

level ground, the potential energy acquired when the foot is lifted, and the consequent slight loss of heat, is neutralised by the *internal* work necessary to prevent the foot having any actual energy at the moment it touches the ground.

Upon this theory it is clear that the fall of temperature must be greater as the height arrived at is more considerable; and that the body must soon regain its normal temperature when the experimenter ceases to ascend. Lortet's observations agree perfectly with these requirements, he finding that his temperature was normal in less than half an hour after he had reached the summit.

In descending a hill the temperature ought evidently to rise greatly if this explanation is the true one.

A. H. GARROD

St. John's College, Cambridge, December 3

#### Hailstones

I HAVE frequently observed that when hailstones are large and well formed, they are almost invariably round and smooth at one end, and roughly conical at the other (as in the annexed sketch), so as to suggest the idea that they are broken portions of spheres, of a structure radiating from the centre.



Perhaps some of your correspondents can inform me if there is any proposed theory which accounts for this peculiar form, which should throw some light on the formation of hail.

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#### ENCOURAGEMENT TO NATURAL SCIENCE AT TRINITY COLLEGE, DUBLIN

NOTICES have from time to time appeared in this journal of scholarships, exhibitions, &c., obtainable in various colleges at Oxford and Cambridge, for proficiency in the purely Natural Sciences. From these we see that the neglect with which the study of nature has been treated is gradually giving way, and that our great Universities are at last becoming alive to the importance of this branch of learning, and to the necessity for encouraging its pursuit among the students. It is a matter for surprise that no similar mention of rewards for Natural Science is ever made with respect to the University of Dublin. And yet, were a Fellow of Trinity College asked what was being done in this direction at his University? he would probably answer, "Oh, a great deal! there are gold and silver medals awarded at the Moderatorship Examination for Natural and Experimental Science; then there are four or five Science Scholarships given annually." It is true a student may take out his degree with honours in Natural Science, and receives a medal, but let us see what is the course for the so-called Science Scholarships; the subjects are mathematics, pure and applied, for which 350 marks are obtainable, and, as a secondary course, either logic or physics, for which fifty marks alone are given. Such are the rewards and inducements held out to the student of *Natural Science*. It is scarcely to be wondered at that the most promising men in the University do not go in for them, but devote themselves to the more profitable classics or mathematics. For these the rewards are liberal and numerous; there are no less than seventy foundation scholarships, and many others, besides a great number of exhibitions, of which, within the last few months, thirty in addition have been granted by the Board. Not one of these has the man who devotes himself to chemistry, zoology, botany—in short, to Natural Science—a chance of obtaining. We ask—is this fair? Even supposing it undesirable to divert any of these scholarships or exhibitions from their accustomed channels, yet surely the Board might establish one or two additional ones out of the—confessed to—60,000l. annual income.

About a year ago it was rumoured that a "studentship" would in future be given at the degree examination

to the first gold medallist in Natural Science, but the idea seems to have died a natural death, and those in whose bosoms a ray of hope had arisen have been doomed to disappointment. It is not to be supposed that the authorities of Trinity College, Dublin, are in any great degree adverse to changes. On the contrary, when a reform(?) is not especially needed, they are not unlikely to introduce it; thus, for instance, the harmless old custom of setting the college clock a quarter of an hour late—giving the students, as it were, a quarter of an hour's law—has been abolished, and the hour for "commons" has been altered.

But we have no wish to lead any one to imagine that an altogether bigoted and unchanging spirit pervades the University; we have much pleasure in saying that many of its institutions are truly liberal; and we can scarcely doubt that before long the governing body will look with more favour on the Natural Sciences, and that they will become aware that Ireland—not so very flourishing at present—will be anything but a loser when the National University sends forth a greater number of scientific men.

A.

#### THE CONSTRUCTION OF HEAVY ARTILLERY II.

##### CHOICE OF MATERIAL

IN an article which appeared on the 24th of last month, we endeavoured to explain the construction of our large ordnance, and to trace briefly the steps by which the combined strength and simplicity of the present pattern in the British service—the Woolwich Gun, as invented by Mr. Fraser—were attained. Simplicity is one chief element of strength; the fewer pieces anything is made of in general the stronger it is, and it has also the advantage of cheapness; but simplicity is seldom the beginning, it is rather the end of a series of inventions and improvements, and this has been the case in gun manufacture.

Having traced the steps of the process, and glanced at the history of its development, one topic more remains to be treated in order to give completeness to the subject, and that is the choice of material; and although the choice of material must come first in actual construction, to know the manner in which the gun is formed, and the qualities sought to be developed in the construction, will be a great help in understanding what qualities it is desirable that the material should possess. There are two qualities between which the choice lies; these are *hardness* and *toughness*. The British Government has decided, we think wisely, in favour of the latter. Hardness is the proper quality to resist a statical force, or pressure; toughness to resist a dynamical force or blow, and the explosion of gunpowder is not only a dynamical force, but it is the greatest that we have to deal with in any mechanical problems. If a hard substance is subjected only to a blow which it is quite able to resist, whose strain is well within the limits of its elasticity, then it is a very fit and proper material for the purpose; and this was the case with the old smooth-bore guns, which were all cast-iron. They were quite strong enough to do with safety all that was required of them. But for the force now imparted to rifled projectiles with their immense range, their tremendous armour-piercing *vis viva*, cast-iron guns are altogether inadequate. Much lower charges than those of our wrought-iron rifled guns would burst them into fragments. Did nature supply us with a material so hard that the strain of gunpowder was easily overcome by it, it would do very well for all guns. If, for instance, diamonds existed of sufficient size that a piece of heavy artillery might be bored from one, then they would be a very admirable material for the purpose. But, as this is not the case, we must fall back on tough instead of hard substances, the more especially as it does not do to approach