

School Science

HIGH SCHOOL ASTRONOMY.

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INTRODUCTORY.

All science teachers, save those of astronomy, agree that beginning students should be given an extended acquaintance with the facts and more obvious uniformities of nature before having much to do with the theories underlying their explanation. Even teachers of astronomy admit that this is the only rational *modus operandi* for other physical sciences than their own. While not disposed to contest the general principle that laboratory, or observational, methods furnish the only sound mode of approaching the study of the truths of nature, most astronomical teachers, and especially high school teachers, see practical difficulties in the way of applying this principle which have hitherto proved prohibitory. As a result, most teachers of astronomy are still clinging to the text-book method of teaching with a devotion worthy a better cause, in the face of the admitted fact that this method has long been relegated to the limbo of the antiquated in all branches of science allied to astronomy.

Instances are known in which the same teacher who planned and executed an admirable preliminary experimental course with his high school class in physics, introduced the same class to the truths of astronomy by the text-book exclusively. Is it not amazing that these things should be so, when we remember that the "wonderful century" just closed, owes the unparalleled advance it has made, at least so far as relates to education, more to the wide-spread introduction of what we have come to know as the scientific method into school work than to all other agencies combined? On the firm basis of this method, discovery and invention have come to be the rule rather than the exception with us. Through it we have learned the true point of vantage for attacking the strongholds of the unknown.

Before the nineteenth century had entered upon its marvelous career astronomers had proved to the world the great fertility of this method for the investigator. It remained to this century

to demonstrate that the method of the investigator is also the method for both teacher and pupil that it is, in short, the method of teaching. How fully and nobly she has performed her task can be judged from the all-pervading prevalence of the scientific spirit of our time.

In the light of these unquestioned facts it is little short of astounding that teachers of elementary astronomy, the oldest, noblest and the most pre-eminently observational of all the sciences, should have responded so feebly to the quickening spirit of the laboratory and observatory. It would seem that after the great astronomical teachers of the pre-nineteenth century had shown the world the true method of teaching, their successors, Esau-like, had renounced their birthright. The few paragraphs which remain to this paper will undertake to discern why this occurred and to suggest a few reasons why modern teachers of the elements of astronomy should return to their inheritance.

It has been but a few decades since astronomy came to be recognized as a proper subject of study for the masses of the people. This was due to a two-fold cause. The wide prevalence among the people of superstitions and of the belief that the subject was suited only to princes, gentlemen of leisure and to the intellectually gifted who were favored with princely patronage, combined to isolate it from the people and from schools. The company the subject had so long kept among astrologers and the nobility even prejudiced the popular mind against it.

The elaborateness displayed by these exalted personages in the erection and equipping of their observatories and the failure of all to recognize the practical utility of the science for work-a-day folk served to content the popular mind that the subject should remain apart from their concerns. The superstitions connected with astrological practices were long cherished by the people and encouraged by quack astronomers, after they ceased to awaken the belief of the educated part of humanity, and these practices fettered the minds of the masses with the indisposition to inquire. Add to this the fact that astronomy was so inextricably interwoven with astrology for centuries as to render the task of ascertaining what was the truth and what error almost hopeless to any but the initiated few, who had no desire to make the distinction.

Again, astronomy, having its beginnings in astrology and in the minds of the people being identified with it, was in their opinion bound to verify the extravagant predictions of the pseudo-science. Failing in this, the real science fell into discredit, so that after the other physical sciences had established the reliability of their conclusions and predictions, they were naturally looked upon as worthier of recognition in educational systems. Those scientists who did succeed in mastering the principles of astronomy and in gaining access to observatory equipment, soon became so engrossed in the beauties and wonders of the sky that they chose to give their thought and time to the pursuit of new truth rather than to popularizing the old. Consequently, they troubled themselves little with popular prejudices against the science.

Finally, a practical acquaintance with astronomy can be attained only by those well versed in the higher mathematics and mechanics. Failing to distinguish between the degree of mathematical attainment needed for making discoveries and what is requisite for understanding what others have done, most persons, appalled by imaginary difficulties, shrink from the supposed task of attempting to acquaint themselves with the elementary truths of astronomy.

However much, or little, reason there may have been in these arguments a hundred years ago, they can have no force with us to-day. Experience and study have taught us the distinction between the superstitions of astrology and the verifiable acts of science. The only remnants of the pseudo-science which remain with us are a term here and there, and we no longer look up on the tenets of astrology as dogmas of authority. Of late years astronomical advance has been so rapid and so suggestive and the dissemination of knowledge so general that the people recognize both its practical and its intellectual value. In response to the demand of educational thinkers and school managers that the study of astronomy shall be approached as is the study of its kindred sciences by observational work, not a little has been done by Prof. Todd, of Amherst, in his "New Astronomy," and by Miss Byrd in her Laboratory Manual. But so long as the suggestions of these writers remain as printed matter in a text-book they are useless. These suggestions must be put into practical application by astro-

nomical teachers before they can bear fruit. In the later issues of SCHOOL SCIENCE it will be shown that much observational work may be done and much inexpensive apparatus may be devised for experimental work with the stars, and that the old idea that practical astronomical work can be carried on only with the aid of an expensive equipment is wrong.

METROLOGY.*

A FOREWORD.

The Department of Metrology will devote itself in general to metric reform in its broadest sense. Especially will it advocate the adoption and use of the metric system of weights and measures. The schools are wasting many years in teaching a system, or a conglomeration of systems, the parts of which have no connection and are a relic of semi-civilization. Outside of science teaching and scientific research there is no harmony between the notation scale and tables of measures. We add, subtract, multiply and divide in tens; we weigh, measure and compute by 12, 3, 16, 272 $\frac{1}{4}$ and many other unrelated numbers.

While the accuracy of instruments of measurement and weight is now greater than it was a century ago, the system and the tables are as clumsy as they were then. We are still content to use a vehicle which a majority of the nations long ago discarded as unfit for use, though the centennial of the new system was passed last year in France.

There is no periodical with a department for metric reform. One struggling organization holds occasional meetings for the promotion of the cause. Possibly a half dozen associations have metric committees. An article now and then in a scientific periodical, or an editorial in some prominent daily, usually favors the metric system. A committee on coinage, weights and measures in

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