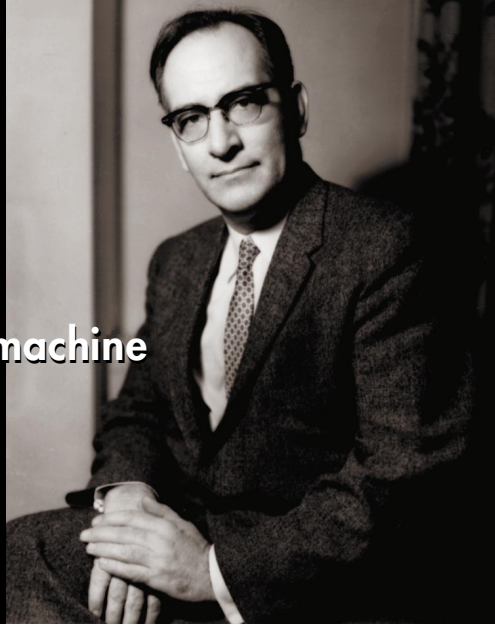
BY MICHAEL T. RYAN

john w. mauchly the man and the machine



In Tom Stoppard's *Arcadia,* Valentine, a young scientist, muses over a conundrum: "The ordinary-sized stuff which is our lives, the things people write poetry about – clouds – daffodils – waterfalls – and what happens in a cup of coffee when the creme goes in – these things are full of mystery, as mysterious to us as the heavens were to the Greeks. We're better at predicting events at the edge of the galaxy or inside the nucleus of an atom than whether it'll rain on auntie's garden party three Sundays from now. Because the problem turns out to be different. We can't even predict the next drip from a dripping tap when it gets irregular. Each drip sets up the conditions for the next, the smallest variation blows the prediction apart, and the weather is unpredictable the same way, will always be unpredictable."

No one would have appreciated the force of Valentine's remarks more than John W. Mauchly. Attempting to solve "the problem of the weather" was an issue he wrestled with for a good part of his career. It was one of a number of projects that fueled his interest in computing machines, and one of several problems that the ENIAC was to have solved.

Yet if the ENIAC could not predict the weather, it could do a lot of other things, enough to earn Mauchly and his collaborator Presper Eckert a distinguished place in the pantheon of 20th-century scientists and engineers whose work has made a difference. Mauchly's career and achievements are the subject of a major exhibition in the Rosenwald Gallery of the Van Pelt Library, which is being mounted as part of the Year of the Computer activities. Curated by Atsushi Akera and Asaf Goldschmidt of the Department of the History and Sociology of Science, with assistance from Dr. Nancy Shawcross, the Library's Curator of Manuscripts, *John W. Mauchly and the Development of the ENIAC Computer* is based primarily on the Mauchly Papers in the Library and on the ENIAC project records in the University Archives. It presents an intelligent and sympathetic view of the man who designed the world's first digital electronic computer and offers a fresh assessment of the nature of his achievement.

The son of a physicist, Mauchly received a PhD in Physics from Johns Hopkins in 1932. Finding an academic position during the depths of the Depression was not easy, but Mauchly was able to secure an appointment at Ursinus College, a small liberal arts school outside of Philadelphia. However, Mauchly soon came to realize that conducting research in a small college was difficult, if not impossible. The annual operating budget of his Physics Department was around $50! The exhibit pays close attention to Mauchly's professional development in the years before the war,

portraying for us a deeply committed and inventive scientist who made a virtue of scarcity. The very absence of equipment, colleagues, and funding seemed to move him to look for new and faster ways to do the complex and laborious calculations needed to solve a variety of problems based on accumulating and manipulating larger and larger amounts of data. What was needed to process the data was a rapid, accurate, multifunctional calculating device.

Mauchly came to the Moore School of Electrical Engineering as an adjunct faculty member to take up the slack left by those who had joined the war effort. At that time, one of the School's principal areas of military support research was calculating ballistics trajectories. Mauchly became involved with this research, and it proved to be the ideal stimulus for his own interests in developing a high-speed calculating machine that could handle huge amounts of data quickly and accurately. He was joined by his lab assistant Presper Eckert, whose job it was to translate Mauchly's ideas into implementable form. It was Mauchly the physicist, Eckert the engineer. The road to ENIAC was in view.

The heart of the exhibit is the development of the ENIAC itself. The exhibit provides a clear and accessible description of the device and its place in the history of computers. Although its unveiling came after the war had been concluded, its purpose was still framed in terms of national defense. On Valentine's Day, 1946, the ENIAC entered history by performing a large, complicated calculation to determine the feasibility of a hydrogen bomb.

The story of the ENIAC, however, was only one chapter—though the major one to be sure—in the career of a creative and dedicated scientist. Mauchly's stay at Penn was brief. No sooner had the ENIAC been successfully tested than Mauchly and Eckert became involved in a dispute with the University over patent rights to the ENIAC. The dispute led to their departure from Penn and to their pioneering ventures in the commercial development and application of computing systems. Although they worked for Remington Rand for a short time, during which the UNIVAC was developed, Mauchly and Eckert preferred a risky independence to the more secure and financially remunerative environment of a corporation. Moreover, many in government and industry saw the enormous research and business potential of the ENIAC and its successors; Mauchly and Eckert quickly found themselves in an intensely competitive and crowded field. To the end, their own research interests remained more important to them than the profits of the marketplace.

Unlike many such exhibits, *John W. Mauchly and the Development of the ENIAC Computer* *(continued on next page)*

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is not simply a celebration of a man and an event. Akera and Goldschmidt conceive it more as a case study of the nature of scientific research and invention in the 20th century. Time and again the exhibit poses fundamental questions in the history of science: What is creativity? What does it mean to "discover," "to invent," in science? To what extent is scientific achievement a social, collaborative, and cumulative process? The exhibit portrays Mauchly not as the isolated, romantic genius, but in the context of wider developments in the history of science that helped shape the career of this protean individual. The enormous importance of the ENIAC in the history of computing as well as for the marketplace has made it a natural arena for priority disputes: Who *really* got there first? However, the exhibit takes a more balanced and nuanced approach. It encourages us to think less in terms of questions of priority and more about complex paths of discovery, paths connecting multiple pasts to multiple presents. The construction of the ENIAC triggered more than a decade of claims, counter-claims, and law suits regarding invention and attendant proprietary rights. Akera and Goldschmidt view these contests as characteristic of the ways in which the intrinsic complexity of scientific research can frustrate, if not undermine, the apparent clarity of the law and the appeal of simple narrative answers to difficult questions.

On one issue, though, the exhibit is straightforward and insistent: It was the genius of Mauchly, his singularly unique contribution, to have designed not only the first electronic digital computer, but to have grasped intuitively the many related functions such a device could perform. If Mauchly had limited his vision to what the Army wanted, he might have created a single-purpose machine with no wider applicability. It was because the ENIAC was so functionally rich that it has come to occupy an important position in the history of science and technology. And who knows? Perhaps some Valentine's Day in the future will herald a solution to Valentine's conundrum in *Arcadia* that recognizes the role played by Mauchly in making it possible finally to predict the weather.

The exhibit formally opens on February 14 and runs through March in the Rosenwald Gallery. Gallery hours are Mondays–Fridays, 9 AM–5 PM, and from 10 AM–2 PM on Saturdays. Those who cannot come to the Library to see the actual show can see its virtual version on the Web at http://www.library.upenn.edu/special/events.html.

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Photos: John W. Mauchly Papers, Department of Special Collections, University of Pennsylvania Library.