being all teleological factors in the expression of this "ideal."

Now in the first place we do not require a revelation from another sphere to tell us that "there's ne'er a villain dwelling in all Denmark but he's an arrant knave," and biologists may similarly remark that they do not require any transcendental analytic to inform them that an organism is something more than a mechanism. But it is indeed a startling announcement to be told that in the investigation of an organism we are to rise above "the category of causation," and carry into our inquiry the conception of teleology. And still more startling is this announcement when we are told that the teleology which we are thus to embrace is not in any way connected with the hypothesis of a designing mind, but is a something which we ourselves are, as it were, to read into the facts which we investigate, by means of a "creative synthesis of thought." It is here, we think, that the "men of science" ought to take their stand; we are all agreed that an organism is something more than a mechanism, but we are not agreed that in any department of science we are justified in quitting the category of causation. On the contrary, for our own part we decidedly maintain that this is the category the limits of which mark the limits of all scientific research, and that in whatever degree science presumes to overstep these limits, in that degree has it ceased to be science and become metaphysical speculation. Moreover, we should say that the speculation is, so far as science is concerned, of an exceedingly vicious kind. It was bad enough to have the "final causes" of the older teleologists posited as the ultimate touchstones of scientific truth; but it seems to us much worse to have a system of teleology of our own manufacture put into its place. Thus, to take an illustration, it is the outcome of a judicious "application of the categories" to assert that a great gulf is fixed between the living and the not living in nature, and therefore that "we can never hope to find a case of *abiogenesis* as a matter of fact." Now we conceive it is the part of a man of science as such to entertain no such bold statement as this. It is, to use a term of which this school of philosophers is particularly fond, the worst form of "dogmatism" thus to affirm, on grounds of metaphysical speculation alone, the antecedent impossibility of any discovery in science—most of all with reference to a matter touching which we are so much in the dark. If our working biologists were ever to adopt the categories as guides to their methods of inquiry, here is a case in which all attempts at inquiry would be barred by an *a priori* dogma; and the same is true of every other case where the "category of causation" is sought to be overshadowed by "the higher categories." Thus, to take another example, in order to show the necessity for the employment of these higher categories in science, it is argued that the regeneration of the amputated limb of the newt is "wholly unintelligible," save as an expression of the teleological impulse to the reconstruction of our ideal type or organism. But, without waiting to ask what becomes of such an impulse in the case of any of the higher Vertebrata when similarly mutilated (perhaps the matter in this case is "wholly unintelligible," but whether or no the illustration can scarcely be deemed a happy one), we object, in the first place, that by discarding the category of causation an *a priori*

barrier is arbitrarily set up against any scientific inquiry into the facts; and in the next place, that the higher categories cannot possibly furnish any semblance of what may properly be termed an "explanation." To say that "each cell is directly determined in its action simply by what it has to do in order that the vital activity of the newt may be restored to its normal condition," is not to explain the process; it is merely to restate the fact. And in all similar cases the so-called "explanation" which is furnished by the higher categories amounts to nothing more than saying that the thing to be explained is what it is. The truth, in short, is that outside the category of causation we cannot explain anything in a scientific sense. We may change our "point of view" as often as we choose by regarding a thing now as mechanism, now as organism, now as beautiful, again as moral, and (if we may be allowed to add to the categories) lastly as comical. But by thus changing our point of view we are in no wise adding to our knowledge in the way of explanation; we are merely regarding one aspect of a thing to the exclusion of its other aspects.

Let it not be thought that in making these remarks we are actuated by any *animus* against the transcendentalists. In the region of philosophy their "Copernican change of thought," which makes the universe revolve round the philosopher, may be a change fraught with all the importance which its adherents claim for it. With this, as we have said, we are not here concerned; we are only considering the system "from one point of view," or in its relation to science, and here we find that its teaching appears to be seriously at fault. We have endeavoured to show that it is not only of no use to puzzle the "plain man" of Locke in the person of the modern biologist by telling him that "the organism, *quod* organism, is not in space at all;" but that even if the biologist could be made to understand what is meant by such a statement, his acceptance of the meaning would be worse than useless to him in his work. Far, therefore, from feeling with our authors that for "such a class (*i.e.* specialists in science) the mastery of the critical investigations of Kant and Hegel, or at least of conceptions which have been profoundly influenced by these writers, will in the near future be absolutely essential," we believe that the less men of science, in their capacity as such, have to do with these investigations the better will it be for the progress of their own. And, on the other hand, seeing that the critical philosophers are so ready with their advice, we may in our turn conclude with a word of advice to them, by observing that it will be the better for the credit of their system if they cease from their kindly endeavours at teaching our Hannibals to fight.

