hope ever to change into a lizard. One of the greatest steps in evolution was the origin of life, but it is unreasonable to suppose that the concurrence of favorable conditions necessary for this step could occur only once in the history of the earth. The impossibility of abiogenesis *now* is, therefore, no argument against an abiogenesis once in the early history of the earth.

Again: the author, while he admits that evolution is not necessarily destructive of the idea of a guiding intelligence in nature, while he insists on the necessity of supernatural interference only at the three points mentioned above, thus implying that evolution may possibly take charge of the process in the intervening time, yet plainly inclines strongly to the supernatural origin of species. Along with many other deeply religious minds, he seems to shrink from the cordial recognition of the law of evolution as if it dispensed with the necessity of a God in nature. But surely this is no more true of evolution than of any other law of nature. If the law of gravitation did not destroy our belief in a divine sustainer of the cosmos, why should the law of evolution destroy our belief in a divine Creator? If the law of gravitation be nought else than the divine method of sustentation, then is the law of evolution naught else than the divine process of creation.

One thing more: the present epoch is supposed by the author to differ from all previous ones in the fact of *rest from creative work*. We cannot allow that this is the decision of science. The very possibility of a science of geology is conditioned on the continuance of geological changes, i.e., of creative work, under our eyes.

In conclusion, we must say, that, given the point of view, the frame of mind of the author, — a frame of mind still the most common among religious men, — the book is undoubtedly deserving of much praise as the very best of its kind. But we feel sure that the frame of mind of the religious world is on the eve of change, and, with the change, the '*raison d'être*' of the book will no longer exist.

TRYON'S CONCHOLOGY.

Structural and systematic conchology (etc.). By GEORGE W. TRYON, jun. Vol. iii. Philadelphia, *The author*, 1884. 453 p., 49 pl. 8°.

THE final volume of Mr. Tryon's work has appeared, including over four hundred and fifty pages of text and about fifty plates. It treats of the pulmonate gastropods, the Scaphopoda or Dentalia, the lamellibranchs, and the brachiopods, and contains an appendix with numerous additions and rectifications and an index of genera comprising nearly sixty-five hundred different names. We have previously referred to what we consider the defects of the plan and of some of the details of the earlier volumes, — defects which this one shares to a certain extent. Nevertheless, as it is in large part a treatise on groups which the author has made the subject of special study, he has made it by far the best of the three, — a fact which it gives us pleasure to recognize. In spite of the criticism which the work as a whole has seemed to us to call for, it is only fair to the author to point out the immense labor required to bring together the material condensed in the two descriptive volumes, and the service which this condensation, in spite of certain defects, will render to workers in conchology and paleontology. The devotion with which the author has applied himself to the study of mollusks for years, has not been fruitless; and here and there in the text most students will find scattered opinions and remarks which will recommend themselves as sound and judicious. While the character of the illustrations cannot be said to be satisfactory, yet they are in most cases sufficiently recognizable to be of service to him who knows what he seeks. If we fail to find in the systematic arrangement that grasp of the subject which might be wished for, and that exposition of recently developed truths one naturally seeks in the newest book, yet we recognize the benefit the author has conferred on specialists, at the cost of an enormous amount of drudgery, by bringing into reasonable orderliness, from innumerable scattered sources, the names and descriptions of thousands of generic forms. For this the work will be welcome in many libraries.

STEAM-ENGINE INDICATORS.

The Tabor steam-engine indicator. By GEORGE H. BARRUS, S.B. New York, 1884. 75 p. 24°.

THE preface of this little handbook states that it was prepared at the solicitation of the Ashcroft manufacturing company, makers of the Tabor indicator, as a book of reference and instruction to purchasers and others.

The subject of principal interest in the book is, of course, that of the construction and performance of the Tabor indicator, especially as compared with other indicators; although there is, besides this, a variety of useful matter, tables, etc.

