CORRESPONDENCE

Future Trends in Population

To the Editor, Eugenics Review

SIR,—In his important paper "Future Trends in Population," published in the July issue of the EUGENICS REVIEW, Dr. Kuczynski discussed, among other subjects, the effect on fertility of early marriage. In order to illustrate as simply as possible the point that earlier marriages would raise fertility only if the net reproduction rate were above unity (whereas they would lower it if that rate were below unity), he made use of a simile. Here are his words:

> "Let us take as an example a group of a thousand elephants and a group of a thousand fleas both with a net reproduction rate of 2, that is to say both doubling within a generation. It is evident that by the time the elephants have doubled themselves, the fleas will have reached an astronomical figure. If on the other hand both the elephants and the fleas had a net reproduction rate of 0·5, that is to say, if they were reduced to one-half within each generation, the fleas would have died out long before the elephants would have been reduced to 500."

A misunderstanding would, I think, be removed if Dr. Kuczynski would explain a difficulty which seems to arise from his example.

The elephant, while breeding more slowly than the flea, lives much longer. The flea, while breeding more quickly than the elephant, dies much sooner. But no one has suggested that the more rapid breeding which would result from women contracting earlier marriage over many generations, would cause such quick-breeding women to die earlier than if they married and reproduced at a later period of their lives. To perfect Dr. Kuczynski's parallel of the elephant and the flea, ought we not to try to imagine that the elephant and the flea both have a similar low fertility (a net reproduction rate below unity), that the flea reproduces much earlier in its life than the elephant, and that after the completion of this early breeding, the flea *lives as long as the elephant.* Of two communities, numerically equal, and of equal fertility *and longevity*, of rapidly breeding fleas and of slowly breeding elephants, which would become extinct first?

Would I be right in answering this question as follows? The community of quickly breeding fleas would, in the early stages of its career, come to outnumber that of the late-breeding elephants. This would happen because there would co-exist at the same time more generations of fleas than elephants. The flea community would rapidly attain a higher numerical peak than the elephant community would ever reach, but after passing this peak the flea community would decrease more quickly and would be the first to become extinct.

Dr. Kuczynski will, I am sure, understand that in asking this question, I am in no way trying to dispute his conclusion. I am seeking merely to remove a misunderstanding which has in fact arisen.

C. P. BLACKER.

Sex Ratio and Population Growth

To the Editor, Eugenics Review

SIR,—In the last issue of the REVIEW (p. 154) Mr. Groome brought out a number of interesting points concerning the relation between the secondary sex ratio and the growth of the population. But whatever the merits of Mr. Groome's proposals his argument for raising the male/female live-birth ratio appears to be based on an initial fallacy, and this fallacy is all the more important because it is shared by a large number of people. At the recent assembly of the British Association, Professor F. A. E. Crew, in his paper on "The Sex Ratio," showed the same error in his statements concerning human populations.

It is, of course, quite true that males show a greater tendency to die than females, and that this tendency consequently affects the sex ratio at different ages in the population. But the significance of the effect cannot be seen accurately by looking at the population as it appears at a given moment. Professor Crew said, "Here [in Vol. 2 of the Report on the Census of Scotland, 1931] it is seen that in this human population, though between the ages of 0 to 14 there were more males than females, and between the ages of 20 to 100 there were more females than males, the sex ratio of those in the population between the ages of 15 and 19 was equality. So, also, in the Registrar-General's Annual Review for 1935 will it be found that among those aged 15 to 19 is the sex ratio most nearly equality. It can be stated, therefore, that in the case of these human populations the sex ratio is equality only amongst those who stand at the threshold of their reproductive prime."

The meaning of this statement is not quite clear. If Professor Crew means that, at the present moment, our population is so constituted that equal numbers of males and females are found only in the age group 15 to 19 years, that is self-evident from the figures. If, on the other hand, he means that with present mortality and the present sex ratio of live births such a situation would persist, he is quite wrong, and falls into the same error as Mr. Groome, who says that "at present the sex ratio at birth is about 105 boys to 100 girls, but a ratio of 116 to 100 is needed to maintain the required numerical proportion of the sexes at breeding age." On the contrary, a sex ratio of 105 to 100 is ample to "maintain the required numerical proportions," other things being equal.

Both Professor Crew and Mr. Groome assume

implicitly that the sex composition of our present population is a true expression of the present differential mortality of the sexes. But it is of course a complex expression of fluctuations, over the last sixty years and more, in mortality from natural causes and war as well as in the net balance of migration. The true effect of differential mortality can be seen only by examining the life table for the particular point of time.

If we take the life tables for England and Wales in 1933 (see R. R. Kuczynski, *Measurement of Population Growth*, p. 179), we find a sex differential in mortality which can best be expressed by the statement that whereas the mean expectation of life at birth is 58·86 years for a male child it is 62·785 for a female. Taking a radix of 1,000 male live births and 1,000 female, the life-table population derived from the 1933 mortality statistics is that shown in columns 1 and 2 of the appended table.

