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DEPARTMENT OF CHEMISTRY
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April 6, 1970

Dr. John B. Wolff
Executive Secretary
BBCB Study Section, DRG
National Institute of Health
Westwood Building, Room 233
Bethesda, Maryland 20014

RE: GM15432-04 BBCB
YU

Dear Dr. Wolff:

Thank you for your letter of March 13. I should like to reply to your inquiries.

Although I have as yet no papers in print that have been supported by this grant, I have available two preprints of research manuscripts. They are sent to you under separate cover. One has been submitted to the Journal of Chemical Physics, and I have been still engaged in a battle with a referee. The other is being submitted to Macromolecules, and I would expect about three months until the publication. As for the paper number 19 of page 14, the final characterization of the cyclic polymers are still not conclusive enough to have a preprint; however, I plan to present the result at the September meeting (Chicago) of the American Chemical Society. By September, I feel hopeful that we will have made the case unambiguously. One of my graduate students, Mr. Bi, is now actively working on the project and the second, Mr. Serfass, has obtained a Master's degree by working on the initial phase of the study and now teaching at a junior college in Maine. There is one further point to be mentioned concerning this synthesis project. That is, we have been exploring a possible patent application for the particular synthetic technique.

Now I wish to comment on the relation of this proposal to that to be submitted to NSF entitled "Configurational Analogues of Biopolymers." There is no scientific overlap. This proposal is to study the phase transitions of various model macromolecules of biological interest whereas the one to NSF concerns the synthesis and the characterization of interesting configurations which may have the biological significance. Hence, there is a clear continuity between the two but no scientific overlap in the sense of proposing to do the research on the similar aspect of overall program. In the proposal to NSF, I will apply for the support on the continuing dilute solution study of various interrupted helix models, cyclic and catenane configurations of differing skeletal rigidity and the ionic strength dependence of chain expansion (or collapse) of the cyclic configuration with the ionizable side chains. On the other hand, here I am proposing to study the thermodynamic transitions to the "ordered" state from the isotropic state of various macromolecular solutions of interesting configurations and conformations. in this application. Furthermore, there is no budgetary overlap

except for the request of the dielectric relaxation instruments. I will discuss the utility of dielectric bridges below.

My contribution to this research during the academic year may be estimated as 13 ∿ 16 hours per week. As you would understand, the exact determination is very difficult but the estimate may be made. The requests for the summers are for two months at the rate of (1/9) of the academic salary per month.

A project assistant is a position filled by a technical personnel who does not possess a doctoral degree. Mr. Iwama has a Master's degree from Tokyo University and will have had four years of experience of research by September. There are also other candidates with a similar qualification and the ones with the research associate qualification. Therefore, I would very much like to fill such a position by a qualified person who will be much more productive than the research assistants.

Now I would like to present the case for a laser and accessories. What we plan for a laser for the light scattering is the following:

Analogous to the critical opalescence[1] in the vapor-liquid transition across the critical point, it is probable that liquid-crystalline phase transition is accompanied by anomalous light scattering by the existence of singularity in the isothermal compressibility, hence the enhanced correlation length in the fluctuation of entropy and concentration. The most exciting result should be derived from the study of spectral width of the scattering light intensity because the half-width is related to the correlation length,[2] thus the physical identification of the morphological elements in the ordered phase should be possible, subsequently more quantitative studies ought to be possible. Although there is a good deal of work on the translational diffusion from the spectral analysis of Raleigh scattering we plan to concentrate on the equilibrium properties of transition that can be measured uniquely with a laser. Monochromaticity and collimation of a laser source of light alone will enable us to measure spectral width. Hence, the major expense will be in the spectral analysis instrumentation. We plan to proceed with the system similar to that reported by Benedek, et. al.[4] which is a "self-heating" technique rather than an elaborate "homodyne" spectrometer.[3] The spectrum Analyzer should be a G.R. 1900-A analyzer or similar. The laser could be Spectra Physics H_e-N_e (6328Å) laser or equivalent. Other accessories will include a Photomultiplier, power supply to the photomultiplier, preamplifier to the analyzer, etc., and optical accessories.

We have a stable optical bench. Of course, we could just use a stable laser source with a reasonable intensity (∿3mW) as the light source for the existing SOFICA photometer which will improve the precision of the present angular intensity measurements through the enhanced collimation and intensity at a cost of about $1000. The request for a laser and the accessories constitutes a move into a new field which appears to have a good future.

Coming to the dielectric relaxation instrumentation, the ferroelectric polarization hysteresis[5] of the liquid crystals must be studied with a better

technique than the one proposed earlier. In particular, the study of the rotational ordering of small molecules in the liquid crystalline matrices can be accomplished by the dielectric relaxation alone if the matrix and the small molecules are analogous in chemical structure so that NMR linewidth is not suited for such a probe. The other advantage of the dielectric relaxation techniques is that it will be well tested, in a few years, for the measurement of the kinetics of helix-coil transitions.[6] Since I have some experience with such a measurement technique[7] and the recent development by Schwarz[6] appears promising, I plan to acquire the capability primarily for the kinetics of conformational change of polypeptides that are made soluble in non-aqueous solvents.

I am hopeful that these comments have answered the questions you raised in the letter of March 13. Please accept my apology for not submitting these details earlier. I could have saved you the trouble of asking. I shall be glad to furnish any other information you may wish. Thank you for the inquiry.

Sincerely,

Hyuk Yu

HY/be

FOOTNOTES:

1. I. L. Fabelinskii, *Molecular Scattering of Light*, (Plenum Press, New York N.Y., 1968), Chapter 1, p. 47.

2. For a recent review, see M. E. Fischer, "Proceedings of Conference on Critical Phenomena," (NBS Misc. Publication 273, Government Printing Office. Washington, D.C., 1966),, p. 108.

3. H. Z. Cummins, N. Knable, and Y. Yeh, Phys. Rev. Letters 12. 150 (1964).

4. a) G. B. Benedek, J B. Lastovka, K. Fritsch, and T. Greytak, J. Opt. Soc. Am. 54, 1284 (1964).

   b) J. B. Lastovka and G. B. Benedek, *Physics of Quantum Electronics*, Ed. (McGraw-Hill, New York, N. Y. 1965), p. 321.

   c) B. Chu and F. J. Schoenes. J. Coll. Int. Sci. 27, 424 (1968).

5. Reference 27 of the proposal.

6. G. Schwarz, J. Phys. Chem. 71, 4021 (1967).

   G. Schwarz and J. Seelig, Biopolymers, 6, 1263 (1968).

7. Reference 13 of the proposal is a dielectric relaxation study; W. H. Stockmayer, H. Yu, and J. E. Davies. Polymer Preprints, 4, 132 (1963).