tative analysis. The treatment is marked throughout by a considerable degree of originality, and the book appears agreeably free from the domination of an examination syllabus or of the authority of any particular school. It is unusual to find the determination of silicon in pig-iron or steel in an elementary book, and so also the use of a Hempel gas apparatus; but there is, after all, no good reason why the practical work of elementary students should not be interspersed with exercises of this more technical kind. It is astonishing what sanctity is still attached to the established order of practical chemistry, and it is not the least interesting feature of this book that it is markedly unorthodox. Most teachers will admit that they may profit by carefully inspecting the plans of instruction adopted by their well accredited colleagues, and such a remark may certainly be made of Prof. Hart's little book. A. S.

La Nature et la Vie. By Henry de Varigny. Pp. ii+356. (Paris: Armand Colin, 1905.) Price 3.50 francs.

In a pleasant and easy fashion the writer of this book carries the reader from the beginnings of life to its termination by death. The origin of life on this planet, the vital phenomena of the lower and higher forms of vegetable and animal life, the part played by bacteria in the fertilisation of the soil, the evolution of living forms, parasitism, the multiplication of animals and plants, the beginning of the end, the problem of death, and the immortality of the protozoa are a few of the subjects dealt with. The book may be recommended as a good popular introduction for the educated but non-scientific reader to general biological problems.

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 intended for this or any other part of* Nature. *No notice is taken of anonymous communications.*]

A Plea for Absolute Motion.

Newton believed in the possibility of absolute motion (*i.e.* motion in space not necessarily relative to other material bodies), founding his argument on the fact that the rotation of a planet might be detected by experiment on the planet itself without reference to outside bodies. Newton's reasoning is unanswerable, but it only takes us part of the way. Though it proves that using the principle of gyrostatic action we can determine direction in space absolutely, it fails to distinguish one parallel line from another. We can only observe relative motion. This statement, which no one doubts, is generally taken to be synonymous with the assertion that nothing but relative motion will ever be known. So firmly is this generalisation rooted in the present generation of philosophers that I am afraid the expression of a contrary opinion will only result in placing its author on the "Index" of De Morgan's Budget of Paradoxes.

It is therefore with considerable hesitation that I venture to raise the question whether we are not most of us in our innermost hearts believers in absolute motion, and whether a good deal of the persistence with which we try in our lectures to prove that no meaning can be assigned to absolute motion does not arise out of the desire to repress our own rebellious doubts. As regards the direct evidence of observation we are all agreed, but if from the outset we limit the results of reasoning to that which may directly be controlled by experiment, we must throw overboard a good many theories which are firmly believed in by men of science. I will try to show that it is almost impossible to exclude the idea of absolute motion from our discussions, and that some of our scientific definitions tacitly admit it.

The observed motion of the solar system through the stellar universe has frequently been introduced into the discussion of relative motion, but I do not think that its full importance has been recognised. The thesis I wish to maintain is that the question whether our solar system possesses velocity not only relatively to the stellar universe, but absolutely in space, constitutes a definite problem to which a scientific meaning can be attached. It is immaterial to my purpose whether our present observations are sufficient to allow us to draw any definite conclusions. If the validity of the question itself is admitted, my point is gained.

In order to free the main issue from the uncertainties arising out of the imperfections of our observations, I will base my argument on an ideal condition of the universe which resembles the real universe sufficiently to be admitted as a possibility. The displacement of a star relative to the solar system may be determined in two ways. While telescopic observations give us the angular motion in a plane at right angles to the line of sight, spectroscopic observations allow us to determine radial velocities. To determine velocities by means of the telescope we require to know the distance of the stars, but the determination of parallax is a question of instrumental perfection and of long-continued observation. We commit, therefore, no error in principle if we imagine the parallaxes of the stars in our ideal universe to be known, so that the combination of telescopic and spectroscopic observations can determine the relative velocity in magnitude and direction.

It is a matter of history that telescopic observations alone have led to the conclusion that the solar system moves relatively to the stellar system towards a point which, as fixed by Prof. Newcomb's discussion, has a right ascension of $277°.5$ and a declination of $35°$. Taking this point as apex, Prof. Campbell divided the heavens into eighteen zones, obtained by drawing circles of latitude at a distance of $10°$ with the apex as pole. In every one of the zones which had a smaller apical distance than $90°$, the average motion was one of approach to the sun, and in every one of the zones having an apical distance greater than $90°$ the motion was one of recession from the sun. A complete discussion gave for the line of direction, as obtained by the spectroscopic method, R.A. $277°.5$, dec. $20°$, the right ascension agreeing exactly with the value deduced by Newcomb, though the declination differs materially. The relative velocity found was about 20 kilometres per second.

We may now idealise this observed universe so as to simplify the argument, and bring out its essential points. Divide the heavens into a number of compartments. Let in each compartment the relative velocities be measured for a large number of stars combining the spectroscopic and telescopic method. Let u be the average velocity of each group relatively to the solar system, so that the velocity of each star in the group can be represented by $u+v$, both quantities being vectors. For the sake of argument, assume that u is the same for all groups, and that v within each group is distributed according to the law of errors. As regards v, there is no predominance of any direction (otherwise u would be affected), and its magnitude will be distributed about its mean value in a manner which we will take to be the same for all groups. The question arises: How should we interpret such observations if the facts were as stated?

It is not sufficient to say that the observations would prove a relative motion $-u$ of the sun with respect to the stellar system, for this would only represent a small part of the facts. The important point brought out by the observations is that the relative motion is observed to be the same for the mean point in each one of a great number of groups of stars. The fact that within each group the distribution follows the law of errors leads to the conclusion that the groups are independent systems, and I put the question thus: Does it require an explanation why all these independent systems should have the same vector u imposed upon them? If you admit the validity of this question, if you begin even to discuss the alternative explanation that the vector u reversed really belongs to the solar system, and indicates its velocity, you have practically surrendered to absolute motion. If there were only one star in existence showing relative motion towards the