An Interview with a Distinguished Pharmaceutical Scientist

George Zografi

Dr. George Zografi is the Edward Kremers Professor of Pharmaceutical Sciences, School of Pharmacy, University of Wisconsin-Madison. He received his B.S. in Pharmacy from Columbia University in 1956 and M.S. (1958) and Ph.D. in Pharmaceutical Chemistry from the University of Michigan in 1960. In 1972, after serving on the faculties of Columbia University and the University of Michigan, he joined the faculty of the University of Wisconsin. Dr. Zografi's research interests are focused in two areas: the properties of solids in the amorphous state and the surface chemistry of lipids, polymers, and proteins in monolayer and bilayer systems. He is the recipient of the APhA Ebert Prize (1984), the AAPS Dale E. Wurster Award for Pharmaceutics (1990), the AAPS Distinguished Scientist Award (1995), and the AACP Volwiler Research Achievement Award (1996). In 1989, he was elected to the Institute of Medicine of the National Academy of Sciences.

WHAT DO YOU THINK HOLDS THE KEY TO YOUR SUCCESS AS A PHARMACEUTICAL SCIENTIST?

Response: Whatever success I have had, I attribute primarily to the environments in which I was educated and where I have spent the last 38 years as an academic: Columbia University, the University of Michigan, and the University of Wisconsin. All of these universities provided me with excellent resources, students, faculty colleagues, and administrators. My interactions with many excellent industrial colleagues also have given me a very useful practical perspective for conducting my research in the pharmaceutical area.

WHAT DO YOU CONSIDER TO BE YOUR KEY RESEARCH ACCOMPLISHMENTS?

Response: I take greatest pride in the professional accomplishments of my former students and postdoctoral trainees in their scientific careers. As far as work in my laboratory, I particularly am pleased with our work on the surface phase behavior and viscoelastic properties of lipid and polymer monolayers spread at the air-water interface, and our more recent studies linking the physical and chemical instability of solids to molecular mobility caused by process-induced disorder and the absorption of water vapor.

WHAT WAS THE TURNING POINT IN YOUR DISTINGUISHED CAREER?

Response: When I joined the faculty of Columbia University in 1961, I met the distinguished surface chemist, Jack Schulman, who generously introduced me to the study of surface monolayers and their potential as models for various self-assembled systems such as biological membranes. Another turning point was the summer of 1966 when I worked with Dr. Everett Hiestand at the Upjohn Co. on the possible effects of pharmaceutical processing on solid surface energetics. Both of these events set in motion the work we've done ever since.

WHO ARE THE INDIVIDUALS WHO MOST INFLUENCED YOUR RESEARCH CAREER?

Response: Besides the above-named individuals and my major professor at the University of Michigan, Albert M. Mattocks, I have been most influenced by the quality faculty colleagues and collaborators with whom I've worked. These include Lou Malspeis and Gil Hite (Columbia); Bill Higuchi and Tony Simonenlli (Michigan); and Ken Connors, Joe Robinson, Jens Carstensen, and Hyuk Yu (Wisconsin). I also cannot say enough about the things I've learned from my graduate students and postdoctoral associates, as they developed independent approaches to their work in my laboratory.

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PHARMACEUTICAL SCIENTISTS ARE FACED WITH THE DILEMMA OF HAVING TO PUBLISH IN BIOMEDICAL OR BASIC SCIENCE JOURNALS AND HAVING TO PRESENT IN THEIR SPECIALTY MEETINGS IN ADDITION TO THE PHARMACEUTICAL SCIENCES VENUES. DOES IT MEAN CUTTING EDGE SCIENCE WILL NOT LIKELY BE FEATURED IN THE PHARMACEUTICAL SCIENCES FORUM?

Response: As an applied science area, pharmaceutical science should be using the best basic science possible to create its own “cutting edge” research, and this is what should be presented in the pharmaceutical sciences forum. If in the course of carrying out certain types of research a pharmaceutical scientist can see broader and more basic implications of the results, it is only natural that he or she would want to present this work outside of the pharmaceutical sciences. Quite a bit of my surface chemistry research, for example, has had more to do with understanding basic interfacial phenomena than with direct applications to pharmaceutical systems. When this has occurred, I have tended to go to journals such as, Langmuir or the Journal of Colloid and Interface Science. When I was studying the surface properties of drugs such as the phenothiazines, or the wetting of solid drugs and excipients, with direct pharmaceutical implications, I chose to publish in pharmaceutical journals. Correspondingly, I see no reason why our pharmaceutical meetings cannot continue to be venues for truly innovative pharmaceutical science, as our understanding of basic science expands.

