The

Arnold O. and Mabel M. Beckman

Institute for Advanced Science and Technology

University of Illinois at Urbana-Champaign

On October 5, 1985, the University of Illinois officially announced that scientist-inventor-industrialist and U of I graduate Arnold O. Beckman had given the University $40 million to establish a unique interdisciplinary research institute on the Urbana-Champaign campus. The Arnold O. and Mabel M. Beckman Institute for Advanced Science and Technology will apply a new approach to interdisciplinary research by joining the biological and physical sciences in quest of a better understanding of human and artificial intelligence.

The announcement of the gift coincided with the 50th Annual Meeting of the University of Illinois Foundation. It was at the Foundation's anniversary dinner on October 4 that University President Stanley O. Ikenberry quietly shared news of the Beckman gift with key members of the Illinois Family who had gathered to celebrate half a century of private giving to the University.

The gift has been supplemented by $10 million in state support sponsored by Governor James R. Thompson to assist in preconstruction costs and preparation. In addition, the governor committed the state to "the perpetual maintenance and operation of the institute," and promised $2 million annually "to help launch new and creative lines of scientific investigation."

Construction of the institute began in 1986 and is expected to be completed by December 1988. The institute will be located where the University's first building once stood, and will mark a new gateway to the campus on the north.

The story behind the Beckman Institute began more than three-quarters of a century ago, when Arnold Beckman, a blacksmith's son from Cullom, Illinois, found an 1861 edition of Steele's *14 Weeks in Chemistry* in the attic of his home. He quickly developed a keen interest in chemistry, prompting his father to build a small backyard shed to house the boy's elementary laboratory. Several years later the Beckman family moved to Normal, Illinois, to take advantage of the better school system. Young Beckman excelled in his science classes, and had completed two and one-half years of college-level chemistry by the time he graduated from high school. After serving in the Marine Corps in World War I, Beckman entered the University of Illinois as a freshman chemistry major in 1919. In 1922 he earned his Bachelor of Science degree in chemistry, and completed his Master's degree the following year.

Arnold Beckman then moved to California, where he has lived most of his life. In 1928 he received his Ph.D. in photochemistry from the California Institute of Technology. The chairman of Caltech's chemistry department once remarked that young Beckman took greater interest in the equipment used in scientific experiments than in the experiments themselves.

Beckman took a position on the Caltech faculty, where he was consulted by the National Postal Meter Company to solve the problem of ink clogging their meters. Beckman quickly found a solution – a new ink formula – but could not find an ink company that wanted to produce it. So in 1934, with a loan from National Postal Meter, he set up the National Inking Appliance Company and got his first taste of the business world.

That same year Beckman also had the good fortune to be approached by a former University of Illinois classmate, Dr. Glen Joseph, who consulted him about a method to standardize acidity levels in lemon juice. Beckman at last had an opportunity to fashion a piece of hardware to support science in a practical way, and that day conceived of the pH meter, a device that launched his career as an inventor and manufacturer of scientific instruments.

In 1935, while still a professor at Caltech, Beckman changed the National Inking Appliance Company to the National Technical Laboratories and located the new enterprise in a 9 x 20-foot section of a garage in Pasadena. He produced thousands of the pH meters, even though he was

advised that the market could absorb only around 600 of them. (Nearly a quarter of a million have been sold to date!) Beckman relinquished his appointment at Caltech in 1939 in order to devote his full energies to business, and the following year he built a large plant in South Pasadena to house the burgeoning industry.

World War II saw NTL intimately involved in the research and development of several important devices, including the quartz spectrophotometer, which automatically analyzes chemicals. It became essential to wartime production of aviation fuel and synthetic rubber, and remained in use, virtually unchanged, from 1940 through 1964, when it was superseded by a new device. More than 21,000 were sold in that time, even though early on Beckman was told he could expect to sell no more than 100 of the instruments.

For the remainder of the war, Beckman continued to develop devices often credited with helping bring the Allied powers to victory. His willingness to seize opportunities ignored by others earned him a solid reputation as an innovator gifted with remarkable business sense, and secured his leadership in the field of scientific instrumentation.

