dents, I pulled down the copy of Osler's *Aequanimitas and Other Addresses* to get a reference I wanted to quote. What was my shock when I found that this book, published about 1904—this book which since my youth has been to me a source of great spiritual and mental stimulation—had not had its pages cut. It had never been taken out or read!

What can a teacher do with men who have no desire for a wide education?

WALTER C. ALVAREZ

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15 October 1954.

The communication of Harry J. Fuller [*Science* **120**, 546 (1954)] regarding the ignorance of the humanities of his candidates for the Ph.D. in biology is of interest. When a course of study is designed to teach a man more and more about less and less, what can one expect?

It is also interesting to note that many scientists, sooner or later, become slightly ashamed of their general ignorance and curtail their scientific work to secure a thin veneer of "culture." A number of years ago a leading medical school in this country went "arty." The faculty went in for oil paintings and water colors, and for years the conversation revolved about art. However, during this period the Art Institute in the same city did not establish any laboratories or carry on any scientific work. I cannot help but feel that what is sauce for the goose should be sauce for the gander.

One of the easiest things in the world to do is to ask a question that another cannot answer. Inability to answer is not necessarily a sign of ignorance.

For generations in England and her colonies it was taken for granted that an educated man was familiar with the Bible, Shakespeare, and Blackstone's *Commentaries*. I am tempted to guess that a considerable number of Ph.D. examiners in science would have trouble passing an examination upon these three, and some would be in the position of never having heard of Blackstone.

The enormous amount of knowledge makes it impossible for any one person to have a speaking acquaintance with but a tiny fraction of it. I doubt that any living man knows 10^{-6} percent of the total available knowledge. In truth, we are all ignorant.

WILLIAM H. BELL

Milford, Ohio

11 October 1954.

It is not easy to comment upon Bell's letter because of its seeming inconsistencies. In the first paragraph, Bell appears to agree with my suggestion that perhaps we are teaching too much about less and less; then, in the third paragraph he implies that it is silly of me to ask graduate students questions to determine something of the extent of their knowledge. Finally, he appears in his statement that "we are all ignorant" to have tossed in the sponge about the whole business of education.

Bell's comments about the asking of questions point up my general thesis, namely, that we are perhaps losing a sense of values in education. Of course, I could stun any doctoral candidate in science into a seeming display of ignorance by asking him the year of Columbus' landing on Martinique or the Empress Josephine's family name. Similarly, a doctoral candidate in the humanities would certainly fold up at a question of the number of cilia on the zoospores of *Ulothrix* or one on the structural formula of indole-3-butyric acid. But the questions that I asked were about *major* landmarks in the history of human thought and achievement and, as such, were important questions.

Just as Bell appears to have failed to distinguish among the value of different questions, so are we increasingly failing to distinguish among values in education. The end-result of such failure is apparent in the academic chaos demonstrated in the catalogs of some of our universities in which the only courses required of all students are hygiene, physical education, and freshman rhetoric.

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15 October 1954.

Paleontological Identification and Analysis by the Punched-Card Method

An expedient method of identifying fossil remains is of the utmost necessity to paleontology. To foster these returns, the paleontologist has developed many taxonomic keys for tracing down an unknown individual. These morphologic and genetic keys are unwieldy and leave much to be desired. For example, if a worker is doubtful as to what subdivision of the key his specimen belongs or the specimen is poorly preserved and does not show the essential characteristics, the key is of little value. It is useless because the worker has to check a great number of descriptions before he identifies his specimen. This can be eliminated by the use of punched cards. Actually, a punched-card classification presents the worker or student with an almost unlimited number of keys. He makes up the key as he progresses. This type of key has a great deal more value to him, since he may use any characteristic that he chooses to begin and succeeds that characteristic with another outstanding feature of the individual he wishes to identify. The use of punched cards also overcomes the difficulty presented by a broken or poorly preserved specimen in which the properties listed at the beginning of a key are not discernible [R. Casey and J. Perry, *Punched Cards: Their Application to Science and Industry* (Reinhold, New York, 1951)].

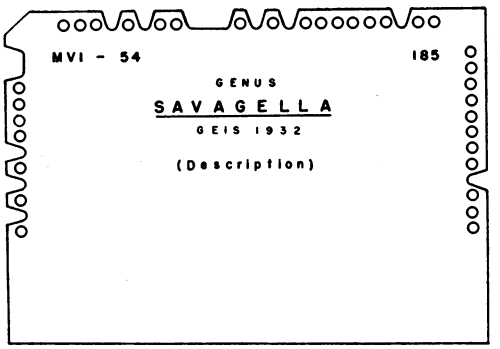

Fig. 1. Punched card of the genus *Savagella*.

Figure 1 depicts the punched card of the genus *Savagella* of the class Ostracoda. There were 48 holes around the edge, 14 of which are shown punched out. Each hole signifies a characteristic of the Ostracoda, and those holes that have been notched show the characteristics of the genus illustrated. Such morphologic criterions as type of hinge, overlap, ornamentation, and dimorphism are included, and the geologic range is also indicated. By using a steel rod and inserting it through a pack of punched generic cards, the cards having the feature picked will fall from the rod. Other diagnostic feaures may then be used until only a few cards remain, facilitating the identification of the specimen.

I have applied this method toward identifying the ostracods and have utilized statistical data obtained from the cards in analyzing their development during the Paleozoic era [master of science thesis, Michigan State College, 1952]. The evolution of hinge, overlap, and various ornamental aspects may be plotted with respect to geologic time or with one another. This greatly shortens a time-consuming process and allows for a more complete analysis of the factors affecting the Ostracoda.

The use of punched cards for identification and analysis certainly is not limited to micropaleontology or to paleontology in general. This method may be applied to all forms of taxonomic systems and, through the use of punched-card equipment, complete catalogs of classes of organisms could be maintained.

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16 September 1954.

A Method for Rapid *in situ* Demonstration of the Thymus and Other Tissues with High Nucleoprotein Content

The importance of considering the thymus as a functional organ throughout life was stressed in a previous communication [V. P. Simmons, *Pediatrics* 5, 574 (1950)]. However, it is seldom seen or recognized today in other than immature laboratory animals or children largely because of the fact that it blends in so well with the fat that envelops it and because the individual lobules are not always in sufficiently close apposition to provide an easily visualized continuum. This difficulty can be quickly and dramatically overcome by fixing the thymus either *in situ* in an anesthetized animal to show its normal relationships or by removing the contents of the entire thymic area and fixing them *in vitro*. The animal is necessarily sacrificed following either of these procedures. Unfortunately, potent fixatives cannot be applied very readily in the living animal without the functional destruction of tissues vital to existence.

Although other fixatives are also effective, Carnoy's solution (absolute alcohol 6 parts, chloroform 3 parts, and glacial acetic acid 1 part) has been found to be quickest acting and very rapidly penetrating.

The solution can be sprayed or poured on, or the tissues can be removed and immersed in it. Surface fixation is accomplished in seconds; the individual lobules become white and are sharply outlined against the surrounding tissues, which are either fatty or less richly endowed with nucleoprotein (see Figs. 1 and 2). Lymph nodes are quickly fixed in the same manner, but their appearance is so different from that of the

Fig. 1. The normal thymic area exposed in a living, anesthetized male guinea pig weighing 400 g.

Fig. 2. The same area following the application of Carnoy's solution. The thymic tissue appears white.