Princeton University

Honors Faculty Members Receiving Emeritus Status

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for Receiving Emeritus Status

Jay Burton Benziger

Jay Burton Benziger, professor of chemical and biological engineering, will transfer to emeritus status on July 1, 2020, following nearly 41 years on the Princeton faculty.

Jay was born on February 17, 1952, and grew up in Niskayuna, New York; his father Burton was a mechanical engineer with the New York State Office of General Services. Jay received his bachelor's degree in mathematics from Carleton College in 1973; a master's degree in chemical engineering from Columbia University in 1975; and his doctorate in chemical engineering from Stanford University in 1979, working with Robert Madix. Immediately following a cross-country car trip, he joined the Princeton faculty as assistant professor, and was promoted to associate professor with tenure in 1985 and to professor in 1992.

Jay's research interests and contributions have covered an exceptionally broad range, especially when viewed through today's lens of specialization. His master's thesis was on "Energy Recovery from Municipal Solid Waste," and his Ph.D. was on "Identification of Reaction Intermediates on an Fe(100) Surface." In his first years at Princeton, he continued in the area of surface science, including pioneering studies of organosulfur chemistry on tungsten surfaces—a class of reactions important for the production of clean-burning fuels. This body of work was recognized with the Exxon Award in Solid State Chemistry from the Inorganic Chemistry Division of the American Chemical Society in 1984.

In the years that followed, Jay maintained his core expertise in surface science, but rapidly diversified into other research areas. One principal thrust revolved around hydrogen fuel cells, particularly those employing polymer electrolyte membranes; hydrogen fuel cells are a nonpolluting energy source that produce water as the only byproduct. Jay introduced a chemical engineering perspective to these devices, and showed that all the principles of chemical reactor design and chemical reaction engineering can be applied to both understand fuel cell behavior (including unexpected and undesired features, such as power oscillations), and to design improved cells with crucial management of the byproduct water. He also investigated the membranes themselves, connecting their mechanical properties with fuel cell performance and

designing composite membranes with improved hydration. In 2012, Jay was appointed an editor of the *Journal of Power Sources*, where he continues to oversee manuscripts related to fuel cells.

Another longstanding effort of Jay's has been the large-scale production of ultra-pure organic liquids, which are employed as the scintillators in the detection of solar neutrinos, including the Princeton-led Borexino experiment, installed beneath Gran Sasso mountain in Italy. Jay oversaw the development of purification systems that reduced radioactive background impurity levels to the almost unfathomably minuscule level of less than one atom per ton—a level of reduction critical to quantifying the fluxes of both solar neutrinos and geo-neutrinos. Papers from the Borexino collaboration, which often had more than 100 authors, showed that Jay was as comfortable and effective in large-scale research projects as he was in his own laboratory in Princeton's Engineering Quadrangle.

Jay's contributions to Princeton's teaching program have been similarly multifaceted and enduring. In the 1980s, he led a revitalization of the core laboratory course in chemical engineering (now CBE 346), broadening the experiments beyond those traditionally found in a "unit operations" course, and with a focus on critical data analysis and presentation that served undergraduates well as a foundation for their theses. At that time, resources for teaching laboratories were scarce, so Jay's implementation of these new experiments relied heavily on ingenuity and elbow grease. Jay has taught this core laboratory course, on and off, throughout his 41 years on the Princeton faculty.

He also developed the course "Ethics and Technology: Engineering in the Real World" (now CBE 260), which he taught repeatedly to students from departments across, and even outside, the School of Engineering and Applied Science. Jay played an integral role in the development and teaching of "Energy Technologies in the 21st Century" (MAE 228/EGR 228/CBE 228/ENE 228), an entry-level course in the Program in Sustainable Energy, now administered through the Andlinger Center for Energy and the Environment, where Jay is an associated faculty member. He also developed and taught laboratory modules (on solar cells, fuel cells, and biodiesel production) for the broad-based "Introduction to Engineering" (EGR 194), and has been an active adviser to student groups participating in the engineering "Community Project Studio" courses since their inception.

Jay has stalwartly led multiple educational programs at Princeton, having served as both the director of graduate studies and the director of undergraduate studies (when the title was still "departmental representative") for the chemical engineering department, and

director of the Research Experience for Undergraduates (REU) program for the Princeton Center for Complex Materials. As departmental representative for chemical engineering, Jay led the reorganization of the undergraduate curriculum into essentially the form it has today, including the incorporation of biology and the introduction of six elective "tracks," or areas of focus.

In the course of daily departmental life, Jay's practical knowledge, unrelenting dedication, and frank opinions will be greatly missed. Following Jay's transition to emeritus status, we greatly look forward to his continued involvement with the department and the University.