Since the early 1950s, when Beckman Instruments, Inc., absorbed a number of smaller companies, including NTL and Arnold Beckman, Inc., Beckman has been a world leader in the field. Perhaps the most visible Beckman inventions of the post-war era are the ultracentrifuge, used to measure the density of chemical substances, and the protein sequencer, which has helped unravel the mysteries of DNA. The list of Beckman instruments goes on and on, and finds applications in many areas: biomedical research, health care, process analysis and control, environmental technology, medical and industrial chemical research, communications electronics, and auto and consumer production.

Beckman Instruments, Inc., has grown from a 180-square-foot shop in a Pasadena garage to an international giant, yet as Arnold Beckman modestly reminds us, "All of our products have one thing in common: they are the results of research and development programs that started with lemon juice."

Beckman served as president of Beckman Instruments, Inc., until 1965, but has remained chairman of the board. The firm was a multi-billion-dollar corporation when it merged with SmithKline Corp. in 1982 to form SmithKline Beckman Corp., of which he is director emeritus.

How did a curious boy in a small Illinois town come to fashion a life so filled with success and personal fulfillment? The answers come from the principles by which he has lived all his life: creativity, uncompromising quality, integrity, and the pursuit of leadership. As he has often said, "There is no satisfactory substitute for excellence."

Sharing his life for over 60 years, Mabel Meinzer Beckman has witnessed her husband's unstinting attention to detail, coupled with his genuine humility and loyalty. He and Mabel became acquainted in 1918 while he was serving in the Marine Corps at the Brooklyn Navy Yard. They corresponded for the next six years, until 1924, when Arnold left after one year of study at Caltech and moved to New York, where he landed a job with Bell Laboratories and became acquainted with electronics. He also had an opportunity to court Mabel, and in June 1925 they were married. The following year they moved to California, and he completed his doctoral work at Caltech in 1928. With his appointment to the faculty of Caltech, Beckman began a successful career in teaching. He and Mabel bought a small home and had two children – a daughter, Patty, and a son, Arnold S.

It was in 1939 that Beckman made his most important personal and professional decision, when he reluctantly gave up his post at Caltech. Beckman says, "I had to make the decision as to whether I'd be prostituting my scientific train-

Dr. Arnold O. and Mrs. Mabel M. Beckman

ing by going off into business rather than remaining in research. Well, I've satisfied myself on that – many say that I've done more for science in general by making instruments available for thousands to use than what I could do in my laboratory by myself. That is a source of satisfaction."

The succession of practical inventions produced under Beckman's direction over the past fifty years attests to the soundness of that pivotal choice in 1935. If there is any one abiding philosophy that has guided his thinking and creativity for the past half-century, it is, as he puts it, "Make sure you know what the problem is. You may laugh, but this is really true. A person will think something is the cause of the trouble and go far down a wrong path before realizing he has not properly understood the problem."

Since early in his career, Arnold Beckman's business acumen, his genius for science, and his philanthropy have been acknowledged nationwide. He has been recognized with dozens of awards and honors, including membership in the National Academy of Engineering, the American Chemical Society, and the American Academy of Arts and Sciences. In addition, he has served on the boards of several universities, government bodies, corporations, museums and hospitals. From 1980 to 1985 he served as a member of the Illinois Cabinet, the national governing board for the Campaign for Illinois, the U of I's first major university-wide fundraising effort.

Dr. Beckman has been a member of the University of Illinois Foundation since 1962, and a member of the Presidents Council, the University's highest donor recognition organization, since 1965. In 1982 the University of Illinois awarded him an honorary doctor of science degree.

At the press conference announcing the Beckmans' gift establishing the Institute for Advanced Science and Technology, Illinois Governor James R. Thompson captured the significance of the event in only a few words: "The lives of Arnold and Mabel Beckman represent a standard of thoughtful, purposeful philanthropy that should serve as a model for all Americans."

