usually return to the same camps in successive seasons. In the daytime they cling to the branches of trees in dense numbers; they are restless and alert and a single gun-shot will put a whole camp to flight. At night they depart in search of food such as fruit, berries, eucalyptus flowers, and honey. They are particularly fond of cultivated fruit, and the damage that they can do in an orchard in one night is appalling. The amount of fruit actually eaten is relatively small; the ground is strewn with fallen material which has been merely nibbled or claw-marked.

Many obvious methods of destruction have been tried. Shooting is expensive. Strychnine poisoning in the orchard is successful to an extent. Poison gases in the camps are not effective because of the timidity of the bat: it is almost impossible to give a lethal dose before they take wing. Infection with *Bacillus typhi marium* is said to have cleared Samoa of the pest some years ago, but we have failed to verify the report and it is understood that Samoa is still badly infested. A small 'flammenwerfer' has been tried but, besides being dangerous and expensive, it is not suitable for general use.

All these, and other, methods have been more or less successful in killing the creatures, but in every case the scale of possible operations is hopelessly inadequate. Wholesale slaughter must be achieved if the pest is to be minimised or even merely kept from increasing. Perhaps the most effective attack will be by biological means. Can any biologist suggest a sound line of investigation which the Council for Scientific and Industrial Research might follow?

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Meteorology: Ancient and Modern.

I do not disagree with those who hold that a review is not an appropriate subject of correspondence for the reviewed; but a paragraph by Mr. W. H. Dines in the issue of NATURE for June 25, puts so compactly, as it were in a nutshell, a question of importance to a wider circle than that which is interested in the study of weather, that I may venture to ask for a little space in which to crack the nut and get at the kernel. Mr. Dines writes (p. 917):

"The author prefers to measure radiative energy in a dynamical unit and states that he finds kilowatts per square dekametre the most convenient. The more usual unit is a gram calorie per square centimetre per minute, but something may be said in favour of gram calories per day, since a gram calorie is more generally understood than a joule and the day is the natural meteorological unit."

This raises the very important question of systematic units for the geophysical sciences. One of my reasons for preferring the kilowatt per square dekametre to the gram calorie per day is precisely that very few people understand what a gram calorie means, and the day that Mr. Dines refers to is not, in fact, a natural unit of time.

Like the questionist who could not define a parallelogram, though he would know one if he saw it, I could not myself say, off-hand, what exactly a gram calorie is for the purposes of computation. I venture to think it doubtful if Mr. Dines could, and would be prepared to risk a little upon the chance of not finding a single member present at a meeting of the Royal Meteorological Society, or (if I might whisper it) of the Royal Society itself, who could give, without reference to a book, an arithmetically workable reply to the question: What is a gram calorie? If any one

were fortunately so encyclopædic, the probable answer would be 41.8 million ergs.

I have also a deeper reason than that. The grand achievement of the first half of the nineteenth century was the discovery that heat had a dynamical equivalent and that energy is always conserved. From that principle we have learned that the energy of a hailstone in the clouds, of a lightning flash, and of a beam of sunshine, are all convertible one into another, perhaps through heat. If, therefore, we really mean what we say in enunciating the principle of conservation of energy, it is urgently desirable that we should keep their identity always in view by expressing all in simple multiples of a single unit.

Now estimating the energy of a lightning flash in gram calories simply 'is not done.' We naturally run to ergs for lightning, and if the lightning will not go to heat for its unit, heat might go to the lightning; and the more reasonably, since the heat unit only becomes a commensurable member of the family when it also is expressed in ergs.

There is no such ambiguity or uncertainty about the kilowatt or the joule. I go so far with Mr. Dines as to say that I am sorry that the names Watt and Joule, or any other name that does not explain itself, should have been attached to 10^7 ergs. I am sometimes exasperated by having to get down a book of reference to confirm or contradict my memory. A kilowatt-hour is an ugly unit; but it is what I, and many others, have to pay 7d. for, so I suppose even if I do not understand it and Mr. Dines does not, the Board of Trade as well as other consumers must think they do.

The word 'hour' leads me to the other lobe of the kernel, the day as a natural unit for meteorology. What, after all, is a day? In another part of his review Mr. Dines rallies me about a chapter on the Kalendar not being, strictly speaking, meteorology. Yet I am quite sure that without that chapter Mr. Dines and I would not understand each other as to what is meant by a day; and with that chapter to refer to I believe I should be able to convince Mr. Dines that by 'a day' he does not really mean a day but an arbitrary unit of clock time, 86,400 seconds, which is only a real day four times in a year.

These things are perhaps of little importance in the physics that is sheltered by a laboratory roof, and indeed the idiosyncrasies of things like calories and days may be transformed into *scientiarum materia disciplinæ puerilis etsi non scientiæ ipsissimæ*; but for the open air study that aims at tracing the connexion between the hailstone, the lightning flash, the sun's radiation, and the strength of the blizzard, equivalence and uniformity, if not everything, are at least the beginning and the end of everything; and there is no question that is of more vital importance to meteorology than a system of units with a common measure of energy as its foundation.

NAPIER SHAW.

June 29.

I do not wish to enter into a discussion upon the general subject of units with Sir Napier Shaw, although I believe that my opinion and his do not greatly differ, but I will explain why I prefer gram calories per day to watts.

It seems to me that gram calories can be more easily explained to an ordinarily intelligent person than ergs, because the latter require some prior knowledge of dynamics before the explanation can be commenced. Also the gram calorie lends itself very readily to the expression of the first result of radiation, namely, to changes of temperature; thus by easy mental arithmetic the thickness of ice that can be