

Brice Carnahan

and

James O. Wilkes

of The University of Michigan

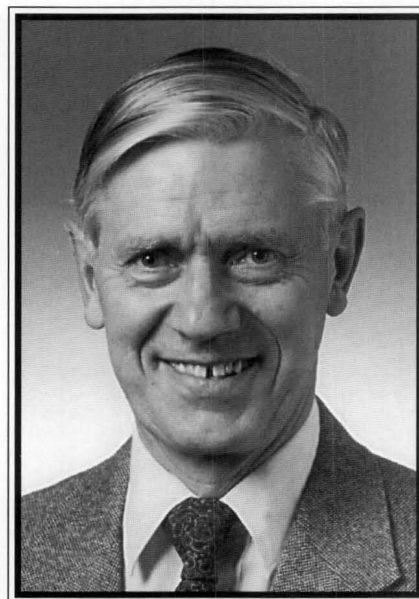
JIM WILKES: THE EARLY YEARS

Jim was born in Southampton, England, in 1932. During the Second World War, his hometown was badly bombed by the Germans from 1939 onwards (an incendiary bomb landed on his house but failed to ignite), and he was soon evacuated to live in Shropshire with his mother and grandmother for the duration of the war, until 1945.

Shropshire—on the Welsh border—was, and is still, a very quiet county, little frequented by overseas visitors. Its rolling hills are prime sheep country, and it is immortalized in A.E. Housman's *A Shropshire Lad*, which refers to four of the villages well known to Jim: "Clunton and Clunbury, Clungunford, and Clun/Are the quietest places under the sun."

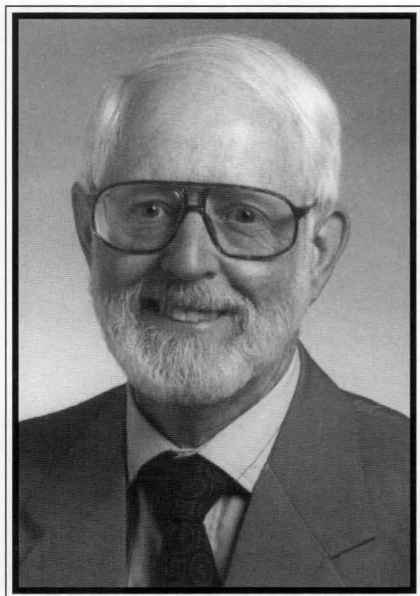
As a scholar of Emmanuel College, Jim obtained his bachelor's degree in chemical engineering from the University of Cambridge in 1955. The English-Speaking Union awarded him a King George VI Memorial Fellowship to the University of Michigan, where he received his master's degree in 1956. He and his wife Mary Ann were married in St. Andrew's Church, Ann Arbor, in 1956.

Jim returned to England for a four-year stint as a faculty member at the University of Cambridge, coming back to Michigan in 1960 to study for his PhD with Stuart Churchill. His dissertation, "Finite-Difference Computation of Natural Convection in an Enclosed Rectangular Cavity," was published in 1963. He has been a faculty member at the University of Michigan since 1960.



It is unusual for a single issue of CEE to feature two chemical engineering educators, but Professors Brice Carnahan and Jim Wilkes have worked closely together for the past thirty-six years and have shared several achievements during that period. They have also made individual impacts of their own in chemical engineering education and research. These two men also present an interesting contrast of personalities—Brice always bubbling over with good humor, very active in professional societies, enjoying sunshine vacations, urban settings, and being with the crowd; Jim being more reserved, devoting much of his energy internally at the University of Michigan and enjoying vacations in remoter (and often colder) regions with his wife, Mary Ann.