The Beckman Institute for Advanced Science and Technology, shown from Wright Street at University Avenue, will be a stunning north gateway to the University of Illinois campus at Urbana-Champaign.

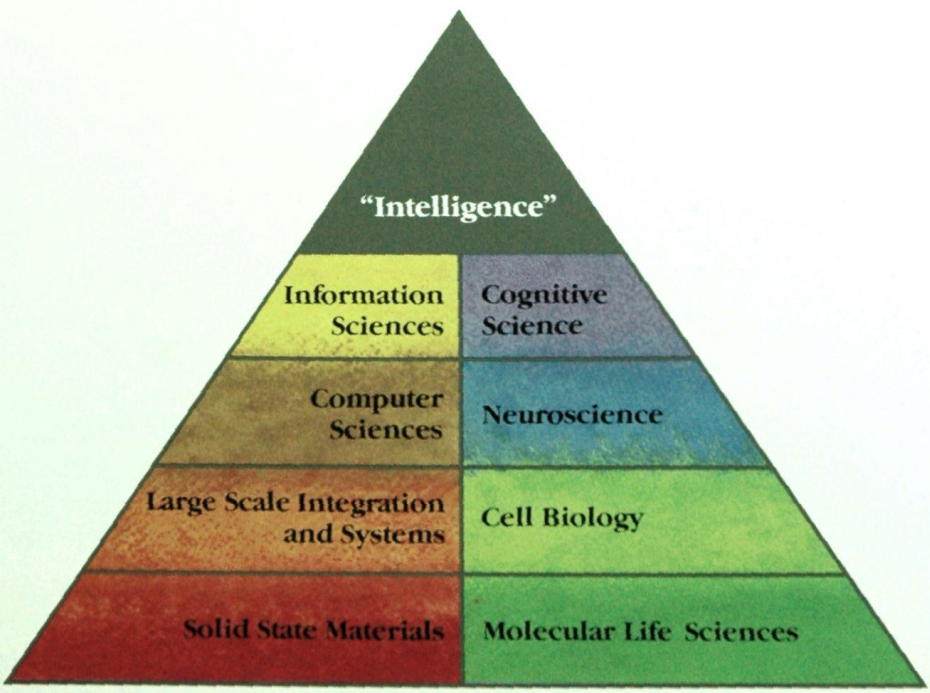
The Arnold O. and Mabel M. Beckman Institute for Advanced Science and Technology will be a world-class research institution, and will test new approaches to interdisciplinary research, bringing the best minds from many fields to bear on broad-scale problems.

The institute will consist of two interrelated research centers with remarkably parallel orientations. One center – the Center for Materials Science, Computers and Computation – will be geared toward broad-based problems in the physical sciences. The other – the Center for Biology, Behavior and Cognition – will attack similarly large problems in the life sciences.

Some have envisioned the institute's structure as a dynamic triangle. Within each center are four main levels of research, beginning at the base with the atomic and molecular level and proceeding through questions of increasing complexity and higher organization. A fifth level – "intelligence" – joins the two centers at the apex.

The focus of the Center for Materials Science, Computers and Computation will begin at the level of solid state materials and move up through large-scale integration

The Beckman Institute for Advanced Science and Technology



and systems, computer sciences, and information sciences. At the apex it will investigate artificial intelligence – simulating in computers the human mind's ability to think and learn.

In sum, this center's research moves from basic physics to functions not unlike the human brain's. New forms of semiconductor materials and new processes for fabricating ultra-high-speed computer chips will be investigated. On all levels – from the molecular composition of single devices up to the complexity of circuits performing artificial intelligence functions – physical scientists will be able to learn from biological scientists' research on the brain. These complex systems then could be integrated further to make computers so powerful that they exhibit human-like traits of intelligence.

The focus at the Center for Biology, Behavior and Cognition will begin at the level of molecular biology and move up through cell biology, neuroscience and cognitive science, leading to direct consideration of human intelligence at the apex. Molecular and cell biologists will study how cells work, while neuroscientists will investigate how cells communicate with each other. In addition, cognitive scientists, who investigate perception, knowledge, reasoning and language, will try to learn more about how humans acquire new knowledge and how machines can be made to do so.