IN THE 1960'S MANY OF YOUR COLLEAGUES WHO WERE TRAINED IN THE PHYSICAL SCIENCES CHOSE TO PURSUE BIOLOGICAL RESEARCH. DID YOU CONSIDER THIS OPTION?

Response: From the very beginning, my research in surface chemistry was motivated by my interest in biological membranes and related biological self assemblies, particularly the relationships of small molecules (drugs) with these systems. Indeed, at one point I seriously considered applying for a NIH Career Development Award in Psychopharmacology because of my work with the phenothiazines and model membranes. Upon deep reflection, however, I realized that I was most interested in the thermodynamic and kinetic aspects of relatively simple model systems for both biological and materials understanding, and that I was really a “physical pharmacist.”

WHAT IS YOUR VIEW ON THE CURRENT STATUS OF RESEARCH IN THE MATERIALS SCIENCE OF PHARMACEUTICALS?

Response: The importance placed on rapid preclinical development of new drugs, as well as the use of increasingly complex drug delivery systems, has created the necessity for more understanding of solid material characteristics including solubility, interfacial behavior, stability, mechanical properties, and compatibility with drugs and biological tissues. We need to have people in the pharmaceutical sciences that can bring the enormous amount of basic information generated by the current “materials sciences revolution,” to bear on these pharmaceutical issues. If we are to predict such physical and chemical behavior, we need sound molecular understanding and predictive models. For a variety of reasons, research of this type in the pharmaceutical industry has declined significantly, so I hope that more people in pharmaceutical academia can see this as an important activity. The biggest barrier, of course, is the difficulty of obtaining “unrestricted” research funding to support such work in academia. I hope that the pharmaceutical industry together with NSF will increasingly recognize the need for funding such “basic” applied research on pharmaceutical materials.

WHAT IS THE KEY TO DEVELOPING SUCCESSFUL COLLABORATIVE RELATIONSHIPS?

Response: I never actively collaborated in research until 1982 when I joined with Prof. Hyuk Yu, a polymer chemist, here in Madison to study the dynamic properties of small molecules and polymers spread as monolayers at the air/water interface. In 1990, I joined with Steve Byrn at Purdue on a program concerned with the role of molecular mobility in crystalline and amorphous solid-state stability; and in 1992 I joined with Dr. Francis Tsao, a pulmonary biochemist, to study the biophysical aspects of lung surfactant. In all of these cases each of us brought our own expertise and perspective to a general set of issues. Mutual respect, open give and take, similar standards of operating, and total dedication to the issues being studied, without excessive concern for who gets the credit, seem to be paramount for a successful collaboration. I’ve thoroughly enjoyed these collaborations and my students have benefited greatly in the process.

YOU HAVE SERVED AS THE DEAN OF THE SCHOOL OF PHARMACY, UNIVERSITY OF WISCONSIN AND ALSO AS THE PRESIDENT OF THE AMERICAN ASSOCIATION OF COLLEGES OF PHARMACY. WHAT IS YOUR VIEW ABOUT SCIENTISTS TAKING UP ADMINISTRATIVE AND PUBLIC SERVICE RESPONSIBILITIES?

Response: This is a very difficult situation because administrative work, of its very nature, has to interfere with one’s professional progress as a research scientist. It reduces the time available for contemplation and reading, as reflected in fewer publications, less grant proposals, and limited ability to attend scientific meetings. Likewise, professional organizational work uses time that could otherwise be spent on scholarship. Having said this, however, I must also say that there is a broader community within an institution or profession that requires leadership and administration. If top-flight scholars do not give some percentage of their entire career to “professional citizenship,” who will provide leadership in a manner that goes beyond management of resources, recognizing the unique and fragile nature of our schools and organizations. It’s a bit old fashioned to say that we all owe some level of such citizenship to those who follow us, but I sincerely believe this to be true.

HOW HAS YOUR PHILOSOPHY OF EDUCATING GRADUATE STUDENTS BEEN CHANGED OVER THE YEARS?

Response: There is nothing more exciting to me than the discovery that comes with doing research. However, I believe that