BRICE CARNAHAN: THE EARLY YEARS



Brice was born in New Philadelphia, Ohio, in 1933, the lowest birth-rate year in the 20th century, thus guaranteeing small classes from kindergarten through college (and also making it easier to get ahead!). In his first appearance in public print in 1939, Brice appears in a local newspaper photograph as a member of Mrs. Dennison's kindergarten kazoo band, the first of many bands/orchestras in which he played clarinet (badly) during his New Philadelphia years. Thus began a life-long interest in music and in the latest and best (and loudest) electronic sound equipment.

His high-school chemistry teacher, Lila Helmick, was a strong influence on Brice and helped him obtain scholarship offers from two nearby (but far enough away to escape small-town boredom) "big-city" engineering schools—Carnegie and Case. He chose Case Institute of Technology and received his BS and MS degrees in 1955 and 1956, respectively. As part of his scholarship/fellowship support from General Dynamics Corporation, Brice worked for several summers at the atomic submarine plant, principally on design and testing of very compact atmosphere control equipment.

As an extension of his interest in things nuclear, Brice's doctoral research was on radiation-induced cracking of paraffins, under the supervision of Joe Martin. His conclusion: this is a very expensive way to crack hydrocarbons. At one point during his experimental work, he managed to contaminate an entire engineering building with a weak gamma-emitting silver nuclide of 270 day half-life, after which he was known as the "silver kid." No doubt this led to his prematurely white hair and a preference for non-experimental work!

Between 1959 and 1965, Brice worked closely with Professor Donald Katz, first as technical director of the Ford Foundation project, "Computers in Engineering Education," and then as Associate Director of a follow-on NSF project, "Computers in Engineering Design Education." Since 1960, with brief (sabbatical leave) stints as a visiting faculty member at the University of Pennsylvania, Imperial College, and the University of California at San Diego, he has been on the faculty of the chemical engineering department at Michigan.

DON KATZ'S INFLUENCE

In 1959, Professor Donald L. Katz (then chairman of chemical engineering at the University of Michigan) foresaw the tremendous impact that computing would have on engineering practice. He convinced the Ford Foundation to support a feasibility study of broad-scale integration of computer use into the undergraduate engineering curricula. In a three-year period, over 200 faculty from nine engineering disciplines and 65 engineering schools participated in the various activities of the Michigan project; they jointly produced many useful reports that were widely distributed to other faculty.

Brice's first contact with the Ford Foundation project occurred in the summer of 1959 when Don offered him a full-time job with the project. Brice's acceptance put his doctoral thesis "on hold" and delayed his PhD by "an unconscionable number of years." But he never regretted the decision—it provided opportunities that he would not have otherwise had and steered him toward an academic career that has brought him much pleasure. The principal recommendations of the Ford project were to

- Train faculty to use computers
- Provide "free" time-shared computing services to all students
- Require a computer-programming course
- Teach numerical and optimization methods
- Integrate computing assignments into all engineering, science, and design courses
- Stress design-like (now called "open-ended") problems throughout the curriculum

Most of these recommendations are still on the mark—thanks in large part to Don Katz's foresight and to Brice's attention to detail, hard work, and ability to clearly and directly communicate essentials to others.

A PROFESSIONAL LIFETIME OF COLLABORATION

Numerical Methods • Nationally, Brice and Jim are probably best known for their coauthorship of *Applied Nu-*

merical Methods. The venture was conceived in typical style by Don Katz, who suggested near the end of the Ford Foundation project that Brice and Jim write up "a few notes" on numerical methods for computers. They were joined by mathematician Professor H.A. Luther from Texas A&M University. After eighteen months of very hard work, a paperback preliminary edition of "ANM" was published locally in 1964; it contained eight chapters, 790 large (8 1/2

by 11) pages, and 47 completely documented computer programs illustrating the various techniques. It also included a significant appendix on the "MAD" (Michigan Algorithm Decoder) language (an Algol 60 derivative), which was used for the computer programs. A hardcover edition of just over 600 pages (again in a large format), illustrated with 40 FORTRAN programs, was finally published by John Wiley & Sons, in 1969, and was very popular nationally for the following twenty years.



Jim and Brice with the many books they have coauthored.