GEORGE J. ROMANES

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

Simultaneous Affections of the Barometer

I HAVE just read in the columns of your journal the very interesting communication (Part II.) from Mr. A. N. Pearson

regarding the transmission eastwards of barometric movements, and in which he likewise alludes to simultaneous affections of the barometer. Speaking of these latter he says: "As to the cause of the widely distributed simultaneous movements of the barometer . . . I have no evidence of any value. The most natural idea is that a connection direct or indirect may be traced between them and changes in the state of solar energy. . . . I have not a sunspot curve for the years under consideration, and cannot therefore make the necessary comparisons."

I may mention that simultaneous affections of atmospheric pressure were first observed by the late John Allan Broun, and that I have compared his instances with sunspot records. The results of this comparison were published last year in the *Proceedings of the Literary and Philosophical Society of Manchester*. I have not the volume here with me, but if my memory does not deceive me an increase of pressure was found to be associated with increasing sunspots and a decrease of pressure with decreasing sunspot.

BALFOUR STEWART

Devonshire, August 17

Dreaming

INSTANCES have lately been described in *NATURE* of remarkable formation or perversion of dreams at the instant of waking. Allow me to offer you the following, which was vividly impressed on my mind, and which I still remember with the utmost accuracy:—

In the summer of 1822, when an undergraduate of Trinity College, Cambridge, I was permitted to reside in College rooms during the summer long vacation. As fires were not wanted in our sitting-rooms, it was customary for each resident's bedmaker or other officer to carry his water-kettle for breakfast and tea to the College kitchen, and bring it back with water boiling. On one occasion I had overslept my usual hour, and I dreamed a dream. I was at the gate of a country farmyard well known to me, and there came a long procession of horses, asses, oxen, hogs, sheep, and all the animals usually to be found in a farmyard, followed by a north-country drover with his plaid or maude crossed over his shoulder, who walked up to me and said, "Sir, I have brought your cattle." In an instant I perceived and actually heard (so intimately were the auditory sounds and the intellectual interpretation intermixed) that my bedmaker was at my chamber door calling to me, "Sir, I have brought your kettle." The hearing had been confused; there had been no reasoning; but there had been instantaneous vigour of creative imagination.

An admirable instance of the same kind is described in the last chapter of Scott's "Rob Roy." Scott appears to have been in some measure a student of dreams. I refer with pleasure to the description of FitzJames's dream, after a day of labour and an evening of excitement, at the end of the first canto of "The Lady of the Lake."

A. B. G.

August 18

Thunderstorms and Auroræ

I WOULD like to ask if any observer has ever suggested a possible connection between thunderstorms and the aurora? Last evening a very heavy shower, accompanied by much lightning, passed to the north of this place. Other black clouds were seen to the south and west, and at nine o'clock flashes of lightning might be seen darting across the clouds in nearly all directions. It was evident that the air was heavily charged with electricity. Just before retiring, about midnight, I looked from my window to see if a shower was still threatened at this point. I found the heavens quite clear except in the north, where a dark mass of clouds still hung. At the eastern extremity of this cloud-bank a rift several degrees wide commenced and extended nearly to the north-western horizon. Frequent flashes of lightning lit up the edges of this rift, while beyond the clouds the clear sky was seen to be brightly illumined by a steady auroral glow. The glow continued nearly unchanged during the several minutes which I watched it, and it was quite evident that it was a genuine aurora, and not a reflection of the lightning flashes. Is it not probable that the same electrical state of the atmosphere which produces the thunderstorms may also cause the aurora, and that the two phenomena may often occur together?