With regard to this principal object of the book, we must confess to a little disappointment; for, since its author is an acknowledged expert in steam-engineering, we should naturally have expected him to institute experimental comparisons between this instrument and whatever other indicator is regarded as the best in market.

The improved form of the Thomson indicator, made by the American steam-gauge company, we believe to be in high favor with the profession. Mr. Barrus may, for aught we know, have compared the Tabor indicator with this or some other good modern indicator; but the only comparisons here published are with older instruments. The special mechanical advantage claimed for the Tabor indicator is the greater lightness of its moving parts. The pencil-arm (which has the highest velocity) is substantially the same in this and other instruments, and the reduction of weight is in parts having a less velocity. Still there is, we think, substantial truth in the claim of lightness. It would seem that any of these instruments might use aluminium to advantage to save weight in the moving parts.

From a curious little loop which is found just at the beginning of the stroke, after the admission-valve is opened, and which is not seen in the Richards and Thomson cards taken at the same time, we suspect that possibly the pencil lags behind its true position in other parts of the diagram, as it certainly must in some part of the loop, and that there are consequently unknown distortions of the card.

While great efforts have been put forth to make the parts carried by the spring light, and to give the spring as much firmness as possible, because its vibrations show with great distinctness upon the card, it does not appear that equal care and ingenuity have been expended to secure a positive to-and-fro motion of the card, which shall exactly correspond to the stroke of the piston. The exactness of this correspondence is of the first importance, but all errors of this nature are so masked in the indicator card as almost to defy detection. Since the typical steam-engine of to-day runs at a very high speed, and the indicator in its present form is essentially a low-speed instrument, the results which it gives are, to say the least, liable to uncertainties. For example: at speeds of six hundred to eight hundred revolutions per minute, the Tabor cards show vibrations which are probably as large as those in the Richards and Thomson at three hundred or four hundred revolutions per minute; and it appears as though no improvements could make any indicator of such a form work well at the highest speeds.

It seems possible, however, that a recent improvement in a new direction, made by Prof. J. Burkitt Webb of Cornell university, may overcome this difficulty;[1] and, as any improvement in instruments of precision is of importance to science, we may here briefly explain its nature. Were a pin so placed as to block the piston of the indicator just as it reached its highest point, it is obvious that the vibrations which then usually appear would be stopped; and, were another pin so placed that the piston could return only a small fraction of the whole distance to the zero line, then the pencil would describe only that part of the diagram between two lines near together, and parallel to the zero line. If during the next stroke these stops be moved one step nearer the zero line, the pencil will then describe another part of the diagram; and the process may go on until the diagram is completed. Since vibration is completely destroyed by this device, Professor Webb is enabled to use long and flexible springs, instead of the short, thick ones now in vogue, and so discard the parallel motion entirely.

RECENT WORKS ON THE MICRO-CHEMISTRY OF PLANTS.

Vegetable histology. By D. P. Penhallow. Boston, *Cassino*, 1882. 40 p. 8°.

Botanical micro-chemistry: an introduction to the study of vegetable histology. By V. A. Poulsen. Translated with the assistance of the author, and considerably enlarged, by William Trelease. Boston, *Cassino*, 1884. 118 p. 8°.

Hilfsbuch zur ausfuhrung mikroskopischer untersuchungen im botanischen laboratorium. Von Wilhelm Behrens. Braunschweig, *Schwetschke*, 1883. 398 p., 127 figs. 8°.

A translation of Schacht's little treatise on the microscope as applied to vegetable physiology, now out of date and out of print, has long been the only handy book in English, available to our students of histology who are unfamiliar with French and German. To be sure, all the better works on microscopic manipulation devote a few well-considered pages to directions for the manipulation of vegetable sections and to the principal reagents. But a convenient special work has long been felt to be a desideratum, especially in this country, where the exchange of microscopic specimens, and the interchange of hints by systematized correspondence, have never received the full

[1] See figure and brief description in the *Trans. Amer. soc. mech. eng.*, 1883, reprinted in *Cotton, wool, and iron*, Feb. 2, 1884.