the best beginning. I believe that, on the contrary, unless the demonstrative and deductive principles of the science are soon introduced to the student's notice, he is likely to acquire a distaste for the subject.

I was learning, under an infliction of practical geometry (at school), to detest the very sight of a box of mathematical instruments, when a fortunate illness kept me at home for two or three years. I believe that Euclid, as it would have been introduced to me at school, would have rendered my dislike for mathematics complete. But becoming possessed of a Simson's "Euclid," and *reading* it instead of learning it for "class," I found geometry the most enjoyable of subjects. In a very few months I came to the end of the book, and I have never lost the liking for geometry which I had by that time acquired.

Let it not be supposed, however, that I advocate the claims of Euclid as a text-book. The first, third, and sixth books might indeed be retained—with certain omissions and modifications; but the second and fourth books (setting aside a few propositions) are monstrosities of clumsiness.* The fifth, eleventh, and twelfth could never be generally used in their present form. But whether a totally new text-book be adopted or Euclid be modified, I am convinced that until the demonstrative and deductive nature of the science is recognised the interest of the student will not be excited.

While, however, my own experience will not permit me to believe that a course of practical constructions is a suitable introduction to geometry, I certainly agree with Mr. Wilson in regarding careful constructions as of the utmost importance to the learner. But, in my judgment, the processes of construction should accompany, not precede, the study of some demonstrative and deductive treatise.

I believe the chief difficulty under which we labour at present, resides in the fact that, owing to the small encouragement given to the study of geometry at our Universities, we have, even among our ablest mathematicians, very few able geometricians. One cannot read the Cambridge text-books of mathematics—written though these are, in many instances, with singular ability—without becoming convinced of this. So soon as a geometrical construction is introduced we recognise the clearest traces of inaptitude. The fact is still more clearly evidenced in treatises professedly geometrical. I take up an edition of Euclid, prepared by a very eminent mathematician, a senior wrangler, and, opening at random the portion relating to deductions, I find the following problem:—"Required to draw a circle through a given point to touch two intersecting lines;" and to solve this obvious third-book problem the aid of the sixth book is called in.

But it is hardly to be wondered at that university mathematicians are, as a rule, not strong in geometry, for the study of geometry is very little encouraged by university tutors. Indeed, an aptitude for geometrical methods is generally regarded as more mischievous than useful in the Tripos. I can remember the hints I myself received on this point. A few instances may perhaps interest your readers.

The first hint was given me in the lecture-room by a high wrangler (an excellent geometrician). The following proposition had been submitted—"A ball is placed on a horizontal plane, above which is a luminous point; show that the length of the minor axis of the ball's elliptic shadow depends only on the height of the luminous point above the plane." I wrote for answer that the fact is obvious, because two sloping planes touching the ball, and with a horizontal intersection through the luminous point, must clearly have the same slope wherever the ball is placed. The proof was accepted, and even regarded (to my infinite surprise) as ingenious; but I was warned not to leave the safe track of analysis.

The next hint was given me by my private tutor, a senior wrangler with fine (but untrained) geometrical powers, on the score of my solving geometrically some problems relating to epicycloidal and hypercycloidal areas.

The third hint was given me by a vacation tutor, also a senior wrangler, and was perhaps the best deserved of the three. He had set me a problem relating to a curve which chanced to be a projection of the four-pointed hypercycloid, and the problem was meant as an exercise in analytical processes. Knowing very little about these, I ventured to proceed *more meo*. I first projected the curve back again (so to speak), established the property in the case of the quadricuspid hypercycloid, and projected all my constructions on the original plane of the curve. I shall never forget the solemnity of the warning I received.

The last case I shall refer to relates to a probability problem (the last in Todhunter's "Integral Calculus") about a messenger and a shower of rain, the messenger's "expectation" under certain stated conditions being expressed in the following pleasing form:—

$$\frac{v}{n}\left\{\frac{1}{2}-\frac{u}{v}+\frac{u(u+v)}{v^2}\log\frac{u+v}{u}\right\}$$

From the day that I gave a geometrical solution of this problem (the logarithm coming out as a hyperbolic area) I was given up as a bad job. No wonder, indeed, for as a problem in the Integral Calculus it can be solved in half-a-dozen lines.

So little encouragement is given to geometrical work, that I know instances where men who have taken very high degrees could not solve the easiest geometrical problems. Many indeed in my time (I believe Mr. Wilson would confirm this) in their second or third year at Cambridge, scarcely know what has to be done with such problems—that is, even how to try to solve them. I wrote a little pamphlet four or five years ago, to show how such problems should be attacked, proceeding on the following plan:—I took the case of a beginner dealing with easy geometrical problems, and considered his difficulties and false steps, as well as the true demonstration ultimately evolved. I did this because I had found it the only effectual course with pupils. To give problems, and on the pupil failing to solve them, to show him the solution, is utterly useless. One must listen to his reasoning, wrong or right, to the purpose or not—show him why it is wrong, or not effective towards the solution of the problem; and so gradually guide him towards the correct solution. In the pamphlet I employed a corresponding method.

Unfortunately (for me at any rate) Messrs. Longmans submitted this pamphlet to "a competent mathematician," who immediately misunderstood my plan; took the imagined difficulties for real difficulties of my own, and solved for my behoof an immensely difficult problem—the first worked-out example in Potts's Euclid. This achievement (*par parenthèse* my pamphlet also) was then submitted to another competent mathematician, and he, excited to emulation, suggested another solution of a problem which a boy of twelve might safely attack. Finally, these labours were submitted to Messrs. Longmans and (signatures removed) to myself. So my pamphlet has remained in my desk; for I thought better of it than to send it begging.

We want geometricians more than text-books just now. If our universities would give geometry a reasonable position among the subjects for mathematical examination, we should probably soon have both. At present a man with geometrical tastes must either turn from his favourite subject during his university career (with small chance, perhaps, of resuming it) or must be content with but a small share of university success.

Brighton, September 15 R. A. PROCTOR

* All the propositions of Book II, save four, may be established (usually) in three lines from the first two, of which they are in fact little more than corollaries. The main objection to the fourth book relates to the inscription and circumscription of the regular figures; but throughout the book the heaviness of Euclid's method is much felt.

Captain Sladen's Expedition

In reply to F.R.S.'s inquiry in your issue of September 14, I may state that the last number of the "Proceedings of the Zoological Society of London" (1871, part 1) contains several articles by Dr. John Anderson relating to discoveries made during Capt. Sladen's expedition to Yunan, and that the next number (1871, part 2), which I am now preparing for the press, will contain others.

It was Dr. *Thomas* Anderson, Curator of the Botanic Garden at Calcutta, whose untimely death we have recently to lament. Dr. *John* Anderson (his brother) is, I am happy to say, in good health at his official post as Curator of the Indian Museum and Professor of Comparative Anatomy at Calcutta, or was so, at all events, at the date of his last letters to me, about a month since.

11, Hanover Square, Sept 16 P. L. SCLATER

Deschanel's Physics

As regards the particular passage in my edition of Deschanel which I am challenged to defend by your Reviewer (NATURE, vol. iii. p. 343), his charge, which is somewhat obscured by rhetorical embellishment, seems to be that in the factor $\frac{H-h}{760}$ it has not been indicated that H and h, as well as 760, denote so many millimetres of mercury *at zero*. I think this was scarcely necessary, as the question whether the observed or reduced heights of the mercurial columns should be employed, is not one on which