

An occasional column, in which Caveman and other troglodytes involved in cell science emerge to share their views on various aspects of life-science research. Messages for Caveman and other contributors can be left at caveman@biologists.com. Any correspondence may be published in forthcoming issues.

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"... AS FAR AS I CAN REMEMBER, NEWTON ALSO SAID "IF I HAVE SEEN FURTHER THAN OTHER MEN - ITS BECAUSE I'VE STOOD UPON THE BACKS OF GIANTS"..."

AS AN ASPIRING CAVEMAN IN QUEST OF TRUTH THE LEAST I CAN DO IS BORROW MY UNCLE ISAAC'S STILTS!



What would they say now?

We speak, write and record billions of words every day. But what happens? Over a period of time, which is not long today, those words become irrelevant, of no particular interest, and forgotten. Today, the electronic 'Delete' button has superseded the archive.

However, for some writers a few pithy statements remain, the prologue to a book, words of wisdom stolen for a speech to graduates, a remark at the end of an e-mail (perhaps the weirdest of all). What is particularly interesting is

that these statements are used in modern contexts. The author's words, provided without permission from the grave, are used to expound on some deep philosophical problem or piece of trivia. How portentous were their words?

Isaac Newton once said, "*What we know is a drop, what we don't know is an ocean.*" Looking back 250 years, it is not hard to imagine that he had a point. Some aspects of civilization had progressed considerably. But, despite advances in understanding of some fundamental principles, science was still in the Dark Ages. But what would Sir Isaac say now? What we now know is a

few drops, a bucket full perhaps, or maybe a puddle or a pond, but surely not an ocean? No doubt he would marvel at our technological advances - imagine watching objects fall and providing an explanation of gravity, only to see gravity defied with ease. But, for all the drops that we now know, are we able to combine them into a larger body of water, something that has a bigger, broader, more universal meaning? This is clearly one of the major challenges in the future.

Here are a few more, some of which were not intended for science, but perhaps they are the most telling.

"Please accept my resignation. I don't care to belong to any club that would accept me as a member." Groucho Marx (*The Groucho Letters*, 1967). Still holds true for academies, societies, and other forms of scientific club.

"There are in fact two things, science and opinion; the former begets knowledge, the latter ignorance." Hippocrates (*Law, Bk IV*, circa 395 B.C.). Hippocrates was way ahead of his time. He realized that the presentation of science in scholarly papers is how knowledge is imparted but to gain that knowledge requires hard work, patience and time. However, reviews, mini-reviews, News and Views and other forms of scientific commentary are common forms of opinion that are used by many to understand pieces of science that they do not have enough time to read from the original source (a.k.a. those who are too lazy). At best, they are doomed to ignorance, or, at worst, to know only the opinion of another and not formulate one themselves.

"You could look it up." James Thurber (*You Could Look It Up*, 1934). Got it yet? More on the theme of reading the original literature rather than listening to, or reading, someone else's opinion!

"Discovery consists of seeing what everybody has seen and thinking what nobody has thought." Albert Szent-Gyorgyi von Nagyrápolc (*The Scientist Speculates*, G. J. Good (Ed.), 1962). With the amazing technical breakthroughs that have taken place over the past two decades, every scientist is able

now to perform the most complex of experiments and, hence, make the same observations. Truly, discovery is based on thinking.

"Show me someone not full of themselves and I'll show you a hungry person." Nikki Giovanni (*Poem for a Lady Whose Voice I Like*, 1970). In the science view, those that think that they have really solved a problem, or who have attained a level of perceived stardom, generally are too smug, dogmatic, self-satisfied and pre-occupied with their own brilliance to ask the more difficult questions, explore the more interesting experiments or think laterally. Those who have not reached this level (and why would anyone want to!) work harder, think more aggressively, perform more imaginative experiments, and are less likely to conceptualize their science without interference from dogma.

"No, a thousand times no; there does not exist a category of science to which one can apply the name applied science. There are science and the application of science, bound together as the fruit of the tree that bears it." Louis Pasteur (*Pourquoi la France n'a pas trouvé des hommes supérieurs au moment du péril. From Revue Scientifique*; circa 1871). Applied science is one of today's buzzwords, especially from administrators, politicians and funding agencies. What is meant is that one's science should have some application (a.k.a. relevance) to human health, industry and the nation. The label of a 'pure scientist' is the antithesis of applied scientist, and is viewed by some as a dirty word. However, I still like the idea of 'pure' science for understanding fundamental problems in biology, for example, and leave others to figure out how to apply that knowledge (profitably!).

"In the fields of observation, chance favors only the prepared mind." Louis Pasteur (Inaugural lecture, University of Lille; December 7, 1854). Still absolutely relevant, in my opinion. Learning, experience and mentoring provide the intellectual foundation for scientists to ask new questions, plan approaches to address those questions,

and the background to interpret the observed results.

"It is better to know some of the questions than all of the answers." James Thurber (1952). In my opinion, a good experiment provides more questions than answers. Addressing those questions further often leads the investigator down pathways of deeper understanding or new ideas that would not have been possible if the answer had been obtained too quickly.

"The scientist takes off from the manifold observations of predecessors, and shows his intelligence, if any, by his ability to discriminate between the important and negligible, by selecting here and there the significant stepping stones that will lead across the difficulties to new understanding. The one who places the last stepping stone and steps across to terra firma of accomplished discovery gets all the credit." Hans Zinsser (*As I remember him*, 1940). OK, those of you who have read other diatribes from me should understand why I like this Zinsser quote. It highlights two areas of science that I find particularly irksome. First, we need to be aware of, and take pains to acknowledge, the giants in the field who toiled before us and upon whose shoulders we now stand when we think that we have understood a scientific problem. Second, those who garner the prizes and awards do so upon the backs of others that provided the stepping stones to the big breakthrough.

"There is only one proved method of assisting the advancement of science - that of taking men of genius, backing them heavily, and leaving them to direct themselves." James Bryant Conant (Letter to the New York Times; August 13, 1945). No Big Brother Science, please. No groups of senior scientists telling us what we should be working on. No editors of journals or heads of funding agencies telling us what is hot and what is not. Leave us alone!

I can't resist one more: *"I don't like cricket, Oh no, I love it."* 10 c.c. (from 10 c.c., circa 1978). Hmm, only if it is a sticky wicket.