Glyco-Forum section

Letter to the Glyco-Forum
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A Green Thumb and a Broad Back: A Tribute to the late Dr. Yasuo Inoue (1934–2005)

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On February 6, 2005, Dr. Yasuo Inoue sent me an email message about his failing health, ending with, “I am sorry to inform you of this unpleasant matter at a joyful festival season [lunar New Year]. — Tomorrow I’ll have to return to the hospital and I would not be able to write directly to you in coming days.” Alas, that was the last message I received from him. He closed his wonderful life and splendid career in glycobiology on February 17, 2005, succumbing to hepatic cancer and cirrhosis.

Dr. Yasuo Inoue was born in Japanese-occupied Taiwan, in a town south of Taipei, where his father was a director of a brewery. After WWII, when Japan relinquished control of Taiwan, Yasuo returned to Japan with his family to continue his education in middle and high school. After obtaining BS and MS degrees in chemistry from Nagoya University, he traveled to the Australian National University for advanced study in chemistry in the laboratory of Professor Douglas D. Perrin and was awarded a PhD in chemistry in 1963. Although it was an unusual move (since most of the graduate studies by Japanese students were pursued in the U.S. or Europe in those days), it was a perfect choice for him because he met his future wife and lifelong collaborator, Sadako (an excellent glycobiologist in her own right) at the University. They were married upon returning to Japan, and Yasuo spent several years as Assistant Professor in the laboratory of Dr. Koji Nakanishi at the Tohoku University in Sendai, where his interests were mostly nucleotides and NMR. In 1971, Yasuo moved to the University of Tokyo to become Associate Professor in biophysics and biochemistry.

Although his first publication on carbohydrate materials was with Sadako on NMR measurement of sulfated polysaccharide (Inoue and Inoue, 1966) during his Sendai era, his serious interest in glycobiology was not aroused until he helped Sadako (without requesting to be a co-author) on the structural elucidation of trout egg polysialoglycoproteins (Inoue and Iwasaki, 1978) by determining the presence of NeuGc. The “sweet” taste once acquired could only intensify, and as he became more involved in polysialoglycoprotein, he started to publish collaborative works with Sadako (Nomoto et al., 1982), an arrangement that would last throughout the rest of their careers. Thus began an era of a brilliant glycobiology research team, which would continue for a quarter of a century. Further exploration of fish egg glycoproteins led to a succession of amazing findings, such as: a unique structure, \( \beta \text{-GalNAc}(1-4)-(\text{NeuGc2-3})\beta \text{-GalNAc} \) which was resistant to sialidase (Iwasaki et al., 1984); novel sialoglycoproteins (hyosporin) from the eggs of Medaka, \( \text{Oryzias latipes} \) (Iwasaki et al., 1987); large amounts of free bi-, tri-, and tetra-antennary sialooligosaccharides in the unfertilized eggs of a freshwater trout (Ishii et al., 1989) and from unfertilized eggs of dace (Inoue et al., 1989). These findings further guided them to discover peptide:N-glycosidase (glycoamidase) activity in the early embryos of Medaka, the first demonstration of such an enzyme in animal cells (Seko et al., 1991). Isolation of a similar enzyme from fibroblasts led them to suggest possible widespread occurrence of post-translational N-deglycosylation (Suzuki et al., 1994, 1997).

Another new frontier pioneered by the Inoues was their discovery of “deaminated” sialic acid, commonly known as KDN (Nadano et al., 1986). Initially, it was found only at the non-reducing termini, but later it was also found in \( \alpha(2-8) \)-linked polymeric forms (Kanamori et al., 1989, Ziak et al., 1996). Discoveries of CMP-KDN synthetase (Terada et al., 1996), chain-terminating \( \alpha(2-8)-\text{KDN}-\text{transferase} \) (Angata et al., 1994) and “KDNase” (Kitajima et al., 1994) followed. Enviably, Yasuo had a green thumb in experimental sciences.
After his mandatory retirement from the University of Tokyo, he took the position of Distinguished Professor in 1996 at the Institute of Biological Chemistry (IBC) of Academia, Sinica, Taiwan, where the director at the time, Dr. Darrell Liu, was anxious to establish a strong glycobiology program. Sadako was also invited to take part in the program, and for the first time, the Inoues were working side by side in adjoining laboratories. Although Academia Sinica is not an educational institution, and availability of graduate students is less than ideal, the Inoues did not slacken their pace of research. Some of the notable accomplishments during this period are: deciphering of developmental pattern of polysialylation (Poongodi Geetha et al., 2002); demonstrating the presence of KDN in human red blood cells (Inoue et al., 1998); implicating KDN(GM3) in carbohydrate-carbohydrate interactions (Yu et al., 2002); demonstrating the developmentally regulated expression of a peptide:N-glycanase in rice seeds (Chang et al., 2000); and the discovery of an α-(2-9)-polyNeu5Ac glycoprotein in murine neuroblastoma (Inoue et al., 2003).

