

suppressed; he must certainly have sold more books than any physicist or astronomer, and must be one of the best-read authors of all time.

GEORGE O. ABELL
University of California
Los Angeles, California

10/2/78

Breakdown in innovation

The breakdown of US innovation has been discussed quite often recently (August editorial, page 88). In addition to the usual prescriptions of technological push, commitment to basic research, and so on, may I reiterate an old buzz word—government bureaucracy. We have all heard that the average application to FDA for approval of a new drug is not counted in pages or volumes, but is weighed in tons. It is beyond imagination how much R&D time, effort and money would be really spent in filling out (and also in reading) the tons of application forms. There are other aspects that may also be detrimental to innovation.

It is not often realized that innovation and risk may be regarded as complementary variables in the Heisenberg uncertainty principle. The bigger the innovation, the bigger the risk. We tend to remember the success stories and often forget the failures. In the decade following the Bohr atom, the list of famous physicists who worked on quantum mechanics is far longer than the few names that we remember today. Under present conditions, successful innovation brings only modest reward (for example, promotion from GS-13 or 14 to 16 or 17 or 18, a 20% salary raise), but a failure would mean a catastrophically ruined career. It is usually much safer to adhere to the established research program. But then it can be argued that an overly rigid program can lead to obsolescence or a tendency to solve the same old problem on a slightly bigger computer for a slightly more accurate answer (May, page 15).

In addition, there is the unwritten but widely believed dogma that scientific creativity declines rapidly after the age thirty. As a corollary, research directors and personnel managers are reluctant to hire scientists older than thirty. With high unemployment in physics (9% in 1974, 13% in 1975), it follows that only scientists younger than thirty can risk any possible failure. Unfortunately, the average age for receiving the PhD degree is in the late twenties.

The bureaucracy and the rigidity tend to produce fashionable research rather than innovative research. Take the war on cancer as an example. We have seen the ever-changing emphasis on radiation therapy, chemotherapy, virus origin of cancer, immunotherapy, and the current fad of environmental origin including hamburgers. In other words, everything except a cure. It is probably not sur-

prising that the war on cancer has now become known as the medical Vietnam.

T. TSANG
Howard University
Washington, D.C.

8/24/78

PRL versus JETP

Physical Review Letters is internationally recognized as the most prestigious physical journal. This means great honor and implies great responsibility.

PRL is devoted to "containing short communications dealing with important new discoveries or topics of high current interest in rapidly changing fields of research," obviously, no matter where such a paper comes from.

Let us analyze from this viewpoint the publications in arbitrarily chosen volume 40 of *PRL*. It contains 512 papers; only 133, that is 26% of the accepted papers, are not related to an American author or institution, and come from Europe, Japan, Canada, Australia and the rest of the world. Of course, the scientific importance of the institution influences the importance of the publication. However, the reverse may also be true.

If we look, for simplicity, only at the month when *PRL* is published and when a paper was received, the number of papers versus the time before publication is as follows:

Time (months)	1	2	3	4	5	6	7	8	9	10	11	12
Number of papers	16	131	147	88	63	28	16	10	2	3	3	3

The average time-lag is about 3.5 months; a quarter of all papers wait half a year on average before they are published! Assuming that they also meet *PRL* criteria of importance, do they meet the criteria of urgent publication?

The Soviet journal that corresponds to *PRL* is *JETP Letters*. For its (also randomly chosen) 23rd volume (in the AIP edition) the figures are the following

Time (months)	1	2	3	4	5
Number of papers	72	99	1	1	1

The average time-lag is just 1.5 months, that is less than half that of *PRL*! Only 1.7% of papers wait more than three months, only 0.5% wait five months; none of the papers wait longer.

This may be related to the system of refereeing in *JETP Letters*, which is therefore of some interest. As an author and referee of the *JETP Letters* and *JETP* for 20 years, I should like to describe it. The names of referees (2 for *JETP* papers) are confidential, as they are for *PRL* and *PR*. The referee receives

a small honorarium. The referee of the *JETP* is advised to submit his comments to the journal within 10 days or else to return the paper to *JETP*. If the comments are not received within the indicated time (usually because the referee is absent), the paper is sent to another referee. The referee rejects the paper *only* if it is not novel, or if it is trivial, or wrong. In each case he must be quite specific: give the reference to similar results; indicate how the main result, if he considers it trivial, may be easily obtained; indicate the mistake. If he cannot be that explicit, he must suggest that the editors send the paper to a referee who is expert in the field. Naturally, such a criticism is practically always accepted by the author (unless the author can indicate a mistake in the referee's comments) and precludes further correspondence. When the paper is novel and the referee sees no mistakes in it, but is unhappy with the style or the presentation, he recommends the publication of the paper, if certain places in it are revised according to his suggestions. After the revision, the paper is sent back to the same referee for his new comments. Typically this takes very little time. A misunderstanding between the referee and the author is very unusual.

It seems to me that, however high a journal's criteria, specificity of the referee's comments and distinction between the scientific value of the paper and its

style may be very helpful both for authors and the journal, and may essentially accelerate publication.

MARK AZBEL
Tel Aviv University and Princeton
9/18/78 Institute for Advanced Study

PRL COMMENTS: We find Mark Azbel's comparisons of *JETP* and *PRL* interesting both as a comparison of journalism and as a comparison of scientific sociology in (largely) the US and Soviet Union. The publication time-lags, which Azbel discusses, can be separated, for *PRL*, into two distributions. For those articles which pass through our selection processes without delay, there is a time lag of a little less than two months between the data the article is received and the time when the journal containing the article is delivered to the subscriber's mailbox. Then there is a highly skewed distribution, which extends almost indefinitely, for those papers (a majority of the accepted papers) which are not approved unconditionally by two referees. It seems that the *JETP* is quicker than we are by nearly a month on immediate acceptances and the second set, the set of papers which