is very difficult. The author's method of measurement is direct and calculation is much simplified.

The method can be easily applied to the measurement of high-frequency currents. By further development it would be possible to eliminate many of the difficulties met with in this research. The effect of a longitudinal direct-current field on the high-frequency resistance of a mumetal specimen has been demonstrated; this is in accord with results already published on the arc impedance of specimens of mumetal wire at telephonic frequencies. From the results obtained in the case of ferro-magnetic materials, the effective permeability has been calculated; this tends to a small value as the frequency increases, as indicated by Arkadiew and others. Constructional diagrams are given for making the apparatus, and experimental diagrams are given showing the variation of skin factor with applied D.C. field in the case of a specimen of 26 S.W.G. mumetal wire.

* Technical Report, Reference M/T 69: The High Frequency Properties of various Forms of Wire Specimens. By G. G. Sutton. Pp. 19+13 plates. (London: British Electrical and Allied Industries Research Association, 1941.) 6s.