During these studies, the Inoues were compelled to refine the tools for determination of polysialic acids, which culminated in various procedures of capillary electrophoresis, and liquid chromatography (Cheng et al., 1998; Inoue et al., 2000, 2001; Lin et al., 1999). The last published method, combining sensitivity of fluorescence detection and high resolution of HPAEC, achieved detection of as little as a few fmols per resolved peak (Inoue et al., 2001) and resolving polymers approaching degree of polymerization of 100. While in Taiwan, Yasuo organized an international conference, “Sialobiology and Other Novel Forms of Glycosylation” in 1998 (Inoue et al., 1999), which was very adeptly executed and was highly acclaimed.

Yasuo was a tireless worker with total devotion to the work in his chosen area, which was shared by Sadako. Their passion for research can be seen from the opening statement in the Japanese review on the discovery of polysialylglycopeptide (PSGP): “In Nature, there exist some substances of extraordinary chemical structures far beyond the investigator’s knowledge and imagination, which excite its discoverer and structural analyst to no end. Especially when such substances are related to important biological phenomena and manifest great biological activities, the delight of the investigator is beyond description.” (Inoue and Inoue, 1985). He was also a man of few words. I often heard Yasuo uttering a Japanese proverb, “Children grow up by watching the backs of their parents,” meaning children learn from the examples set by parents. What a broad back he had! The examples he set had great impact on his students, the cream of the crop at the renowned University of Tokyo, who were fortunate enough to spend time in his laboratory. Nearly all of them are now outstanding researchers highly active in the glycosciences. Yasuo was very generous in supplying his superbly trained and highly inspired students to other outstanding glycobiology laboratories in the world. For example, Drs. Akiko Kanamori, Akira Seko, Shinobu Kitazume, Chihiro Sato, Tadasu Suzuki, Tomohiko Taguchi, Takashi Angata, Mariko Kudo, and Yoko Funakoshi have made or are making important contributions in the laboratories of Drs. Ajit Varki, Richard Cummings, Yoshito Hirabayashi, Minoru Fukuda, Katsuko Yamashita, Rick Troy, William Lennarz, Karen Colley, Kiyoshi Furukawa, Naoyuki Taniguchi, and others. Dr. Ken Kitajima, the most senior of the pack from the Inoue laboratory, currently Professor at Nagoya University Bioscience and Biotechnology Center, embraces a few of them as well.

Yasuo’s generosity was not limited to supplying talented students to other laboratories. Near the end of his stay in Taiwan, he and Sadako donated a sizable sum to establish the Foundation for Research and Education of Glycosciences, which aims to assist glycoscience students in Taiwan to travel to international glycoscience meetings. Although the foundation was helped by additional contributions from industry, the fact that the Inoues were so munificent as to donate their savings, accumulated by living rather simply and frugally, is enormously admirable.

Yasuo has departed us now, but the flame of Yasuo’s great enthusiasm for science, especially for glycosciences, will no doubt be kept kindling by his former students and associates from Japan and Taiwan for many years to come. This man with a green thumb and a broad back made a big difference to this world.

References

Ishii, K., Iwasaki, M., et al., (1989) Free sialooligosaccharides found in the unfertilized eggs of a freshwater trout, Plecoglossus altivelis. A large


Meeting Announcements

Glycoproteomics: Protein Modifications for Versatile Functions
Dubrovnik, Croatia
June 28–30, 2005

This conference, a satellite to the 30th FEBS Congress and 6th IUBMB Conference “The Protein World” (Budapest, July 2–7), will take place in the Hotel Palace in Dubrovnik, Croatia. This satellite meeting will expand the main FEBS/IUBMB congress by focusing on the sweet side of life and provide the most encouraging and pleasant atmosphere for the exchange of glyco-results and glyco-ideas.

The following topics will be covered: Glycoprotein Structure and Function; Glycosyltransferases and Glycosidases; Lectins; Proteoglycans and Extracellular Matrix; Glycoimmunology and Glycopathology; Glycosylation in Development; Glycotechnology and Glycotherapeutics; Glycochemistry and Analytical Methods in Glycoscience.

Scientific board: Mima Flögel, HR, president; Marija Heffer-Lauc, HR; Hans Kamerling, NL; Pauline Rudd, UK; Nathan Sharon, IL; Ronald Schnaar, US; and Salvatore Turco, US.

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Complex Carbohydrate Research Center
Training Courses

Athens, Georgia
July 11–15 and 18–22, 2005
July 11–15, 2005: Separation and Characterization of Glycoconjugate Oligosaccharides
July 18–22, 2005: Analytical Techniques for Carbohydrates Structure Determination

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GLYCO 19
Nineteenth International Symposium on Glycoconjugates
Cairns Convention Centre, Cairns, Queensland, Australia
July 15–20, 2007

The scientific program will cover many facets of glycoscience including:
Biotechnology and glycomics
Cell and developmental biology
Immunology and cancer
Plant glycobiology
Pathogens and pathogenesis
Structural biology

Further information about this meeting is available at www.glyco19.org

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Glycan Database

The MITRE Corporation has released its free SugarBind™ database of pathogens and toxins that bind to carbohydrates on host tissue cells. The database, initially developed by MITRE to facilitate research on biocapture films, allows users to search for bacteria, toxins, and viruses that bind to a particular sequence of sugars at the non-reducing terminus of an oligosaccharide. Alternatively, one can learn which glycans are ligands of adhesins (lectins) expressed by a particular species. Abstracts of primary literature are easily accessed, and a list of citations can be printed from search results.