The key to the institute's strength is its melding of many scientific disciplines whose advancing bodies of knowledge and increasingly similar methodologies are bringing them closer together. Although interdisciplinary research institutes exist elsewhere, none has attempted to bridge the physical and biological sciences on a scale comparable to that in the Beckman Institute. An editorial in *Science* (November 22, 1985) praised the University of Illinois for its fine record in interdisciplinary activities, and noted that "many of the future opportunities in research lie in complex phenomena requiring an interdisciplinary approach."

Thomas E. Everhart, chancellor of the Urbana-Champaign campus of the University of Illinois, has said that the implications of the Beckman Institute go beyond research to the educational mission of the University by broadening the perspectives of both students and faculty. "We are recognizing this reality in the Beckman Institute, creating two coupled, cross-disciplinary centers, and coupling those in turn with other parts of the campus life in a way I think will have profound effects on the University of Illinois and the rest of society."

The Beckman Institute will be impressive for its architecture as well as the scientific activity within. Designed by the Detroit-based architectural firm of Smith, Hinchman & Grylls Associates, Inc., the copper-roofed institute's general design harmonizes with and recalls some of the best features of campus buildings to the south, particularly in its brick and limestone exterior.

The campus entrance to the structure features a dramatic campanile or tower rising 130 feet from ground level to peak. The fifth floor of the tower will contain executive meeting space in a room overlooking the south campus. Visitors will enter the building under the tower, which sits on pedestals, and proceed through a rotunda on the south side. The interior of the public areas will be of terrazzo, marble, and carpeting, with oak and cherry wood paneling and vinyl wall coverings.

An atrium serves as the central public space between the two main wings comprising the institute. The atrium includes three spaces: a dining area for 100 or more persons, a casual lounge area, and flexible exhibit space. The atrium also leads to a private outdoor garden to the west of the structure.

The south wing will have both four-and five-story levels and will house offices. The four-story north wing will contain laboratories – including 33 of the wet "chemistry" variety and 64 dry facilities for electronics and computers,

Campus visitors will enter the institute under the campanile or tower and through a rotunda.

plus 50 laboratory equipment support rooms. Bridges will span the atrium in three locations and connect the north and south wings of the institute building.

The total complex is designed to accommodate up to 660 individuals in office space and at laboratory work stations. Also within its planned 310,000 square feet the Beckman Institute will include a 250-seat auditorium featuring state-of-the-art audio/visual equipment, as well as three seminar rooms to hold up to 100 persons.

An architectural model of the Beckman Institute viewed from the southeast.

The Beckman Institute will be built on the site of the University's first building, long since demolished. The site is on the north end of campus at Illinois Field, a baseball field just south of University Avenue and east of Wright Street in Urbana.

When the U of I first opened its doors as the Illinois Industrial University in 1868, it consisted of a single building that the trustees had purchased from a seminary and ordered remodeled. Students were housed in a dormitory on the top floor of the building. The structure also contained classrooms, a lecture hall, laboratory, museum and library.

The capacity of the building soon was overwhelmed by the growing university, and the campus's activities moved to newer quarters. Practically abandoned, the old building fell into disrepair and its demolition began in 1881. The grounds on and around which it stood eventually became Illinois Field, scene of intercollegiate football and baseball games. In 1910 it was the site of the first collegiate Homecoming ever.

In his remarks at the press conference announcing the formation of the Beckman Institute, U of I President Stanley O. Ikenberry said, "The Beckman Institute will provide a unique physical setting and a new academic organizational structure especially designed for the challenges and opportunities of contemporary science. Its specialized facilities and services are designed not only to advance the work of scientists but to promote communication and collaboration – two of the hallmarks of Arnold O. Beckman's genius as an industrial leader.

"There is a deep love and affection that flows between Dr. and Mrs. Beckman and Illinois. Their roots remain deep in this State. By their action they will shape the spirit and character of the University of Illinois for generations to come. Every member of the University Family is deeply grateful."