LETTER TO FORMER GRADUATE STUDENTS AND POSTDOCS

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Friends: As you realize by now, one of the duties of a research advisor is to write letters of recommendation for his former collaborators. I love you all, and will keep writing until you pass away or I pass away, whichever comes first (and even a few years thereafter; remind me to tell you the story of a professor who had to write letters after he died . . .). But at times the number of such letters, and worse, the pressure to do them by yesterday, by fax, etc., mounts up.

Therefore, after hours of consultation with the current research group (who displayed much more interest in this subject than in anything else in years), we have come up with a scientific scheme, a semiempirical formula. This specifies the compensation you will have to pay for a letter, requested by you or your Department Chair.

The compensation for that perfect letter (COMPL) will be measured in the equivalent of grams of pure gold, "gpg," so as to avoid inflation and currency exchange problems. It may be calculated by the following empirical formula at right. The variables and parameters have the following meanings:

- t_{now} is the *actual date,* expressed with the Julian day number
- $t_{departure}$ is the *date of departure* from the research group
- $\Theta(x)$ is the Heavyside step function; $\Theta = 0$ if $x < 0$, $\Theta = 1$ if $x > 0$
- n is the number of recommendation letters written so far
- $t_{deadline}$ is the date by which the recommendation letter *should* be sent off
- $t_{response}$ is the date when a request for a recommendation letter *reaches* RH
- t_{news} is the date when the former group member (FGM) *gets to know* that a recommendation letter should be asked for
- t_{reply} is the date when the FGM *took the time* to ask RH for the recommendation letter. Here I have to rely on the information provided by the FGM; I know this will not be easy to obtain, but there are many former KGB agents looking for work . . .
- N_{Info} is the *number of missing pieces of information* among the following: complete address to which a letter should be sent, type of job, up-to-date curriculum vitae
- $z_{\text{in press}}$ characterizes the way a request *reaches* RH (equal to 10 if it is forwarded to me when I'm away on a trip, 1 for fax and e-mail, 2 for telephone, 0 otherwise)
- $z_{\text{out press}}$ shows the way the reply must be sent off from RH (equal to 5 for courier post, 2 for fax and e-mail, 0 otherwise), and
- $\alpha, \beta, \gamma, \delta, \varepsilon, \zeta, \eta, \aleph$, and Ω are semiempirical parameters, self-consistent with years of writing experience, iterated toward the following values:

$\alpha \equiv 0.049$ gpg
$\beta \equiv 0.207$
$\gamma \equiv 0.033$ gpg $\times$ letters^{-1}
$\delta \equiv 0.028$ gpg $\times$ days $\times$ letters^{-1}
$\varepsilon \equiv 3.014$ gpg
$\zeta \equiv 0.489$ gpg
$\eta \equiv 0.516$ gpg
$\aleph \equiv 2.047$ (ultimate penalty)
$\Omega \equiv 0.5$ gpg

$$\mathrm{COMPL} = \underbrace{\alpha\left\{e^{\beta\left(\frac{t_{now}-t_{departure}}{365}-2\right)}-1\right\}\times\Theta\left\{\frac{t_{now}-t_{departure}}{365}-2\right\}}_{\text{history term}}$$
$$+\underbrace{\left(\gamma\int_{t_{departure}}^{t_{now}} dn+\delta\left(\frac{dn}{dt}\right)_{t_{now}}\right)}_{\text{accumulation and request rate term}}$$
$$+\underbrace{\varepsilon\begin{cases}\min\left[\dfrac{1}{t_{deadline}-t_{response}},\aleph\right] & \text{if } t_{deadline} > t_{response}\\ \aleph \text{ otherwise}\end{cases}}_{\text{pressure term}}$$
$$+\underbrace{\zeta\left(\frac{t_{reply}-t_{news}}{t_{deadline}-t_{news}}\right)}_{\text{procrastination term}}+\underbrace{\eta\times N_{Info}}_{\text{aggravation term}}+\underbrace{\Omega\left(z_{press}^{in}+z_{press}^{out}\right)}_{\text{medium term}}$$

These specific values should cover all possible cases. For reasons of mercy, however, COMPL amounts below 1 gpg will be neglected. Also, note the grace period of two years in the "history" term. So applicants for their first position need not worry too much.

I forgot to say that COMPL is not allowed to become negative.

