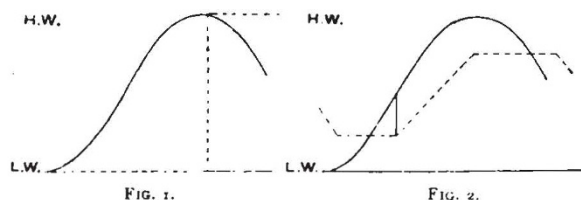


attain this end the relation between the water levels outside and inside the dam must be that shown in Fig. 1 by the full and dotted lines respectively. The motors or turbines must be designed to work efficiently with any head from 0 to  $H$ , and able to do all the work in such a short time that the high and low water levels remain practically constant during that interval, say 20 minutes.

If the interval between high and low water is six hours, the motors must be capable of delivering eighteen times the average power, and of this power  $17/18$  must be stored. It is, of course, impracticable to fulfil these conditions. The turbines have to work with a nearly constant head, and it would be impossible to arrange for the whole work to be done in the short time available at high and low water.

The most practicable plan is indicated in Fig. 2. The flow through the turbines is adjusted to reduce the rise and fall inside the dam to half that of the



tide and the time of working increased to about three hours. The effective head is  $H/4$ , and the distance through which it acts (i.e. the stroke) is  $H/2$ . In this way about one-fourth of the tidal energy ( $w.A \frac{H^2}{2}$ )

might be utilised, half of which would have to be stored if the power supply is to be constant. Taking into account the various losses due to turbine, electrical, and storage efficiency, it is improbable that more than one-fifth of the whole tidal power could be delivered as electric current.

If  $A$  is 1 square mile and  $H$  30 ft., it will be found that for each square mile of reservoir surface something more than 10,000 h.p. might be expected.

I have no knowledge of the details of the Severn scheme, but if it were possible—which I doubt—to enclose 20 square miles of estuary where the average difference of tidal level was 30 ft., the power available for distribution would be under 250,000 h.p.

It may be remarked that the same power could be obtained from a river having a current of little more than 2 miles per hour and a cross-sectional area of 2000 ft., if in its course there was a fall of 30 ft.

A. MALLOCK.

#### Heredity and Acquired Characters.

IN NATURE of January 6 there appears a long communication on heredity by Sir Archdall Reid which he conceives to be a reply to criticisms made on a former letter by him on the same subject by Sir Rav Lankester, Prof. Poulton, Dr. Gates, and myself. Leaving these eminent biologists to look after themselves, which they are quite capable of doing, perhaps you will allow me to say a word or two on some points raised in the letter in the current issue.

Sir Archdall Reid accuses me of torturing "a word which has now an established and perfectly clear meaning." The word is "variation." I wished to contribute to clearness by defining it, for, so far from its having a clear meaning, there are at least three senses in which it can be used. Further, let me say that if a five-fingered child were born of a six-fingered parent, I should not describe it as a "variation," but as a "reversion."

Next, Sir Archdall Reid challenges me to define the

"quibble" about "acquired character." "Acquired character" is a technical term; by it is meant a quality, i.e. the degree of development of an organ, which is produced as a response to function, altered from the normal in response to an alteration of the environment from the normal; but Sir Archdall Reid interprets it as any adult character whatever.

Sir Archdall Reid has, however, understood the point, because he says that "the supposition that 'acquirements' tend to become 'innate' is . . . ridiculous." Such an *ex cathedra* statement contributes nothing useful to the discussion. There are definite experiments on record which, if true, prove this very point, but Sir Archdall Reid apparently knows nothing about them.

Then we are told that "low in the animal scale we find little or no evidence of development in response to functional activity." On reading this the question that instantly occurs to one's mind is: "Where did Sir Archdall Reid learn his zoology?" I have been working with Echinoderm larvæ for many years, and in no animals known to me is structure more sensitive to changes in the environment (Proc. Roy. Soc., B, vol. xc., 1918).

Lastly, Sir Archdall Reid says: "We are now in the morass in which Lamarck and Weismann floundered." I have attended many congresses of biologists, and I have never found evidence of confusion in their minds as to what was meant by an "acquired character." They differed, and continue to differ, as to whether there is evidence that an "acquired character" can be inherited, or, to use Sir Archdall Reid's paraphrase, that "acquirements" can become "innate," and this difference can be settled only by the outcome of experiments which are now in progress, but I have nowhere detected evidence of a condition of thought that could be described as a "morass." I conclude, therefore, that it exists alone in Sir Archdall Reid's mind.

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PROVIDED that biologists understand one another, it is, perhaps, not an insuperable barrier to the progress of biology that Sir Archdall Reid is unable to understand their terminology. I write merely to point out that though he seeks to teach biologists the proper use of terms, Sir Archdall Reid, in his letter in NATURE of January 6, contradicts himself in his own terminology. He states that even in human beings many characters do not develop in the least in response to functional activity, e.g. hair and external generative organs. On the other hand, in man most characters develop wholly, or almost wholly, in response to that stimulus. Yet in another paragraph he asserts that all characters are necessarily innate, acquired, germinal, somatic, and inheritable in *exactly the same sense and degree*. If biologists recognise, as Sir Archdall Reid does, a difference between characters that develop in response to functional activity and those which do not, what need is there for him to ask biologists why they describe some characters as "innate," "germinal," and "inheritable," and others as "acquired," "somatic," and "non-inheritable"?

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University of London Club, 21 Gower  
Street, W.C.1, January 7.

#### Solar Radiation in Relation to the Position of Spots and Faculae.

ABOUT September 1 last an arrangement was made between the Director of the Argentine Meteorological Service and the Director of the Astronomical Observatory of the University of La Plata for observations of