Freshman Computing • For various extended periods since 1967—and continuously since 1981—Brice and Jim have been responsible for organizing and supervising the freshman engineering digital-computing courses at the University of Michigan. The enterprise has grown in magnitude and complexity, to the point where it has occupied about half of their professional time for the past decade. These courses are now taught, very successfully, by an all-student cadre of instructors. Typically, about 1,100 students enroll each year in about 30 sections of four different courses; over the years, Brice and Jim have directly impacted perhaps 30,000 University of Michigan freshmen through these courses. Very frequently—sometimes annually—they have updated their two books for use in these freshman courses, the most recent titles being *FORTTRAN for the Macintosh and IBM PS/2* (1994) and *The Macintosh, the PC, and Unix Workstations: Operating Systems and Applications*. (1995). In all, there have been 27 different editions of these two texts or their predecessors, some of which are shown in the photograph above.

BRICE'S INTERESTS AND ACCOMPLISHMENTS

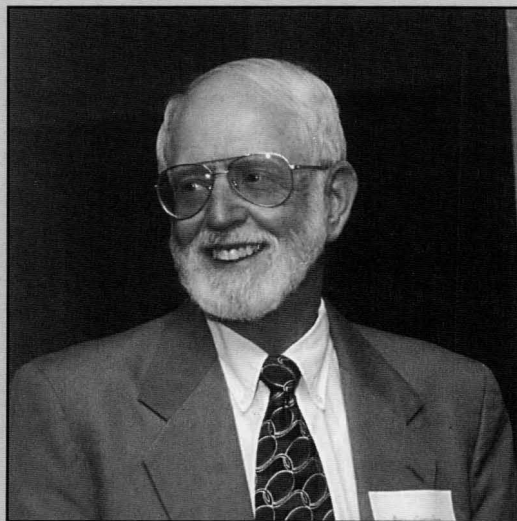
Since coming to the University of Michigan forty years ago, Brice has been at the forefront of computers and computing, particularly in chemical engineering. His initial and

extensive collaboration with Don Katz firmly established his interest in computing, numerical methods, and process design and simulation.

As an outgrowth of the Ford Foundation project, Brice presented a famous (at Michigan, anyway) and highly popular series of six two-hour evening lectures on computers and programming, first in "MAD" and later in FORTRAN; one memorable lecture was given in a Batman costume to compensate for a time conflict with the premier hour of the Batman television series. These evolving lectures were attended each term by about 300 students, faculty, staff, and lay persons who needed a quick, non-credit introduction to computers and programming. The series began in 1960 and lasted over a quarter century, well into the PC era. In the chemical engineering department, he mainly teaches numerical methods and computer-aided process design, with an occasional foray into sophomore-level material and energy balances.

Brice's research interests and those of his doctoral students have focused on algorithm design and software development for computer-aided process modeling, particularly for dynamic process simulation. He is currently working on decomposition, numerical, and coordination algorithms suitable for solution of large-scale dynamic process models in distributed-memory parallel computing environments, and, with Professor Costas Kravaris, on the potential of the approach for distributed model-based control.

In the late 1970s and early 1980s, Brice and a cadre of student assistants developed, under NSF sponsorship, some of the earliest computer-based courseware for chemical engineers. His MicroCACHE software, consisting of executive routines for module authoring and presentation, and several instructional models for numerical methods and flowsheeting, was originally developed for the Apple II personal computer and later converted for use on the IBM PC. The MicroCACHE work was followed in the mid-to-late 1980s by development of the more powerful



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MicroMENTOR system software and courseware, which is currently being used at Michigan as the principal delivery vehicle for networked access, control, delivery, and statistics-gathering for all IBM PC-based software used by students in the chemical engineering department at Michigan (including the newest Michigan instructional modules developed under the direction of Michigan Professors Fogler and Montgomery and distributed by CACHE).