Payment is to be in the form of a

the dean but asked to see the president of the university, and a meeting was promptly arranged. He was offered a salary three times that of the highest paid full professor, a whole floor of the chemistry department, and all kinds of other perquisites. He went back to Woods Hole to think the matter over. About a week later, he called me, and said "Irv, you and your colleagues have been most warm and generous, but I am going to decline your offer." So I asked whether there was anything else we could do to attract him, and he said, "No, Irv; the only objection I really have to Northwestern is that it has no one there who even thinks that he has been cheated out of a Nobel prize!"

On another occasion I was a minor intermediary for Prof in establishing one of his industrial connections. Starting with his work on vitamin C, I suppose, he had a fascination for trying to isolate pure, defined molecules from tissue extracts, be it a thymus hormone to cure myotonia or retine and promine to modulate cell growth. About the former, he wrote:

"I started hunting for fluorescent substances and soon discovered a substance in my extract which, if illuminated with near-ultraviolet, showed a splendid fluorescence. It was present in traces only. The isolation of this substance in crystals was the only brilliant piece of chemical work I ever produced. The crystals were sent for the analysis of their constitution to Merck & Company, whose report was expected with great excitement. I did not have to wait long for it. It told me that what I [had] isolated was a substance [a plasticizer] which I [had] extracted from my rubber tubing."

At that time he was also forced to abandon his thymus myotonia research for other reasons. For this work, he had to use goats as the animal model and he had a colony at the Marine Biological Laboratory, but as he said in his Hopkins lecture, "I work in a marine biological laboratory and the smell of goats clearly identifies them as non-marine organisms."

From thymus extracts he also isolated the two growth factors that he christened retine and promine. However, he could obtain only minute quantities from this gland. At the suggestion of Charles Huggins, he looked at urine and indeed found tiny quantities in it. So he decided he needed a large-scale collection and isolation facility. At that time, I was a consultant for Abbott Laboratories, a very large pharmaceutical firm about 40 miles north of Chicago. Abbott is very near the Great Lakes Naval Training Station and also Fort Sheridan, where tens of thousands of recruits for the Navy and for the Army were being trained continuously. So let me continue on with Prof's own words at that time:

"Abbott Laboratories in Chicago offered to collect and crudely extract for us quantities of several thousand gallons of urine weekly. This was a wonderful godsend. We blessed the armed forces, which were the final source. The U.S. Army is urinating now for me, and it is comforting to know that there is at least one army in this world which does something useful."

This incident reminded me of another of Prof's famous "thanks" for help, which he wrote in 1946 just after he had left Hungary. In a preface to his book *Chemistry of Muscular Contraction,* he expresses gratitude to the Josiah Macy Foundation and others and then concludes with the quip ". . . my thanks are [also] due to Professor J. W. McBain of Stanford University for giving me his fountain pen to write this book."

Since there are so many widely circulated anecdotes and stories about Szent-Györgyi, as a historian I must interject a small note of caution. The store of items we have accumulated is called nowadays "oral history." Some years ago I had a long conversation with Samuel Goudsmit, the discoverer, with George Uhlenbeck, of electron spin, during Goudsmit's visit to Northwestern to receive an honorary degree. I was trying to extract an oral history of the origins of wave mechanics in the heady period of the mid-1920s, when the young Goudsmit was in the vortex of events. At the outset of our conversation, Goudsmit said: "oral history?—*all* lies!" I feel he was exaggerating. However, it is my impression that only about 50% of what we hear from people who are reminiscing is not true—the problem is to figure out which 50%.

Nevertheless, of one thing I am 100% certain. It will be a long, long time before another like Albert Szent-Györgyi appears again in the scientific world.

IRVING KLOTZ received his undergraduate and Ph.D. degrees (Chemistry) from the University of Chicago. He joined the faculty of Northwestern University as an instructor and became Professor of Chemistry in 1950 and Morrison Professor of Chemistry and Biochemistry in 1963. In addition to his long-term interest in solvent water effects on protein structure and behavior, Professor Klotz has devoted substantial efforts to investigations of ligand–receptor interactions, structure and function of nonheme oxygen-carrying proteins, chemical modifications of proteins, and the construction of polymers with enzymelike properties. At present, he is also trying to understand some of the interpenetrations of science with the humanities. Professor Klotz is a member of the National Academy of Sciences (USA), Fellow of the American Academy of Arts and Sciences, Fellow of the Royal Society of Medicine, and recipient of the 1949 Eli Lilly Award of the American Chemical Society and the 1993 William C. Rose Award of the American Society for Biochemistry and Molecular Biology.

nice book, in any language, its value equal to the COMPL. Non-U.S. residents may substitute labor (in the form of translating one or more of my poems into their native language) in the place of a book.

