to no other result, seeing that he has no means of increasing the data, or testing the truth. No doubt, an actuary might say, that he could give no opinion on such insufficient data, and so save himself from the charge of having given an erroneous decision; but the object of my remarks is to point out, that numerous instances occur in which actuaries not only may, but ought to act on very imperfect data; not, indeed, with the view of establishing their own individual character for accuracy, but with the far higher aim of promoting the advancement of science, by giving the best foundation they can from which to proceed when additional information shall have been obtained.

I shall take the opportunity of explaining the object of these remarks, by referring to another paper in the same Number of your Magazine.

The subject of Extra Rates for Foreign Climates has hitherto been confessedly one in which the Offices have had nothing like established principles to guide them; and it is probably the general opinion, that we have at present no data that can be held at all sufficient for the construction of a correct table of such rates. But it is not less the duty of the actuary to take the materials he has, and to make the best use he can of them, thereby forming a rule for his guidance at present, besides contributing a most valuable item in any future investigations. To proceed upon defective and insufficient data, and to give forth the result as a final and certain truth, must be held as indicating a want of candour or discrimination; but to produce from the best materials that are extant the natural deductions which these are fitted to afford, and to admit the deficiency and imperfection which may attach to them, is a work deserving of the highest commendation and encouragement. The actuary who would refuse to assist in such an attempt, because his labour might afterwards be condemned as erroneous, must have a greater desire to establish his own reputation for correctness, than to aid in the promotion of science. It may be averred, without fear of contradiction, that the most useful labours of any actuary who aspires to the dignified name of a philosopher, must be exercised in the field of unexplored truths, where perhaps a distant approximation to what shall ultimately be discovered is all that can be arrived at; and yet that distant approximation may be the means of establishing many most valuable and important propositions which might otherwise remain unsolved.

VERUS.

ON THE VALUE OF ISOLATED REVERSIONS.

To the Editors of the Assurance Magazine.

GENTLEMEN,—In Mr. Jellicoe's very useful paper on the Purchase of Life Interests and Reversions, the methods of making this sort of property return a certain rate of interest not dependent on the duration of the annuitant's or the reversionee's life are clearly pointed out, and it seems to me that the principles therein developed can be satisfactorily applied in the majority of cases that arise. But the formula for finding the purchase-money for £1, payable at A's death, cannot be well adopted always. It is $s = (1 - Ar)v$, where s is the sum to be received by the seller, A the price of an annuity of £1 on the life, and r and v respectively the annual interest on, and the present value at the end of a year of, £1, at the rate of interest which the

x 2

buyer is to make. Now when the life is rather young, A, at the rate calculated on· by the Government or other annuity offices, may be greater than $\frac{1}{r}$, or the value of a perpetuity at the rate which the buyer is to make; and when this is the case, $Ar \nearrow 1$ and s is negative; and in a good many instances that arise, s comes out smaller than would probably satisfy sellers. Under this impression I have devised another plan, according to which the purchaser may be defended from the risk of the rate of interest to be made, suffering diminution from A's living longer than was calculated on. Let s_1 be the mathematical value of the reversion (*id est*, the single premium to insure £1 on A's life), and let $s_1(1+r)^n=v$, where s_1, r, and v are all in accordance with the rate of interest to be made by the buyer: then it will be found that $n = \dfrac{-\lambda s_1}{\lambda(1+r)} - 1$, which represents the number of years in which s_1 will amount to v. Now, if the buyer purchases an annuity on A's life of rv, to commence n years hence, and gives to the owner of the reversion what remains of s_1, after deducting the price of this annuity, he clearly can, under no circumstances, make less than r per £1 interest. For if the life survive n years, the buyer enters upon the annuity rv, which will provide the requisite interest upon the sum v, to which s_1 has by that time accumulated; and when the life fails, he will receive v and the interest thereon for the year immediately preceding the death. The investment presents to the buyer an inviting aspect, being, in fact, a lottery containing large prizes and no blanks; for r is the minimum rate of interest that he can realise, and there is a considerable chance of the life failing before n years, and that consequently a higher rate will be made. Yet it will be found, that often the seller would receive more under this plan than under the other. To take a case that recently presented itself: let it be required to determine the purchase-money for a reversion, payable upon the death of the survivor of two lives aged 50 and 48. The following table exhibits the mathematical value of the reversion according to the Carlisle Table, and the results of the two methods supposing the annuities to be purchased at Carlisle $3\frac{1}{2}$ per cent.:—

	4 per cent.	5 per cent.	6 per cent.
Single Premium..	·3477	·2732	·2172
Mr. Jellicoe's Plan ..	·3080	·1427	—·0190
Plan now recommended .	·2910	·1971	+·1230

A certainty of 4, and a possibility of 250 per cent., might to some be more attractive than 5 or even 6 per cent. certain. Leaving, however, out of the question this consideration, it appears that in this case, when 5 or 6 per cent. are attempted to be realised, my plan gives a considerably higher value for the reversion than Mr. Jellicoe's—which, indeed, gives a negative value for it at 6 per cent.

I am, Gentlemen,

Your very obedient Servant,

National Assurance Co. of Scotland,   C. G. SHAW.
February, 1852.