Brice is currently chairman of the department's graduate committee, a position in which he has served for sixteen years. In this connection, he hosts a very popular party at his house every March for recruiting prospective graduate students who are visiting the department. In the Engineering College, he was elected by college faculty to the College Executive Committee for a four-year term (1979-1983) and served from 1983 to 1993 as a member of the Executive Committee of CAEN, the large and versatile Computer-Aided Engineering Network at Michigan.

On the national scene, Brice was a founding member and the first interim chairman of the CACHE (Computer Aids for Chemical Engineering Education) Corporation—in fact, the organizational meeting for CACHE, called by Brice and Warren Seider of the University of Pennsylvania, was held in Ann Arbor in 1969. In CACHE, he subsequently served as vice-chairman and chairman (1974-1975) and is currently very active as a board member and as CACHE publications chairman, positions he has held since 1970. As publications chair, he has overseen production of nearly all of CACHE's major documents, including preparation and distribution of the Proceedings of ten International AIChE/CACHE conferences in the last decade. He has held elected AIChE positions leading to the chairmanship of the CAST (Computer and Systems Technology) Division in 1981-1982, and has been a member of the editorial board of *Computers and Chemical Engineering* since 1978.

Brice has received numerous citations for his dynamic style of teaching and service, including the Engineering Class of 1938 Distinguished Service Award (1963), the

Jim was a pioneer in the numerical solution of partial differential equations, both by finite-difference and finite-element methods, and his research interests have always been in that area. He has chaired or cochaired the committees of twenty-one doctoral students . . . he has [also] always been interested in church organs and has served on numerous committees for doctoral organ students at the University of Michigan. He often finds "historical performance correctness" boring, preferring organ recitals that incorporate a few tuneful selections and are imaginative in their use of varied tone colors.

University of Michigan Outstanding Achievement Award (1968), and awards from the University of Michigan Engineering College for Excellence in Teaching (1983) and Excellence in Service (1993). At the national level, his leadership in computing for chemical engineers has been recognized by the AIChE Computing in Chemical Engineering Award (1980), the Detroit Engineering Society Chemical Engineer of the Year Award (1987), and the ASEE Chemical Engineering Lectureship Award (1991). For the last of these, he presented a lecture at the Toronto ASEE meeting in 1990, with two fascinating themes—an outline of the development of computers and computing over the previous fifty years, and not only educational uses of computers over the same time period but also predictions of future trends and developments (several of which have already transpired!). This ASEE lecture was published in the Fall 1991 and Winter 1992 issues of *Chemical Engineering Education*.

Brice is an avid reader, especially of nonfiction, and has a keen interest in world affairs, politics, education, and travel. He is especially interested in the far East, and in the past two years he and Jim have each taught two month-long intensive graduate courses at the new College of Petroleum and Petrochemical Technology at the Chulalongkorn University in Bangkok.

JIM'S INTERESTS AND ACCOMPLISHMENTS

Jim was a pioneer in the numerical solution of partial differential equations, both by finite-difference and finite-element methods, and his research interests have always been in that area. He has chaired or cochaired the committees of twenty-one doctoral students, the great majority of whom have also engaged in experimental work in tandem with their numerical studies. Topics studied have ranged from two-phase flow, measurement of turbulent velocity fluctuations, natural convection, reservoir engineering, metal casting, and many aspects of polymer processing. His two current doctoral students are working on paint-leveling and injection-molding problems sponsored by the General Motors Corporation.

Jim is most at home in the classroom, where he teaches fluid mechanics and numerical methods. Occasionally,



Jim at the console of the 1891 "Father" Willis organ in Blenheim Palace.

and only on April 1st, he demonstrates how dimensional analysis can be used to estimate the speed of a dinosaur by measuring its fossilized footprints. He has also recently developed (with colleague Pablo LaValle) a fine first undergraduate laboratory, with many experimental projects that go beyond the traditional fare. He has been recognized many times for his dedicated classroom teaching, being a first recipient in 1980 of the College of Engineering's newly instituted Engineering Excellence in Teaching Award. In 1987 he received the highest University of Michigan award for classroom teaching—the Amoco Good Teaching Award—and was named an Arthur F. Thurnau Professor from 1989–1992, an appointment that is based largely on undergraduate teaching evaluations.

