Table 1. Disulfide values in oxidized glutathione, insulin, and prothrombin.

Biological substance	Quantity of biol. substance in titration mixture	$10^{-3}M$ $AgNO_3$ used in titration (ml)	N per milliliter or milligram of biol. substance (mg)	—S—S— per mole of biol. substance (mole)	
				Our data	Data from literature
Oxidized glutathione*	0.5 mg	0.82		1.00	
	.25 mg	.42		1.03	
	.10 mg	.16		0.98	
	.05 mg	.08		.98	
Insulin†	1.0 ml	.85			2.91‡
			0.268	2.81	
	.05 ml	.42			2.98§
	1.0 ml	.21			
			.066	2.83	
	0.5 ml	.11			
Prothrombin‖	5.0 mg	.30	.156	3.86	
	2.0 mg	.12	.157	3.86	4.10¶
Prothrombin**	0.1 ml	.07	.167	4.06	

* Nutritional Biochemicals Corp.; calculated on basis of 13.7 percent N.
† Lilly Research Laboratories, T-2842; calculated on basis of 15.55 percent N and mol. wt. 5700.
‡ Harfenist (7); beef insulin, component A.
§ Harfenist (7); beef insulin, component B.
‖ Purified bovine prothrombin (Seegers); reconstituted from frozen-dried state; N corrected for 2.42 percent ash.
¶ Laki *et al.* (8); calculated from 3.14 g amino acid per 100 g protein expressed as cystine/2 and from mol. wt. 62,700.
** Purified bovine prothrombin (Seegers); thawed from liquid-frozen state; calculated on basis of 15.5 percent N, mol. wt. 62,700.

It is necessary that the Na_2SO_3 be freshly prepared, cold, and fully saturated, and that it be used within 45 min after preparation. Under the foregoing conditions, —S—S— does not react with Ag^+. It was observed that higher protein concentrations could be employed in the presence of the antifoam emulsion. Passage of nitrogen through the titration mixture was unnecessary (*6*). Typical results obtained with the method are shown in Table 1.

Multiple determinations, using variable concentrations, have been made on oxidized glutathione, insulin, prothrombin, thrombin, fibrinogen, and thromboplastin. Recovery of oxidized glutathione was virtually complete when it was added to the proteins used in this work. The results obtained by this method are in good agreement with those obtained by others on *hydrolyzates* of insulin (*7*) and of prothrombin (*8*).

References and Notes

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4. I. M. Kolthoff and J. J. Lingane, *Polarography* (Interscience, New York, 1952), vol. 2, p. 944.
5. Dow Corning antifoam AF emulsion.
6. The advice of Reinhold Benesch and Ruth Benesch is greatly appreciated.
7. E. J. Harfenist, *J. Am. Chem. Soc.* **75**, 5528 (1953).
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9 July 1954.

Communications

Few Students Want Culture

Harry J. Fuller's communication [*Science* **120**, 546 (1 Oct. 1954)] reminds me of a day at a public examination for a Ph.D. degree in surgery when the young candidate had reported satisfactorily on much research work on surgery of the stomach. Then a bombshell fell when one of the professors with a historical turn of mind asked who was Dr. W. Beaumont, and the candidate did not know! The professor then asked if he, the young physician, had ever heard of Alexis St. Martin, and he had not. This so upset the committee that the degree was not granted.

After 40 years of teaching medicine to graduates and undergraduates I have the unhappy feeling that most of the men whom I have watched as undergraduates, interns, residents, and graduate students, preparing for a specialty, were not interested in becoming learned and widely experienced and wise. They were interested in getting a certificate of 3 years' *attendance* that would enable them to take an examination, which, if passed, would give them a listing as a specialist. The less effort used in getting this certificate, the better.

The saddest moment in my teaching life came one day when, going into a library that had been used for half a century by hundreds of graduate medical stu-

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

Professor of Medicine Emeritus,
University of Minnesota (Mayo Foundation)

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.

HARRY J. FULLER

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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)].