I realize the act of requesting a letter of recommendation is rich in psychological complexity; I don't mean to make it any more difficult. So keep on asking for those letters—writing them may be the most creative thing I do!

I wish you all a good year, healthy and happy and productive.

Best regards,

Roald

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Richard Dronskowski was of immense help in perfecting the formula and in its self-consistent implementation. He sells a program for computing COMPL, for 1.0 gpg.

ROALD HOFFMANN was born in 1937 in Zloczow, Poland. After the war, he came to the United States in 1949 and studied chemistry at Columbia University and Harvard University (Ph.D. 1962). Since 1965 he has been at Cornell University, where he is currently the John A. Newman Professor of Physical Science. He has received many professional honors, including the 1981 Nobel Prize in chemistry (shared with Kenichi Fukui).

"Applied theoretical chemistry" is the way Roald Hoffmann likes to characterize the particular blend of computations stimulated by experiment and the construction of generalized models, of frameworks for understanding, that is his contribution to chemistry.

Dr. Hoffmann also writes essays and poems. Two of his poetry collections, "The Metamict State" (1987) and "Gaps and Verges" (1990), have been published by the University Presses of Florida. A collection of essays, coupled with collages by artist Vivian Torrence, "Chemistry Imagined," has been published by the Smithsonian Institution Press in 1993. Dr. Hoffmann is also the presenter of a television course, "The World of Chemistry," which aired in the United States on many Public Broadcasting System stations as well as others abroad.

THE LAW OF INANIMATE MALICE*

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In addition to such fundamental axioms of chemistry as the law of conservation of mass, the law of multiple proportions, the various laws of thermodynamics, and so on, there are a variety of lesser known laws which govern the practical operation of chemical research. The best known of these is *Murphy's law*, which states that "anything which may possibly go wrong will do so." Another one of these is *O'Halloran's law* (also known as *Brady's law*), which simply avers that Murphy was an optimist. A special Murphy case is *Hofstadter's law* [1], to the effect that "things take longer than expected even when one takes Hofstadter's law into account."

A much more obscure, but far more insidious, evil is the *law of inanimate malice* (LIM). For some years, whenever we have been presented with the opportunity to deliver some scientific results before an audience, we have spread the word about this law. Now that advancing age and the restrictions of retirement make such public pronouncements less frequent, it seems desirable to continue the fight against this vicious law through the printed word. It is, however, entirely possible that the printing presses of Springer-Verlag will deliberately break down just when this exposure of the LIM is about to be printed.

* Since linguistic problems have been know to arise in explaining this law, we note the following equivalents. French, La loi de la malice inanimée; German, Das Tücke des Objektes; Hebrew, Hok Nivzut Ha'Domem.

A typical example of the LIM follows. You have finally worked out a procedure for preparing a novel new molecule of immense theoretical significance. Weeks have gone into the preparation, and you have finally done the key experiment. All that remains is to get the NMR spectrum of the reaction product. The structure will then be established and success will be yours. Only, the product is extremely unstable, and the spectrum must be determined within a very short time after the pure compound has been obtained. All is set up, you race down to the NMR lab, insert the sample tube into the magnet, rush to the console, press the enter key on the computer, and #/ëŸΩ, the NMR machine breaks down. By the time it is back in operation, the sample has decomposed and you have to start all over. "Oh, what bad luck," you say to all and sundry. Bad luck, my foot! The instrument knew that this was a most important spectrum and quite deliberately shut itself down, probably chuckling to itself gleefully at the same time.

We once undertook a seemingly straightforward photochemical investigation[2]. In the best modern fashion, samples of the irradiated solution were withdrawn at intervals and subjected to gas-chromatographic (GC) analysis. As the peak for starting material decreased, a single new peak developed, and the final solution, after disappearance of most of the starting material, contained a single compound, or so we concluded. This was confirmed by preparative chromatography on the slightly basic adsorbent Florisil. Over 90% yield a single crystalline substance was obtained. Its GC retention time was identical to that of the peak observed during the course of the irradiation. A nearly perfect experiment. But, as we delved into the