Jim was department chairman at Michigan from 1971

to 1977 and Assistant Dean for Admissions in the College of Engineering from 1990 to 1994. In the Engineering College, he was elected to the Executive Committee for the period from 1985 to 1989. On the national and international scene, he has been coeditor since 1989 of the "Class and Home Problems" section of *Chemical Engineering Education*, and since 1973 he has been Associate Editor for the U.S.A. of *Chemical Engineering Research & Design* (the British equivalent of the *AICHE Journal*). Last year he was elected (in a contested election!) as Water Commissioner of the village where he lives.

Jim has extensive interests outside the university. Since visiting Clungunford Church in Shropshire in 1943 with his neighbor, Graham Jukes, he has always been interested in church organs and has served on numerous committees for doctoral organ students at the University of Michigan. He often finds "historical performance correctness" boring, preferring organ recitals that incorporate a few tuneful selections and are imaginative in their use of varied tone colors. One of his "heroes" was the late Virgil Fox, an American organist *par excellence*, who could inspire vast audiences of people who were otherwise little interested in classical organ performance. Jim has an Allen digital-computer organ in his home.

Another source of inspiration was Professor Terence Fox, who founded the chemical engineering department at Cambridge in 1946. Fox was a shy but brilliant man who knew what was important and who brought the department to preeminence before his untimely death in 1964. He was instrumental in bringing Kenneth Denbigh, John Davidson, Peter Danckwerts and others into the department. Danckwerts subsequently wrote an appreciation of Fox's talents, saying, accurately, "Fox did no research and published nothing." How times have changed—today, Terence Fox's resume would be tossed aside and he would stand no chance of being hired, let alone of receiving tenure!

As an amateur organist, Jim received his performance diploma, Associate of the Trinity College of Music (London), in 1951, and his Service-Playing Certificate from

the American Guild of Organists in 1981. He is a member both of the American Guild of Organists and of the Winchester & District Association of Organists in England. About once a year, he gives "popular-science" lecture/demonstrations on how organ pipes work (Kelvin/Helmholtz instabilities have to be simplified for lay audiences!), the most recent being an invited presentation to the 1995 National Convention of the Organ Historical Society. He gives occasional recitals, the most recent being to an enthusiastic audience in a packed church—back in Clungunford in 1995, on the occasion of the 100th anniversary of the installation of their organ.

In 1995, Jim wrote and published a profusely illustrated 160-page book, *Pipe Organs of Ann Arbor*, which describes about seventy-five instruments in the city's churches, colleges and universities, residences, and cinema—and even in a funeral parlor.

He is also working on two other books: *Fluid Mechanics for Chemical Engineers* and *Place-Names of Hampshire and the Isle*

of Wight. The latter was written in a beautifully illustrated manuscript of about 1,000 pages by his grandfather, Alfred Oscroft, in the two decades before his death in 1939. It traces the origins of the names of all the villages, hamlets, towns, etc., in Hampshire, many of which have Anglo-Saxon roots. The cross-checking of all the references, many of which are at least 100 years old, will take much time, not to mention learning the rudiments of the Anglo-Saxon language. Related to this endeavor, he is a member of the English Place-Name Society.

In addition to music and writing, Jim's hobbies include hiking in North Wales and in the American West (he has visited Zion National Park eight times and always enjoys walking up to the West Rim), tennis and table tennis, gardening, and reading. Most recently, he has read Martin Gilbert's *Churchill*, David McCullough's *Truman*, Doris Kearns Goodwin's biography of the Roosevelts during World War II, *No Ordinary Time*, and is just beginning George Blake's *No Other Choice*. □



Jim and his wife Mary Ann in their perennial garden