LIFE TABLE POPULATION, ENGLAND AND WALES, 1933

Ages (years)	(1) Males	(2) Females	(3) Column (1) multiplied by M/F live-birth ratio of 105 : 100	(4) Resultant M/F Ratio in Life Table Population
under 1 year	945·5	958·0	992·8	103·6
1–4	3,667·2	3,736·7	3,850·6	103·0
5–9	4,496·2	4,588·7	4,721·0	102·9
10–14	4,454·2	4,548·7	4,676·9	102·8
15–19	4,409·6	4,507·5	4,630·1	102·7
20–24	4,345·8	4,449·4	4,563·1	102·6
25–29	4,274·7	4,382·5	4,488·4	102·4
30–34	4,200·3	4,312·8	4,410·3	102·3
35–39	4,111·4	4,232·9	4,317·0	102·0
40–44	3,995·4	4,135·8	4,195·2	101·4
45–49	3,835·3	4,012·6	4,027·1	100·4
50–54	3,617·9	3,848·5	3,798·8	98·7
55–59	3,330·5	3,628·5	3,497·0	96·4

The combined effect of differential mortality and the sex ratio at birth is then shown, as in column 3, by multiplying column 1 by 1·05, the ratio of male to female live births which Mr. Groome quotes. It is then evident from column 4 that the sex ratio at birth is ample to counterbalance differential mortality right through the reproductive ages. Females do not begin to outnumber males until the age group 50 to 54 years.

The mortality differential has, of course, varied considerably in the past. In the period 1891-1900, as shown by the life table for that decade, it outweighed the excess of male live births at an earlier stage. By the age group 30 to 34 years the females in the life-table population were already beginning to outnumber the males. But the life-table population for the period 1838 to 1854 shows a situation very similar to that in 1933, males outnumbering females up to the age group 50 to 54 years, and only being slightly below in the group 55 to 59 years. The difference between the life tables for 1838-54 and 1891-1900 means that female mortality fell more than male during the period, and this is easy to understand. The use of antiseptics must have been an important factor in reducing mortality in the puerperal state, while, on the other hand, the development of factory legislation gradually excluded women from relatively dangerous occupations. Since 1900 the trend is somewhat confused and there appears to have been no definite movement in the direction of reducing differential mortality. But the English Life Table No. 10, for 1930-2, shows exactly the same relative position as that exhibited by Dr. Kuczynski's abridged life table for 1933. So far I have not been able to discover where the change in relative mortality occurred.

However, that is a different question. The point which concerns Mr. Groome's argument is that, migration and war apart, the present sex ratio at birth is sufficient, with present mortality, to provide a surplus or an equality of males throughout the reproductive ages. And migration and war are two unknown factors for which we can scarcely hope to provide in advance—in this field, at least.

There is a second fallacy in Mr. Groome's argument—that concerning the relation between the age of the mother and the sex-ratio of the children born to her. Mr. Groome quotes some statistics from a paper by Professor A. S. Parkes, showing a markedly decreasing masculinity of births with the increasing age of the mother. But these statistics were derived from a sample of only 8,384 births, delivered at St. Mary's Hospital (Manchester) over the period 1911 to 1920. On the face of it, these births would hardly appear to constitute a random sample, and this impression is confirmed when larger groups are dealt with. A number of countries give complete details of the sex of births by the age of the mother, among them Australia and the United States. The results of an analysis of Australian births for the years 1932 to 1934 are given in an appended table and do not show any significant or consistent relation between maternal age and masculinity, and a similar analysis given by Mr. W. T. Russell in his excellent paper, "Statistical Study of the Sex Ratio at Birth" (*Journal of Hygiene*, 1936, XXXVI), shows an analogous situation for the births in the United States in the period 1921 to 1924. According to Mr. Russell "there is no conclusive evidence that the sex ratio is related to the age of the parents,

SEX RATIO OF BIRTHS BY AGE OF MOTHER
AUSTRALIA—1932-1934

Age of Mother (Years)	MF Ratio 1932	MF Ratio 1933	MF Ratio 1934	Average * MF Ratio 1932-34
15-19	105·8	105·2	105·0	105·4
20-24	106·2	106·7	104·5	105·8
25-29	105·3	105·4	104·3	105·0
30-34	106·3	105·2	103·1	104·9
35-3	104·1	104·5	105·4	104·6
40-44	105·1	106·9	102·8	104·9
45-49	113·7	109·6	95·5	106·5

* The average is based on the total births in each age group in the period, and is not an average of the sex ratios in each year.

but any relationship which may exist is with the age of the father rather than with the age of the mother." Even this paternal relationship is, however, very small and means little in terms of absolute or relative differences in the sex ratio. Certainly the complete statistics for the United States and Australia do not show anything like the range of variation given in Mr. Groome's statistics.

One further point. Mr. Groome says that the control of the sex ratio "would, at least, cause a very much slower reduction in numbers than that with which we are now faced." Yet at the same time, as Dr. Kuczynski pointed out in the last issue of the REVIEW, later marriage and the postponement of childbearing would, by increasing the length of the female generation, have a similar effect. This is shown clearly by the approximate version of Dr. Lotka's formula for the yearly rate of natural increase (or decrease), which is: $r=\sqrt[T]{R_0}-1$, where R_0 is the net reproduction rate, and T is the length of a female generation.

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Family Allowances Schemes

To the Editor, Eugenics Review

SIR,—For population and other reasons there may come a strong, and perhaps successful, campaign for some system of family allowances. I therefore wish to suggest that the State should pay parents only for the offspring of the first two effective confinements, but should make the payment attractive—say, about £1 weekly for each dependent child. This would stimulate the birth-rate and yet would reduce the fertility of the people in the poorest classes, especially if sterilization and abortion were made available to them. Also it would increase early marriage and therefore the proportion of male births, with the subsequent benefit to the marriage-rate indicated by Mr. J. R. Groome in his very useful letter in your July issue (p. 154).

Another factor which will tend to raise the birth-rate in the long run is that, when couples only have the children they desire, there will be a constant selection in favour of philoprogenitiveness.

B. DUNLOP.

Manor Fields,
Putney, S.W.15.

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