The data were compiled through an exhaustive search of literature published over the past 30 years by glycobiologists, microbiologists, and medical histologists. Approximately 80 scientific articles, lectures, and letters are listed to date. MITRE hopes that this unique resource will facilitate research related to the development of carbohydrate-based therapeutics, and will be sustained through the submission of new entries as more is learned about the glycobiology of disease. The SugarBind database is available online at http://sugarbinddb.mitre.org.

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Erratum
doi:10.1093/glycob/cwi054

The citation lines of the articles in Glycobiology 15(4) should have appeared as follows:

Structural analysis of the lipopolysaccharide from Pasteurella multocida genome strain Pm70 and identification of the putative lipopolysaccharide glycosyltransferases
doi:10.1093/glycob/cwi015
Frank St. Michael, Evgeny Vinogradov, Jianjun Li, and Andrew D. Cox
Glycobiology vol. 15 no. 4 pp. 323–333, 2005

Functional analysis of Drosophila β1,4-N-acetylgalactosaminyltransferases
doi:10.1093/glycob/cwi017
Nicola Haines and Kenneth D. Irvine
Glycobiology vol. 15 no. 4 pp. 335–346, 2005

NMR study of the preferred membrane orientation of polyisoprenols (dolichol) and the impact of their complex with polyisoprenyl recognition sequence peptides on membrane structure
doi:10.1093/glycob/cwi016
Guo-Ping Zhou and Frederic A. Troy, II
Glycobiology vol. 15 no. 4 pp. 347–359, 2005

The N-X-S/T consensus sequence is required but not sufficient for bacterial N-linked protein glycosylation
doi:10.1093/glycob/cwi019
Mihai Nita-Lazar, Michael Wacker, Belinda Schegg, Saba Amber, and Markus Aebi
Glycobiology vol. 15 no. 4 pp. 361–367, 2005

Selective cleavage and anticoagulant activity of a sulfated fucan: stereospecific removal of a 2-sulfate ester from the polysaccharide by mild acid hydrolysis, preparation of oligosaccharides, and heparin cofactor II–dependent anticoagulant activity
doi:10.1093/glycob/cwi021
Vitor H. Pomin, Mariana S. Pereira, Ana-Paula Valente, Douglas M. Tollefsen, Mauro S. G. Pavão, and Paulo A. S. Mourão
Glycobiology vol. 15 no. 4 pp. 369–381, 2005

Increased expression of protein C-mannosylation in the aortic vessels of diabetic Zucker rats
doi:10.1093/glycob/cwi012
Yoshito Ihara, Shino Manabe, Munetake Kanda, Hiroaki Kawano, Toshiyuki Nakayama, Ichiro Sekine, Takahito Kondo, and Yukishige Ito
Glycobiology vol. 15 no. 4 pp. 383–392, 2005

Glucan-like synthetic oligosaccharides: iterative synthesis of linear oligo-β-(1,3)-glucans and immunostimulatory effects
doi:10.1093/glycob/cwi020
Frank Jamois, Vincent Ferrières, Jean-Paul Guégan, Jean-Claude Yvin, Daniel Plusquellec, and Vaclav Vetvicka
Glycobiology vol. 15 no. 4 pp. 393–407, 2005

Inner core assembly and structure of the lipooligosaccharide of Neisseria meningitidis: capacity of strain NMB to express all known immunotype epitopes
doi:10.1093/glycob/cwi018
Charlene M. Kahler, Anup Datta, Yih-ling Tzeng, Russell W. Carlson, and David S. Stephens
Glycobiology vol. 15 no. 4 pp. 409–419, 2005

Human EDEM2, a novel homolog of family 47 glycosidases, is involved in ER-associated degradation of glycoproteins
doi:10.1093/glycob/cwi014
Steven W. Mast, Krista Diekman, Khanita Karaveg, Ann Davis, Richard N. Sifers, and Kelley W. Moremen
Glycobiology vol. 15 no. 4 pp. 421–436, 2005

Synthesis, preliminary characterization, and application of novel surfactants from highly branched xyloglucan oligosaccharides
doi:10.1093/glycob/cwi013
Lionel Greffe, Laurence Bessueille, Vincent Bulone, and Harry Brumer
Glycobiology vol. 15 no. 4 pp. 437–445, 2005
Erratum
doi:10.1093/glycob/cwi062

Glycosaminoglycans and proteoglycans in normal mitral valve leaflets and chordae: association with regions of tensile and compressive loading
doi:10.1093/glycob/cwh076
K.J. Grande-Allen, A. Calabro, V. Gupta, T.N. Wight, V.C. Hascall, and I. Vesely
Glycobiology, 14(7), 621–633, 2005

Figures 2 and 6 should have appeared as shown below. The author regrets the error.