

An Interview of a Distinguished Pharmaceutical Scientist

Tsuneji Nagai¹

Tsuneji Nagai, Ph.D., recipient of the 1999 AAPS Research Achievement Award in Pharmaceutics and Drug Delivery, is Professor Emeritus (1999) in the Department of Pharmaceutics at Hoshi University in Tokyo. He received his B.S. (1956), M. S. (1958) and Ph.D. (1961) degrees from the University of Tokyo, and undertook post doctoral studies at Columbia University (1965–1966) and at the University of Michigan (1966–1967). His main research interests are in bioavailability studies and controlled drug delivery formulations. He has published 527 refereed research papers and over 500 other types of articles, authored one book, and co-authored 93 book chapters and 62 patents. In addition, he has three marketed ethical drug products to his credit: "Aftach", "Rhincort", and "Salcort".

Professor Nagai has received various awards and honors, including the FIP Hoest-Madsen Medal (the gold medal research prize, 1986), Japan National Invention Prize (1984), Japanese Pharmaceutical Society's most prestigious research prize (1988), Fellow of AAPS (1992), Fellow of AIMBE (1999) and others. The Conference of Challenges of Drug Delivery and Pharmaceutical Technology was held in honor of his 65th birthday in Tokyo on June 9–11, 1998. In May 1999, he was honored by the Imperial Prize, "Medal of Purple Ribbon," in recognition of outstanding achievement in arts and sciences, that was accorded him in the audience of the Emperor.

Professor Nagai was Founding President of the Academy of Pharmaceutical Science and Technology, Japan (1985–87), Vice President of FIP (1986–94), and President of Controlled Release Society (1996–97). An editorial board member of several Japanese and about ten international scientific journals, he is Editor-in-Chief (for Japan and Far East) of *International Journal of Pharmaceutics* and of *Journal of Controlled Release*. Finally, Professor Nagai has served as a member of advisory committees in the Ministry of Health and Welfare; Ministry of Foreign Affairs; and Ministry of Education, Science and Culture, all of Japan.

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

Response: I am often reminded of the saying, "A qualified person can see individual trees and the woods at the same time." To me, individual trees are our basic or applied research studies on drugs and their delivery systems, whereas the woods are more than that, encompassing non-scientific issues. I would like to be a qualified pharmaceutical scientist like that.



WHAT ARE THE 2–3 ACHIEVEMENTS THAT YOU ARE MOST PROUD OF? WHY?

Response: (1) Three ethical drug products ("Aftach[®]", "Rhincort[®]" and "Salcort[®]") are marketed on the basis of our research. Every pharmacist or pharmaceutical scientist would like to materialize a new drug.

(2) The citation frequency in the field of drug delivery in the world is No. 4 according to the 1975–1997 data published by ISI. This data analysis covered 6,000,000 chemists, the first 10,800 of whom received more than 500 citations of all their papers. Specifically, 287 papers from my group received 1,636 citations. This may be a record among Japanese pharmaceutical scientists.

(3) Establishment of The Nagai Foundation Tokyo, on October 25, 1986 in commemoration of my 1986 Hoest-Madsen Medal from FIP (International Pharmaceutical Federation), the first for Japanese. Officially approved as government-licensed on January 28, 1994, the Foundation has been promoting international exchange in pharmacy and pharmaceutical sciences.

HOW HAS YOUR RESEARCH THRUST EVOLVED OVER THE YEARS? WHAT IS THE COMMON THREAD IN YOUR DIVERSE RESEARCH PROGRAM?

Response: Over the years, my research has focused increasingly on establishing a mechanism to solve problems in collaboration with researchers from industry and hospital pharmacies, many of whom were my former students. The common thread is bioavailability-driven drug formulations.

WHAT WAS THE TURNING POINT IN YOUR DISTINGUISHED CAREER?

Response: It was when I was appointed Professor of Pharmaceutics at Hoshi University

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CAN YOU NAME THE TWO OR THREE INDIVIDUALS WHO HAVE MADE A DIFFERENCE IN YOUR CAREER? HOW SO?

Response: (1) The late Professor Morizo Ishidate of the University of Tokyo, a giant in pharmaceutical science and the pharmacy profession, who taught me what a pharmaceutical scientist should do for the benefit of mankind;

(2) The late Professor Komei Miyaki, Founding Editor-in-Chief of the monthly membership magazine of Pharmaceutical Society of Japan, who inspired me to develop a scientific philosophy of my own;

(3) The late Professor Tetsuji Kametani, a former president of Hoshi University with over 1,200 publications, who showed me how to organize a productive research group.

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 THAT CUTTING EDGE SCIENCE WILL NOT LIKELY BE FEATURED IN THE PHARMACEUTICAL SCIENCES FORUM?

Response: Many pharmaceutical scientists are conducting cutting-edge scientific research and have published their findings of pharmaceutical relevance in pharmaceutical journals. Therefore, it is not suitable to conclude that cutting edge science is not likely to be featured in the pharmaceutical sciences forum.