Lewiston, Maine, U.S.A., July 6

E. R. CHADBOURN

"Elevation and Subsidence"

QUOTING Prof. Geikie's "Text-book," Mr. Starkie Gardner says: "Strata of sedimentary origin which have accumulated to

thousands of feet in thickness, may be depressed deep beneath the surface and brought within the influence of metamorphosis. . . ." He continues: "This is an absolute admission that at some depth, relatively not great, pressure converts solid into viscous or fluid strata." A few lines further: "If the mere pressure of overlying strata can anywhere or at any depth render rocks molten or fluid, they will become molten or fluid wherever the required pressure occurs." But is not the supposition the exact reverse of what is really the case, viz. that not only does pressure *not* liquefy rocks, but actually *prevents* their melting at a temperature at which they *would* melt were the pressure removed? Mr. Gardner himself admits this in the case of the nucleus, i.e. when we come to very extreme pressures; how then can pressures of an intermediate order of magnitude have the opposite effect? This is surely not the view of Prof. Geikie. The passage quoted by Mr. Gardner from his work refers to the fusion of rocks by the *high temperature* found at great depths.

If Mr. Gardner means to imply, as some of his expressions strongly suggest, that the *cause* of the high temperature of the interior of the earth is the pressure of the superincumbent rocks, it would be interesting to know how he reconciles his theory with the principle of the conservation of energy. Heat is energy, pressure is force. Force can only give rise to a manifestation of energy by acting through a finite distance, the energy manifested, or "work done," being the product of the force and the distance through which it acts. If either factor be zero, the other not being infinite, the product is also zero. The application to the case in hand is too obvious to require statement.

Trinity College, Cambridge, August 4

F. YOUNG

Insects and Flowers

HAVING this morning received the last number of the *Proceedings of the Linnean Society* containing Mr. A. W. Bennett's and Mr. Christy's observations on the constancy of insects in their visits to flowers, it occurred to me, after reading only the first page, to see how insects behaved in my own garden, where there is a great variety of plants. I had not read the conclusions of either author, and had no preconceived opinion on the subject. The results were noted at once, and were as follows:—

1. *P. rapæ* (small white butterfly) on a bed containing white and rose-coloured double and single stocks also, scarlet pelargoniums and pink phlox; visited single white stocks only, going all round the circle in which they were planted; then flew off, made a dive at a white phlox, but did not alight, hovered about some little time without alighting, and finally went out of sight.

2. Same species; two individuals on a bed of scarlet pelargoniums edged with sulphur-coloured pansy (? *Viola lutea*, var.). One butterfly kept to the pelargoniums, paying repeated visits; the other did the same with the pansies.

3. Same species on a bed of dark purple pansies with bright yellow eye, crossed and edged with orange French marigolds. Two individuals visited both plants promiscuously, but the marigolds oftenest. A *P. napi* (green-veined white butterfly) did the same. *Vanessa urticae* (small tortoiseshell butterfly) on the same bed visited only the marigolds. This species seems remarkably partial to yellow.

4. *P. rapæ* on a bed of scarlet pelargonium and pale blue pansy with dark centre and pale yellow eye intermixed. Visited the pansies very often; the pelargoniums once only during observation.

5. Same species on *Lythrum salicaria* remained a long time visiting different spikes, then flew round, neglecting all other flowers till it found another plant of the same kind, which it continued on as long as I watched it.

Bombus lucorum. This bee was very abundant, both workers and females. I watched them on a mixed bed which contained *Pentstemon barbatus* (dull scarlet), African marigolds (yellow), *Antirrhinum majus* (crimson), pansies, both dark purple and yellowish white, and mignonette. The favourite plant was the pentstemon, especially with the ♀. They got at the nectary by inserting the proboscis in a hole cut near the base of the corolla. The next favourites were the marigolds. One individual confined himself exclusively to the antirrhinum. In one case only did I observe a bee to change from one kind of flower to another, though I looked out especially to see if they did so. This was a bee which went from a crimson petunia to an antirrhinum of very nearly the same shade of crimson.