# ARE WE AT A NEW FRONTIER OF NEW AND TRANSFORMATIVE KNOWLEDGE GENERATION ... OR SIMPLY PUBLISHING FOR ITS OWN SAKE?

Communicating new discoveries, hypotheses that explain natural or engineered systems along with experimental and/or modeling information to substantiate them, and the functional workings of new devices or technologies by writing peer-reviewed papers has been the hallmark of scientific knowledge generation and dissemination from very ancient times. Inherent in this process is the assimilation of past knowledge through reading and learning from the already reported work; this process was also true in ancient "oral traditions" that lacked written records. An equally important aspect of scientific writing is that complex ideas should be disseminated such that they can be understood by a much larger audience and is just not confined to the domain-specific community. This ancient principle of scientific documentation has also been articulated by many scientists in the 20th century. Two particularly eloquent expressions of this view are quoted by Gary Zukav on a preamble page of his quintessential everyman's science book: *The Dancing Wu Li Masters* (Bantam, New York, NY, 1984), and they are as follows:

"Most of the fundamental ideas of science are essentially simple, and may, as a rule, be expressed in a language comprehensible to everyone."

– Albert Einstein*

"Even for the physicist the description in plain language will be a criterion of the degree of understanding that has been reached."

– Werner Heisenberg†

While for Gary Zukav these statements were the guiding principles in his attempt to explain quantum mechanics, relativity, and the *cosmic dance* of physics to a "lay" readership, they are indeed necessary reminders to all of us as well in today's world of technical publishing. The current explosive growth in publications, both in number of papers and in number of journals, suggests a new frontier of enormous information generation. A careful assessment‡ suggests otherwise. The trend appears to be that of

*A. Einstein and L. Infeld, *The Evolution of Physics*, Simon and Schuster, New York, NY, p. 27, 1938.

†W. Heisenberg, *Physics and Philosophy*, Harper and Row, New York, NY, p. 168, 1958.

‡J. Kaur, E. Ferrara, F. Menczer, A. Flammini, and F. Radicchi, "Quality versus Quantity in Scientific Impact," *Journal of Informetrics*, Vol. 9, pp. 800–808, 2015.

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information *entropy generation*, or writing and publishing papers for their own sake with little content richness, where citations and quantified measures are the goals rather than advancement of science and generation of new knowledge.

Often there is a reworking of old research, obtusely presented with reinvented nomenclature and contrived analysis, or re-evaluation of an already solved problem with another method. Computational techniques allow for many such "creative" excursions but without adding anything significant to our fundamental understanding of the problem. The past is also often forgotten, in that the new explorations do not build upon the existing knowledge base. In this context, a *Sanskrit* verse from an ancient Hindu text, *The Hitopadeśa*, comes to mind:

यस्य नास्ति स्वयं प्रज्ञा शास्त्रं तस्य करोति किम् ।
लोचनाभ्यां विहीनस्य दर्पणः किं करिष्यति ॥

yasya nāsti svayaṃ prajñā shāstraṃ tasya karoti kim
lochanābhyāṃ vihīnasya darpaṇaḥ kiṃ kariṣhyati
(*Hitopadeśa*, 3:119).[§]

This couplet, in essence, translates as follows: How can *shāstra*[¶] (a compendium of knowledge) help a person who does not apply an inquiring self-intelligence to its reading? This would be analogous to the question of what use is a mirror to someone who does not wish to see and contemplate. The implication of this verse is that one has to learn and discern what is already known, expand its context, and then seek new avenues of inquiry so as to build upon it and advance the body of knowledge. Else, we end up being repetitive in our quests and such effort gives credence to the cliché of reinventing the wheel. Echoing this view, the late Professor Arthur E. Bergles would often lament that "Everybody has time to write [papers], but nobody has time to read [new papers for reviewing as well as those in the literature relevant to the specific research][‖]." The zeal for quantification of what now passes as scholarship (number of papers, citation index, etc.)[3] has significantly distracted engineering science research from the more meaningful goals

[§] *The Hitopadeśa* is an ancient (∼700–800 CE) allegorical collection of stories in Sanskrit, which is considered to be influenced by another more ancient collection (*The Panchatantra*, ∼600 BCE or much earlier since the historical accounts are rooted in oral history traditions) of Bhārat (or India). The word hitopadeśa literally means: narratives (opdeśa) that are in the best interest (hitah) of mankind.

[¶] A *shāstra* is a collection of findings of and inquiries in a field of study (science, arts, philosophy, etc.). For example, *rasāyana shāstra* for chemistry, *gaṇita shāstra* for mathematics, *khagola shāstra* for astronomy, *artha shāstra* for economics and/or political science, *chhanda shāstra* for study of poetry and its structure, and *nāTya shāstra* for the art and science of theater, among others.

[‖] Text in square brackets added by author to clarify context of the quotation.

of inquiry that provides new usable devices, design methods, and reliable science-based tools for effective technology transfer. Such subjective, non-instantly-quantifiable outcomes of research can find value dividends only with passage of time.

This sentiment is also enunciated by Professor John W. Rose, in his ensuing paper ("Personal Reflections on Fifty Years of Condensation Heat Transfer Research"), which is dedicated to the memory of Art Bergles in celebration of his life and contributions to the field of enhanced heat transfer. To quote Dr. Rose:

> "… much of what is published has not been carefully reviewed and is either not read or only briefly scanned, often simply to include it in the bibliography to placate potential reviewers. Papers cited are often limited to those which can be readily accessed on line. Many present day authors are unaware of much of what has gone before. Work is unnecessarily repeated, often with errors …"

Needless to add that I unequivocally share and reiterate these observations, and I can also aver based on numerous conversations with Art that he too agreed with this. To provide some remedy, Art often emphasized the need for publishing meaningful reviews so as to "reduce some of the entropy generation inherent in heat transfer communications." On his part, John Rose has provided an eminently meaningful commentary on the evolving work on dropwise condensation, as well as condensation of metals, over integral finned tubes, inside microchannels, and on Marangoni condensation of mixtures. It is sincerely hoped that such review papers, along with the many other reviews and reports of advanced investigations via very carefully conducted experiments or modeling that have appeared in this journal as dedications to the memory of Art Bergles, would provide the readers excellent examples of cutting-edge research and scholarship. Careful readings, coupled with adoption of the implicit rigor in analyzing results, should yield dividends to other investigators.

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