WHAT IS YOUR VIEW ON THE CURRENT STATE OF RESEARCH IN BIOPHARMACEUTICS AND DRUG DELIVERY?

Response: The current status is alright. But it is showing signs of becoming stagnant. The field is in need of an infusion of revolutionary ideas and approaches.

WHAT ARE FUTURE CHALLENGES TO PHARMACEUTICAL SCIENCES?

Response: The challenges include those that arise from swift advances in genomics and bioinformatics.

WHAT ARE FUTURE CHALLENGES IN BIOPHARMACEUTICS AND DRUG DELIVERY?

Response: There are a few: gene delivery in a reproducible manner and development of user-friendly drug delivery systems.

AS PHARMACEUTICAL RESEARCH IS TAKING ON AN INCREASINGLY MOLECULAR AND CELLULAR THRUST, ARE YOU CONCERNED THAT OVER TIME, THERE WILL BE NO ONE TRAINED IN THE TENETS OF CLASSICAL PHARMACEUTICS, OTHERWISE KNOWN AS PHYSICAL PHARMACY?

Response: The ultimate goal in pharmaceutical research is to finish up the formulation for clinical use on the basis of sound

physicochemical principles. Therefore, if no one is trained in this technology, pharmaceutical research and education might disappear. Consequently, we must make every effort to champion this research area as very attractive while acknowledging a role of modern biology.

SCIENCE IS BECOMING INCREASINGLY MULTIDISCIPLINARY. HOW CAN ONE ESTABLISH AND/OR MAINTAIN HIS/HER OWN RESEARCH IDENTITY IN THAT ENVIRONMENT?

Response: It is absolutely essential that one establishes his/her own research philosophy and identity, while using multidisciplinary methodology in tackling intellectually challenging pharmaceutical problems.

SCIENCE IS ALSO BECOMING INCREASINGLY GLOBAL. IN ANY MAJOR SCIENTIFIC MEETING, ONE SEES A HEALTHY MIX OF SCIENTISTS FROM ALL OVER THE WORLD. LIKEWISE, IN ANY MAJOR SCIENTIFIC JOURNAL, ONE SEES THE SAME RICH MIX OF SCIENTIFIC CONTRIBUTIONS. WHAT PURPOSE THEN WOULD REGIONAL (E.G., ASIAN, EUROPEAN, NORTH AMERICAN, LATIN AMERICAN, ETC.) SCIENTIFIC MEETINGS AND JOURNALS SERVE?

Response: Regional meetings serve an important role for scientific exchange and collaboration within a geographical region. This is especially so in a rapidly developing region such as in Asia, where opportunities for collaborative research in oriental medicine abound.

YOU HAVE BEEN AN EDITORIAL ADVISORY BOARD MEMBER OF PHARMACEUTICAL RESEARCH IN ITS FORMATIVE YEARS. WHAT DO YOU THINK IS THE REALISTIC NICHE FOR THE JOURNAL IN THE COMMUNITY OF ELITE SCIENTIFIC JOURNALS? SHOULD THE JOURNAL STRIVE TO BE BROAD-BASED OR SHOULD IT SHARPEN ITS FOCUS IN A FEW FOUNDATION-BUILDING AREAS?

Response: The key is to keep the impact factor high. The focus should be on cutting edge research of broad pharmaceutical relevance.

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

Response: I always stress that research is more than data collection. It is the harmonization and organization of data around a central hypothesis that is important.

HOW HAS YOUR PHILOSOPHY OF MENTORING JUNIOR COLLEAGUES CHANGED OVER THE YEARS?

Response: I maintain that a scientist must be able to describe clearly and accurately not only their own research but also that of leaders and colleagues in their field.

WHAT WOULD BE YOUR ADVICE TO OUR JUNIOR PHARMACEUTICAL SCIENTISTS WHO ARE ABOUT TO EMBARK ON THEIR CAREERS?

Response: I would emphasize the importance of striving for a good balance between depth in interrogation of probing questions and breadth of awareness of advances in one's chosen field. It is equally important to be collegial in the daily interaction with his/her colleagues.

WHAT WOULD BE YOUR ADVICE TO OUR SENIOR PHARMACEUTICAL SCIENTISTS IN THEIR RELATIONSHIP TO THEIR JUNIOR COLLEAGUES?

Response: Senior scientists have an obligation to mentor their junior colleagues and, whenever possible, to be their strong advocate.

DO YOU FEEL THAT WE ALL HAVE AN OBLIGATION TO BE A VOLUNTEER IN SCIENTIFIC ORGANIZATIONS? IF SO, WHY?

Response: Yes, I do. This is a fine example of the "give and take" principle.

WHAT IS THE PLACE FOR ENTREPRENEURSHIP IN ACADEMIA?

Response: To be entrepreneurial is what academia is all about, but the starting point must not be to reap personal financial gain.