and appear as medulla. One may therefore speak of the "cystine stimulus" at the root of the growing fibre; when this is inadequate the wool will suffer either in quality or quantity or in both.

It becomes obvious that the sheep requires a considerable amount of cystine for the growth of wool, in precisely the same way that a contractor must have cement for the production of concrete. In addition, it is possible, as has been pointed out, that the *quality* of the fibre is dependent upon the cystine supply.

Passing reference may here be made to the fact that cystine possesses marked absorptive power for ultra-violet light; its occurrence in large quantities in feathers, animal hairs, wool, and epidermal scales indicates that the evolutionary process has retained this substance as a protection against the toxic rays of the sun.

There is abundant evidence that no animal can manufacture cystine from simpler substances for its own requirements. It must be obtained in a preformed state in the diet. Now, dry wool actually contains, in round figures, 13 per cent. of cystine. That the importance of this study cannot be overestimated is evident when it is realized that the usual pasture plants contain only very small amounts. Indeed Aitken[2], working at Otago University, was unable to demonstrate its presence in grass at all. Yet since every known protein contains cystine, even though it may be present only in minute amounts, and since the sheep is dependent upon the pasture for its cystine supply, it seems probable that the demonstration of its presence in grass merely awaits the development of a suitable analytical technique. Emphasis should be laid on the fact that inorganic sulphur as supplied in licks, &c., cannot take the place of cystine, nor can it be incorporated by the sheep into its growing wool; its role in nutrition is of minor importance and need not be further mentioned in what follows. We are here concerned with the utilization of cystine-sulphur as supplied by the proteins in the diet of the animal.

Causes of Cystine Deficiency in the Wool Fibre.

The failure on the part of a sheep to incorporate sufficient cystine into the growing fibre may be due to a variety of factors, hereditary and environmental. It is desirable briefly to consider these factors separately, although their several effects are probably interrelated in a complex manner. Other agencies of which at present we have no knowledge may also interfere.

(1) *Hereditary Factors.*—Different breeds and different individuals presumably possess in varying degrees the power to supply the optimal quantity of cystine to the fibre as it grows from the follicle. In the Merino, which has been bred for wool for hundreds of years, medulla is conspicuously absent or rare; the Romney, on the other hand, frequently grows a fleece in which coarse hairy fibres abound. Again, within some breeds the tendency to produce medulla varies from one animal to another, due to hereditary differences.

(2) *Seasonal Factors.*—At certain times, when wool is being grown at a fast rate, the "cystine stimulus" may be unable to keep pace with the rapidly growing wool. This statement rests